

**PROCEEDINGS OF THE
WORLD POPULATION CONFERENCE**

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ANNOUNCEMENT

The World Population Conference represents a pioneer effort on an international scale to grapple with one of the most fundamental problems which mankind faces to-day. The earth, and every geographical division of it, is strictly limited in size and in ability to support human populations. But these populations keep on growing; and in so doing they are creating social, economic and political situations which threaten to alter profoundly our present civilization, and perhaps ultimately to wreck it.

What can be done about it? To take the first preliminary step towards intelligently answering this question, and implementing the answer to practical action, is the purpose of the World Population Conference. This Conference is a temporary organization, for the period of its meeting in Geneva, of the world's leading experts on the phases of the population problems; biological, social, economic, medical, statistical, and political. Full voting membership in the Conference is limited strictly to persons of established scientific standing in some division of the subject. Opportunity will be given, however, for interested persons to attend the public sessions, hear the papers and discussions, and take part in the latter under certain restrictions made in the interest of economy of time and effort. During the sessions of the Conference a daily *Journal* will be issued, setting forth the progress of its deliberations. As soon as possible after its closing session a complete definitive record of the proceedings will be published in permanent form, and will be then available to the general public.

The primary method of the Conference will be the presentation of carefully considered scientific essays by recognized authorities, to be followed by critical discussion. The range and comprehensiveness of the topics to be dealt with is sufficiently evident from the detailed Table of Contents (page 7). Propaganda of any kind, or for any objective or doctrine whatever, will find no place in the Conference. Its viewpoint is that of the scientific laboratory or the study, rather than that of the pulpit or the hustings.

It is hoped that out of this Conference will come the organization of a Permanent International Union on Population, which will cooperate with other international scientific organizations, collate and integrate the world data on the various aspects of the problem, and in other ways help towards its intelligent solution.

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EDITOR'S FOREWORD

Many contributors were prevented from presenting the full text of their papers at the Conference owing to lack of time. In order to present, as far as possible, the various points of view bearing on the subject, I have included these contributions in the Proceedings. This has necessitated groupings as follows: Principal Papers, Discussion (taken mainly from the Verbatim Report), Supplementary Remarks and Supplementary Papers.

As certain members of the Conference spoke in French and others in German, I have used the following signs to show the reader from what languages the translations were made:

* signifies translation from the French.

† signifies translation from the German.

The Who's Who of the Conference contains only the names of those who participated in the Conference and those of the Advisory and General Councils.

Geneva, October 1927.

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PREFACE

by

Mrs. MARGARET SANGER.

The problems of population have been looming upon the horizon of international thought for the past ten years, and with the advance of scientific application to social problems it was only natural that some of us should turn to the scientists with the possible hope that from them might be gleaned the solution.

It was with this idea in mind that the World Population Conference was initiated and organized. It was the first time that biologists had been invited to participate with sociologists in the solution of economic problems and, as has been seen, the biological principle played a very large part in the discussions.

The result of this gathering was the recognition of the need and desire for further study, and a permanent Union for the study of Population in various countries was formed.

It has long been my desire to have the population question discussed from an international scientific standpoint, and it is with a feeling of some satisfaction that I am at last able to present to the public so complete and comprehensive a volume on this great question as it was discussed at the World Population Conference.

I trust that the valuable information and data submitted herein may prove a source of help and inspiration to those who ceaselessly work towards the solution of the population problem.

My thanks are tendered to Mr. Clinton Chance, who, with Mrs. Edith How-Martyn, cooperated with me throughout and devoted over a year to the preliminary preparation for the Conference.

Thanks are due to Professor Raymond Pearl and also to Sir Bernard Mallet, who accepted the chairmanship of the Advisory Council, and also to the members of the Advisory Council for their valuable help.

I wish to make special mention of Professor Julian Huxley, whose cooperation and active participation from the outset has been one of the determining factors in the success of the Conference. He, together with Professor Carr-Saunders and Dr. Crew, has given valuable assistance and advice in the editing and completion of these Proceedings.

My warmest thanks are given also to Mrs. Cora Hodson, Miss Susan Green, Mrs. Anne Kennedy, Miss Anita Comstock, Miss W. Breed, Mrs. Marjorie Martin and many voluntary workers for their wholehearted assistance in the arrangements for the Conference.

ADDRESS OF WELCOME

by

Professor W. E. RAPPARD

at the Reception held Tuesday evening, August 30th, 1927,
at the Palais Eynard.

I have the honour to extend a very cordial welcome to all and everyone not only in the name of the University of Geneva, but also in the name of the Government of our Republic and of the City of Geneva.

Ladies and Gentlemen, you have come here to Geneva, drawn — we are labouring under no delusion on this point — not by the University of Geneva, nor by our ancient city, but by the League of Nations which at this time of the year brings together here so many different minds. I should like to remind you of some circumstances which will show you that the ancient and historic city of Geneva is essentially sympathetic towards those problems which have brought you here. Let me point out three facts.

The first is that the famous work of Robert Malthus was translated for the first time by a Genevese, by the pen of Pierre Prévost. The second edition is by Pierre and Guillaume Prévost. The third edition is by Pierre and Guillaume Prévost, preceded by an introduction written by a professor of the University of Geneva. It was not until 1845 that there appeared in the French language a translation of the work of Malthus which was not of Genevese origin.

Now, at that time Geneva had 25,000 inhabitants, and France, her neighbor, had nearly twenty-five millions. The interest shown by our City in problems of population is not a chance coincidence.

The second fact is that in 1805 Napoleon I, who, like many monarchs, wished to encourage the growth of the population, made a law in which he decreed that the seventh child in every family could be brought up at the public expense. He then wished to submit this law for the approval of the legislative assembly, and it happened that the person presenting the proposition was a fellow-citizen of ours, Marc-Auguste Pictet, who intimated to the Emperor that this measure did not seem

to him to be either desirable or even practicable. As another Genevese, Edouard Mallet, sixth cousin of our eminent President, has said, it was the first official manifestation of the ideas of Malthus on the Continent. That is the second fact that I should like to point out to you.

The third fact is this: you all know an economist of whom we in Geneva are proud, and who is renowned throughout the world, Sismondi. Having, at the beginning of the century, published an extremely liberal book, inspired throughout by the spirit of Smith's doctrine, Sismondi, in 1819, published his "New Principles of Economics" or "Wealth in Relation to Population". I should like to ask your permission to quote some passages from this work, which will not take long.

"Governments, like writers, seem to me to make the mistake of considering sometimes how wealth can best be increased, sometimes how population can best be increased, while neither the one nor the other should be considered alone. Statesmen should find the ratio between population and wealth which will assure the greatest happiness to the human race on a given area."

I ask you whether it is possible to define optimum population better than by trying to find the ratio between population and wealth which will assure the greatest happiness to the human race on a given area. It is already more than a hundred years ago since such a definition was given. That shows two things, first, that Sismondi, and other great minds, have tried for upwards of a hundred years to find the solution of this problem. The solution is not easy to find, which indicates also perhaps that, since this is such an old problem, it is worthy of the attention of all eminent men and women who are interested in the future of the race.

You are here, Ladies and Gentlemen, to study freely, without any party bias, the problem of the relation between population and wealth. The University of Geneva, as well as the authorities, and in particular the Chief of the Department of Public Instruction (who has asked to be excused this evening), are at your service, and you can count on their cooperation. We extend to you a cordial welcome, and I wish you all success in your work.

OPENING ADDRESS

by

Sir BERNARD MALLET, K.C.B.,

President of the Conference.

Ladies and Gentlemen, I have to say a word of hearty welcome to the many ladies and gentlemen, distinguished in biological and economic science, many of whom have travelled long distances in response to the invitation of the Council in order to take part in our discussions; and I take this gratifying response as a proof of the deep interest which the subject inspires, not only among scientists, but also among the public generally.

It is true that population questions have been the subject of constant discussion among economists and statisticians, at least from the time of Malthus's epoch-making work; but I think I am correct in saying that it is only in comparatively recent years that these questions have attracted the serious attention of biological experts. It is significant that the first suggestion for the present Conference came from certain well-known scientists in the United States of America, who then approached and found an eager response from their British colleagues. This will account for what some will no doubt consider an undue predominance of the Anglo-Saxon element in our councils.

But there are many other countries in which various aspects of this question are little less urgent than in the United States and Great Britain, and in which, as the important literature of the subject in many languages testifies, anxious attention is being given to it.

I am being constantly asked what are the precise objects for which this Conference has been called? If those who ask this question expect that all or any of the problems of population will be solved by three days' discussion, however carefully arranged, or that anything like international agreement can be arrived at by the union of experts of different countries, however eminent, on this single occasion, I am afraid that they are doomed to disappointment. But the mere fact to which I have alluded of the widespread interest in and study of the

problems of population is surely sufficient to justify this attempt to secure a representative international gathering of specialists not only in economics, sociology and statistics, but in biological science, for the purpose of exchanging ideas on some of these problems.

We cannot, indeed, hope for any immediate practical result from our deliberations. It is in the highest degree improbable that Governments will venture to touch upon questions which bristle with controversy, political, moral and religious, until much greater progress has been made in the consolidation of scientific opinion as applied to these questions and the consequent education of the public has taken place. It is difficult, however, to believe that a full discussion on purely scientific lines of the theories, facts and statistics relating to some fundamental population problems will not result in some advance towards the realisation of this ideal.

One of the most interesting of these theories is the concept of optimum population which will be discussed this afternoon. I will not attempt to anticipate the arguments for or against this theory in its relation to political societies. But a suggestion has been made which rather appeals to me, namely, that our Conference may be defined as one to bring in contact with one another scientists specially interested in the investigation of the factors which will determine optimum population in various portions of the earth at different times. This will naturally lead to the exchange of information between investigators who will each contribute from the researches and experience of his own nation; and there will be very many problems, arising within national boundaries, in the investigation and solution of which truths of importance to many outside those boundaries will undoubtedly be discovered; while others may very well arise in which cooperative research between scientists of more than one country can eventually be arranged.

This leads me to the second object aimed at by the deliberations of this Conference. We can expect only to make a beginning on the present occasion, and those responsible for convening it have had strongly present to their minds that, if any real progress is to be made, further Conferences will be necessary at not too infrequent intervals; and that it will be essential to establish some permanent international organization, on as adequate a scale as may prove possible, for the purpose of watching developments, of promoting and encouraging research, and of calling future meetings. I have therefore to ask for your approval for the nomination of a small committee drawn from among the members of the Conference to study the question during the next three days, and to present a report to a specially convened meeting on Saturday morning, a meeting of a private

character. If the Conference agrees, I would put forward the following names of gentlemen to serve on the sub-committee:

Dr. E. M. East,	Dr. Erwin Baur,	
Prof. W. E. Rappard,	Dr. F. A. E. Crew,	
Dr. W. Welch,	Sir Bernard Mallet	} <i>ex officio.</i>
Prof. C. Gini,	Dr. Raymond Pearl	
Dr. Léon Bernard,		

The Advisory Council have made every effort in the choice of subjects to be discussed, and, by the invitations issued, to place the discussions on a scientific basis. But a glance at the program is enough to show that there is still a considerable range of questions on which acute differences of opinion exist, both between individuals and between nations. The success of the Conference depends on the willingness of its members to second the intention of the promoters to maintain the discussions on a high level. As has been stated in one of our circulars, our point of view is "that of the scientific laboratory or study and not that of the pulpit or the hustings". It would be strange if the atmosphere of conciliation which pervades Geneva should not have its influence in this hall, and I am bold enough to believe that population questions, treated in this manner, can be discussed with self-control and without passion or animosity.

The more one looks into population questions, the more one feels the inadequacy of the material provided by Governments; I speak only of my own, though I am not aware that much better results are obtained elsewhere for the study of many of the questions with which we are concerned. General registration of the population would enable a flood of light to be thrown on many matters. I need only refer, as an instance of what I mean, to the questions introduced into the British Census of 1911, and which resulted in a most valuable study on the fertility of various social classes in England and Wales from the middle of the 19th Century to 1911 by my former colleague Dr. T. H. C. Stevenson, that very eminent vital statistician. This still remains, I believe, the most complete and authoritative pronouncement on this question. I am sure my friend Dr. R. A. Fisher, among the members of the Conference who will speak later this morning, will confirm my opinion on this question and, if there were time and opportunity to do so, give us further instances of the need for more complete statistical information. I am hoping one result of this Conference may be to increase the pressure on Government authorities to supply it.

FIRST SESSION.

Chairman: Sir Bernard MALLET, K.C.B.

Paper presented to the Conference:

BIOLOGY OF POPULATION GROWTH, by Professor Raymond Pearl.

Supplementary Paper:

THE DEVELOPMENT OF THE POPULATION IN ITALY, by Professor A. Niceforo.

THE BIOLOGY OF POPULATION GROWTH

by

Professor R. PEARL.

I.

The primary biological variables involved in the growth of population are two in number: the force of *natality*, measured by the birth rate, on the one hand; and the force of *mortality*, measured by the death rate, on the other hand. These primary elements are fundamental to the discussion of the growth of populations of any and all organisms whatever, from *Amoeba* to man. In most of the lower organisms living in a state of nature, whether plant or animal, these are the only first-order variables which have to be taken into account in discussing the problem, and in experimental studies on population growth the arrangement of the experiments is usually such that only natality and mortality can possibly directly determine the number of individuals in the population at any given time.

In most human populations, especially those inhabiting large geographical areas, a third factor may influence directly the size of the population at any given moment, in greater or less degree. This third factor is *migration*, and it is theoretically to be regarded as a primary variable in determining the growth of such human populations.

Besides the three primary biological factors of natality, mortality and migration which influence the observed growth of human populations, there are various secondary environmental factors which may play a part in determining the final result. These are such things as food supply, the economic situation in general and, in particular, social forces of various sorts, and perhaps others. But it should always be kept in mind, and this I particularly wish to emphasize, that these are all *secondary* factors from the biological point of view. They produce whatever effect they may have upon the final result, namely, the size of the population at any given moment, by acting, more or less powerfully as the case may be, upon one or more of the three primary biological variables — natality,

mortality and migration. Thus an economic depression in a particular country may affect adversely the birth rate of that country, or even the death rate if the degree of the depression is sufficiently great or its duration sufficiently prolonged. These effects will, in greater or smaller degree, reflect themselves finally in the size of the population. This final effect upon the growth of the population may, however, be extremely slight, and difficult or even impossible of separate statistical recognition or measurement, because of compensating influences at work at the same time. Logically, however, the operation of these secondary factors must always be recognized. But, from the point of view of the theory of population growth, their influence is always a second-order one. They can produce any effects upon population only by operating upon the primary biological forces of natality, mortality and migration.

II.

It is an observed fact which at this stage of the discussion involves no theoretical implications whatever, or postulates special to it, that the growth of populations of the most diverse organisms follows a regular and characteristic course. In general and everyday terms of commonsense, this characteristic manner of population growth may be described in the following way. The population at first grows slowly, but gains impetus as it grows, passing gradually into a stage of rapid growth, which finally reaches a maximum of rapidity. After this stage of most rapid growth, the population increases ever more and more slowly, until finally there is no more perceptible growth at all. In short, the populations of various forms of life first wax in their speed of growing and then wane.

This characteristic phenomenon may be more precisely described in a variety of ways, depending upon which of several mathematical aspects of the matter we choose to stress. This may best be illustrated by a concrete example. For this we may well take a relatively simple case biologically, such as is afforded by the growth of a population of yeast cells. The yeast plant is an organism low in the scale of life. Its reproduction, under the conditions of the experiments, is by the process of cell division; the cells present in the populations at any given moment forming new cells by budding. An experiment on the growth of a population of yeast cells is made as follows: a measured amount of wort which furnishes nutriment to the yeast plants is seeded with a few cells. Then at equal intervals of time thereafter the equivalent of a census count is made of the cells then present. Because of the minute size of the individual cells and of other technical difficulties, some sort of indirect

method is commonly used to measure the size of the population, in place of direct counts. But this is a matter merely of detail, which need not detain us in the present discussion.

The outcome of a typical experiment of this sort, the data being taken from an investigation of the subject made by Carlson¹, is shown in Table I. A further discussion of these data, with their graphical representation, will be found in an earlier work².

TABLE I.

The Growth of a Population of Yeast Cells (Data from Carlson)

Hours of growth	Quantity of yeast		Absolute quantity of yeast produced per hour (= time rate of growth) (d)	Quantity of yeast produced per hour in percent of total up to that hour (=percentage rate of growth) (e)
	Observed	Calculated		
(a)	(b)	(c)		
0	9.6	9.9	8.7	%
1	18.3	16.8	10.7	90.6
2	29.0	28.2	18.2	58.5
3	47.2	46.7	23.9	62.8
4	71.1	76.0	48.0	50.6
5	119.1	120.1	55.5	67.5
6	174.6	181.9	82.7	46.6
7	257.3	260.3	93.4	47.4
8	350.7	348.2	90.3	36.3
9	441.0	433.9	72.3	25.7
10	513.3	506.9	46.4	16.4
11	559.7	562.3	35.1	9.0
12	594.8	600.8	34.6	6.3
13	629.4	625.8	11.4	5.8
14	640.8	641.5	10.3	1.8
15	651.1	651.0	4.8	1.6
16	655.9	656.7	3.7	0.7
17	659.6	660.1	2.2	0.6
18	661.8	662.1	—	0.3

¹ CARLSON, T. "Ueber Geschwindigkeit und Grösse der Hefevermehrung in Würze." *Biochem. Ztsch.*, Bd. 57, pp. 313-334, 1913.

² PEARL, R. "The Biology of Population Growth." New York (Alfred A. Knopf, Inc.), 1925, pp. XIV + 260.

In this table, the first column (a) gives the hours during which growth occurred; the second column (b) records the observed quantity of yeast, or in other words the size of the population, at each successive hour; the third column (c), which may be neglected for the present, gives the size of the population at each successive hour as calculated from a mathematical equation to be discussed later; column (d) gives the simple time rate of growth, that is, the absolute amount of new yeast produced by the growth of the population in each successive hour. The figures in this column are the observed values of the ratio dy/dt , y denoting size of population and t denoting time in hours. The last column (e) gives the relative rate of growth, in proportion to the already attained size of the population, in each time interval. In mathematical terminology, the figures in this column are the observed values of the double ratio $\frac{1}{y} \frac{dy}{dt}$ for each hour.

Column (d) tells us that in the growth of this yeast population the absolute increment of new yeast cells per unit of time increases each hour as the population grows, up to a maximum increment per hour, which is attained in this case somewhere about the seventh or eighth hour. Thereafter, as growth continues, the absolute increment of new cells per unit of time decreases hour by hour until it almost vanishes and, for all practical purposes, the population has ceased to grow.

If the figures of column (d) were plotted, they would obviously form a curve shaped like a cocked hat or sugarloaf, low at the two ends and rising to a peak somewhere in the middle. As a natural consequence of this trend of the first differences, the relative growth rates given in column (e) are bound to be largest at the start of growth and to become smaller as the absolute size of the population increases. Although this relative rate of growth presented in column (e) is the one most often discussed by demographers in talking about population growth, it tells us much less clearly what is the real nature of the characteristic curve of population growth than does the simple time rate, or first derivative of the population growth curve given in column (d).

The phenomenon shown in column (d), namely, that the absolute increment of growth per unit of time increases with time to a maximum value and then decreases till the end of measurable growth is reached, has been found in recent years to be the way in which populations of such a wide variety of organisms actually grow, that it may now be fairly regarded as the characteristic, normal mode of population, to at least a first approximation. I shall not take the time here to review all the evidence that this is so. This has already been done in

two recent books¹. It has been shown that experimental populations of yeast, of bacteria, and of the fly *Drosophila melanogaster* follow this characteristic curve with great precision in their growth.

Furthermore, it has been demonstrated statistically that populations of human beings have grown according to the same type of curve, so far as may be judged from the available census records, in at least the following places: Sweden, United States of America, France, Austria, Belgium, Denmark, England and Wales, Hungary, Italy, Norway, Scotland, Serbia, Japan, Java, Philippine Islands, Baltimore City, New York City, and the world as a whole. In the case of the places named, the census records do not extend over a sufficiently long time to make the case conclusive that population growth, if undisturbed, would follow in human groups the complete course exhibited by the yeast population just discussed. The available data only make such a conclusion probable. And one cannot conduct experiments with human beings on this point as can be done with lower organisms. But fortunately it has been possible to find one group of human beings, the indigenous native population of Algeria, in which a cycle of population growth has been practically completed during the period for which census records are available, these having been carefully made by the French. In this case the human population followed in its whole cycle of growth a curve of the same characteristic form that has been discussed for the yeast. This case has been fully described and analysed in my book, *The Biology of Population Growth*.

III.

The equation to the curve which has been found by experiment and observation to be descriptive of population growth in a wide variety of organisms was first discovered by the Belgian mathematician Verhulst² in 1838. His pioneer work was forgotten, and overlooked by most subsequent students of the population problem. In 1920 the present writer and his colleague Lowell J. Reed, without any knowledge of Verhulst's prior work, independently hit upon the same equation³.

¹ PEARL, R. "Studies in Human Biology." Baltimore (Williams & Wilkins Co.), 1924. Part IV.

Id. "The Biology of Population Growth." *Loc. cit.*

² VERHULST, P. F. "Notice sur la loi que la population suit dans son accroissement." *Corr. math. et phys. publ. par A. Quetelet*. T. X, pp. 113-121, 1838.

³ PEARL, R., and L. J. REED. "On the Rate of Growth of the United States since 1790, and its Mathematical Representation." *Proc. Nat. Acad. Sci.*, Vol. 6, pp. 275-288, 1920.

Verhulst called his curve the "logistic". This usage we shall follow. The characteristic appearance, and some of the mathematical properties of the logistic curve are shown in Fig. 1.

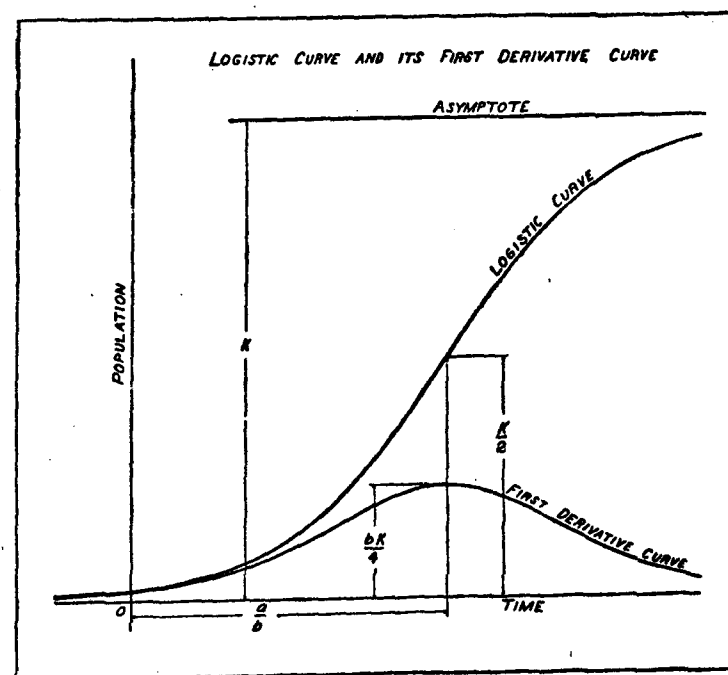


FIG. 1.

The logistic curve and its first derivative.

The third column of Table I (column c) shows the high degree of accuracy with which this logistic curve is able to describe the observed growth of a population of yeast cells. For the whole series of nineteen observations, the root mean square deviation between the experimental results and the theoretical curve is only 3.59. The equation of the fitted curve is:

$$y = \frac{66.5}{1 + e^{4.1896 - 0.5353x}}$$

where y = quantity of yeast, and x = time of growth in hours.

The possession of such a curve as this, which is found by actual experience to describe accurately the course of population growth in a wide variety of organisms, is a valuable first step, but only a first step, towards reaching an understanding of the biology

of the process. What we want to know is how the biological forces of natality and mortality are so integrated and correlated in their action as to lead to a final result in size of population which follows this particular curve rather than some other one. This demands that we shall push the enquiry further.

IV.

There are two lines along which this further investigation must proceed. The first is a theoretical mathematical analysis of the relation of birth rates and death rates to the logistic curve, under various postulates. We have done a considerable amount of work, as yet unpublished, upon this subject. Certain aspects of it have also been discussed by Yule¹ and Lotka². I shall not attempt to present the details of this analysis on this occasion, because of their technical character. Some of the results, however, may be stated in simple form and are pertinent to the present discussion.

It is easily shown that, if birth rates and death rates are assumed to remain constant, at any values consistent with growth at all (*i.e.*, birth rates larger than death rates), the population will grow according to an exponential curve on to infinity. The rate of this progression may be slow or rapid according to the assumptions made, but the form is exponential. Nothing like the slowing-down of growth after a period, which is seen in the logistic curve, appears under this postulate.

But plainly, with actual populations of living organisms, birth rates cannot continue constant indefinitely. In saying that birth rates shall be constant regardless of the size of the population already attained, it is tacitly, but implicitly, assumed that the universe in which the hypothetical population is growing expands proportionately with this growth, so that each single element always has plenty of room, no matter how large the whole group becomes. But such an assumption is unwarranted for any actual population whatever. All populations of real organisms live in universes with definite limits. The absolute size of the universe may be small, as in the case of the test-tube which holds the yeast cells, or it may be as large as the earth, most of which could conceivably be inhabited, on a pinch, by man. But in any and every case there is ultimately a definite limit to the size of the universe in which any real population lives.

¹ YULE, G. Udny. "The Growth of Population and the Factors which control it." *Jour. Roy. Stat. Soc.*, Vol. 88, pp. 1-58, 1925.

² LOTKA, A. J. "Elements of Physical Biology." Baltimore (Williams & Wilkins Co.), 1925. pp. xxix + 460.

This consideration obviously alters the complexion of the case. For it at once follows that, if the universes in which populations live are finite and inextensible, there must come a time in the growth of any population when the individuals composing it begin to get crowded, and as the growth continues beyond this point they will get more and more crowded.

It is not an unreasonable hypothesis *a priori*, and, as we shall presently see, there is abundant experimental and observational support for the view that crowding or, as it is technically termed, density of population, when it reaches a certain degree, has an adverse effect upon both of the two primary biological forces underlying population growth, natality and mortality. This assumption has been made and the theoretical consequences worked out, under several simple postulates as to the quantitative relationships between the variables.

The net result of this first, or mathematical, attack upon the problem of population growth is to show that, with simple postulates as to the relations between the two first-order variables, birth rates and death rates, and the second-order variable, density of population, and without consideration of any other variables whatever, we are led rigorously to the conclusion that under these postulates the growth of population must necessarily follow that type of curve (the logistic) which is empirically found to describe the growth of actual populations of widely diverse organisms.

The second mode of attack upon the problem of the biology of population growth is the experimental. Its purpose is to observe at each stage the growth of the population of some actual organism, small enough to be capable of laboratory management, under rigorously controlled and known conditions. Not only can the growth of such an experimental population as a whole be observed, but also it is possible to set up experiments in which each separate variable such as natality, mortality, density of population, etc., can be particularly studied, and its behavior under controlled conditions described and measured. It is to this mode of attack upon the problem that much of the research energy of my laboratory has been devoted during the past five years. The organism chiefly used has been the fruitfly *Drosophila melanogaster*, the form so widely employed as material for genetic studies.

V.

Before undertaking to present some account of the results of these experiments, I wish to point out that the significance of

these, or any similar experiments on lower organisms, in the discussion of the problems of human populations should be neither overrated nor underrated. Obviously, in all such experiments the conditions of life are not only simpler but also more uniform than any under which human populations live. Further, the organisms concerned are less complex physiologically and psychologically than are human beings. No conclusion reached by the study of experimental populations of lower organisms can safely be transferred by simple inference to human populations. It must in every case be conclusively shown by independent investigation of human populations that the same conclusion holds for them, if it does. Furthermore, if the same result is, in fact, found to appear in both experimental and human populations, by no means may it safely be inferred that the causes leading to this result are necessarily the same in the two cases. They may be or they may not. To find out which alternative is true demands special *ad hoc* investigation.

On the other hand, it must also be kept in mind that the forces of natality and mortality are basic biological attributes of aggregates of living things, men as well as flies. The ultimate biological forces leading to the observed growth of a human population are these two, natality and mortality, just as truly as they are in a population of flies or yeast cells. Because of the much greater ease and precision with which the behavior of these variables, under diverse controlled conditions, may be analyzed in experimental populations of lower organisms, the results obtained from such studies may be of great value in the direction of suggesting points for statistical investigation in human populations. Over and beyond this consideration is the further one that populations of whatever organisms are, in their very nature, aggregate wholes, and behave in growth and other ways as such. The elements of their behavior arising out of this condition of aggregate wholeness are just as true in populations composed of individuals of one species as in those composed of individuals of another.

Perhaps the most impressive thing which has come out of the statistical study of human population growth is the evidence that the steady onward march of this growth is not sensibly influenced by the host of economic and social events which are supposed of logical necessity to affect it. During the past few years, the argument has been made that the very populations which have in fact grown with great precision according to a logistic curve cannot possibly have done so, because this curve does not "take account of" a lot of these second-order variables. This argument is rubbish, born out of the conservative resistance to any new idea which the established order of learning has

always shown, by that windbroken and spavined old stallion, faith in *a priori* logic as against plain facts of experience. As a matter of fact, the logistic curve does "take account of" all these second- and third-order variables, in the sense that it describes the integrated end effect upon population size of the aggregated forces tending towards increase in numbers on the one hand and decrease in numbers on the other hand. The population growth of the United States is an excellent case in point. If one plots the census counts of this population from 1790 to 1920, it is impossible to detect in the curve of growth any separate or disturbing effect of immigration, although, as we have seen, migration is theoretically a first-order variable in population growth. The actual observed growth of the population of the United States follows the logistic curve with remarkable precision. To suit various theorists, it presumably ought not to, but *in fact* it does. Benjamin Franklin long ago pointed out that, for the growth of population aggregates of any considerable size, migration was an unimportant factor as compared with natural increase by reproduction. He was right. Whatever the future may develop, the past history of the matter shows plainly that human populations have behaved in their growth in the same way that experimental populations of lower organisms do, with truly remarkable faithfulness.

VI.

The details of the technique of making experiments on population with the fly *Drosophila melanogaster* have already been described¹ and need not be repeated here. It will suffice to say that, in bottles of measured size, definite amounts of food material are placed, and then an initial group of a few flies — say one male and one female — is added. At regular intervals thereafter, the then existing population in each bottle is carefully counted and recorded, and the individuals composing it returned to the bottle to carry on their normal lives until the next census count.

There are several ways in which an experiment on the growth of a *Drosophila* population can be carried out. Some of these ways differ in principle in a manner that is of importance in determining the kind of result obtained. The simplest case is to set up an experiment in the way described briefly above, and thereafter literally do nothing further except to let nature take

¹ PEARL, R. "The Biology of Population Growth." Chap. II.

its course and count the flies at intervals. What then happens is that the population grows along a logistic curve for a little more than half of a complete cycle of such a curve. Then quite suddenly the population begins to decrease in numbers. This decrease goes on at an accelerating rate until there are no survivors.

This result is precisely that which is to be expected mathematically on the postulates that birth rates decrease and death rates increase uniformly at a constant linear rate. This is shown in Table II.

TABLE II.

The Growth and Decline of a Hypothetical Population assumed to start with Two Individuals and to be Subject thereafter to the Indicated Birth and Death Rates.

Period	Percentage birth rate in period	Births in period	Percentage death rate in period	Deaths in period	Population at beginning of period
1	100	2.0	10	0.2	2.0
2	90	3.4	20	0.8	3.8
3	80	5.2	30	1.9	6.5
4	70	6.8	40	3.9	9.7
5	60	7.6	50	6.3	12.6
6	50	6.9	60	8.3	13.9
7	40	5.0	70	8.7	12.5
8	30	2.6	80	7.0	8.7
9	20	0.9	90	3.9	4.4
10	10	0.1	100	1.3	1.3

In the actual experiments, the changes in the birth and death rates which lead to this type of curve, with first growth and then decline of population, are directly associated with the diminishing food supply under the conditions of a limited and closed universe.

The second type of experiment is one in which an attempt is made to add food as the supply is used up. The technical difficulties of doing this satisfactorily with a *Drosophila* population are considerable, but by sufficient care they can be overcome in large degree. The resulting growth of the population then follows a simple logistic curve, as I have described in detail

and illustrated elsewhere¹. There are two points in connexion with experiments of this type which seem to need emphasis in the light of further work. The first is that, owing to the technical difficulties of adding new food to a bottle, for reasons that are fully discussed in the reference cited, the food conditions are always sub-optimal in experiments of this type. The second point is that the smoothness with which the populations follow the logistic curve in this type of experiment is a direct consequence of the fact just mentioned that the conditions as to food are definitely sub-optimal. The nutritional level of the bottles is not high. It only a little more than barely permits continued growth of the population. Under these circumstances violent oscillations of either birth rates or death rates do not occur. The observations of population size lie smoothly on the logistic curve until the asymptote is nearly reached.

The third type of experiment, which I here report on in a preliminary way for the first time, is so planned as to have the food conditions always optimal both as to quality and quantity. This is accomplished in the following way. Suppose a bottle A_1 to be prepared with our new synthetic food², which has been shown experimentally to lead to lower death rates and higher birth rates than any other natural or laboratory food tried, and to be seeded with an initial small population. At the end of three days a census count is taken and the population is transferred to a new bottle, A_2 , containing fresh new food to the same amount as was present initially in A_1 . At the end of another three days a census count is again taken and the population again transferred to another bottle A_3 , which again contains new fresh food, and so on indefinitely. Meantime the lag bottles, A_1 , A_2 , etc., which the adult population has left by transference, are examined daily. Whenever in any such bottle any flies hatch out from eggs which were laid by the females of the adult population while they were resident in that bottle, these newly hatched flies are counted (as births) and added to the adult population in whatever bottle it happens then to be. So then we get a record of the daily birth rate of the population. Also each day the bottle is examined in which the adult population is actually then resident and the deaths recorded. So, then, the situation in these experiments is that (a) there is a new and abundant crop of fresh food every three days, (b) all the young are born in a lying-in hospital and transferred to and counted into the general population only after they have been born and

¹ PEARL, R. *Loc. cit.*, pp. 32-44.

² PEARL, R., ALLEN, A. L., and W. B. D. PENNIMAN. "Culture Media for *Drosophila*. II. A New Synthetic Medium and its Influence on Fertility at Different Densities of Population." *Amer. Nat.*, Vol. 66, pp. 357-360, 1926.

dried off there, and (c) there is complete registration of both births and deaths as well as census counts of the population as a whole. The population is dependent upon any given single food supply only over a period of three days. During so short a period even the largest populations obtained do not begin to exhaust the food.

Many experiments of this type have been performed. The general result is that the population first grows up to a maximum or asymptotic level, just as in the second type of experiment described above. But in this case the population can be kept at this asymptotic level as long as the experimentist desires. A striking result, however, is that, during both the growth period, and thereafter, there are violent oscillations of the population in size, about its mean position as given by the fitted curve. In fact these waves in the size of the population, produced by oscillations in the birth and death rates, are perhaps the most characteristic feature of population experiments of this particular type. It has not so far been possible to devise any method of holding these populations in a steady state at the level of the asymptote, when there is at all times an abundance of fresh food. The population simply waves up and down about an average size. I believe that this condition of unstable equilibrium is, in part at least, causally connected with the optimal food conditions. A detailed account of these experiments will be published, it is hoped, some time in the course of the next year.

VII.

It has been stated above that the growth of a population along the logistic curve can be completely accounted for on theoretical mathematical grounds by making certain simple postulates regarding the relations between three variables, birth rate, death rate, and density of population. The basic postulate was that increasing density of population has associated with it adverse changes in birth rates and death rates. Is there experimental evidence in support of such a postulate?

For several years an intensive experimental investigation has been going on in my laboratory regarding the effect of density of population upon natality and mortality in *Drosophila*. The chief results of these studies I shall now briefly review.

Some years ago Pearl and Parker¹ showed that, if a count

¹ PEARL, R., and S. L. PARKER. "On the Influence of Density of Population upon Rate of Reproduction in *Drosophila*." *Proc. Nat. Acad. Sci.*, Vol. 8, pp. 212-219, 1922.

were made of the progeny (adult flies or imagoes) produced in bottles of uniform size, uniform amount of food, and uniform air space, but with varying densities of population, the results were those shown in Table III.

TABLE III.

Experimental Data on the Influence of Density of Population on Rate of Reproduction in Drosophila.

Pairs per bottle at start.	Mean population over 16 days	Imagoes produced per female per day. Observed	Calculated number of progeny per female per day
1	2.00	21.4	21.1
2	3.40	12.6	14.5
3	5.50	10.8	10.2
4	7.32	9.1	8.1
5	9.29	5.9	6.7
6	10.29	6.8	6.2
7	11.51	5.2	5.6
8	14.48	4.6	4.6
9	16.62	4.1	4.0
10	18.74	3.1	3.6
12	21.70	3.5	3.1
15	26.02	2.3	2.5
20	34.02	2.2	1.8
25	47.75	1.0	1.1
30	47.73	1.2	1.1
50	90.66	.33	.34

There is evidently a profound and regular change in the rate of reproduction of *Drosophila*, under the conditions of these experiments, with increasing density of population. The number of progeny produced per female per day declines as density increases, at first extremely rapidly and then more and more slowly at higher densities. The total number of progeny flies (23,922) is large enough to give confidence in the results.

The last column of Table III gives the calculated ordinates of the equation, fitted to the observations by the method of least squares,

$$\log y = 1.54 - .008x - .658 \log x,$$

where y denotes number of progeny flies produced per female per

day over a 16-day period, and x denotes mean density of the mated population (measured as flies per bottle).

It is at once apparent that this equation describes the observed facts with extraordinary precision. Rarely, even in a physical or chemical experiment, does one get closer agreement between observation and theory than is here shown. Plainly the curve is the expression of the law relating these two variables, rate of reproduction and density. It is the inverse of Farr's law relating death rates and density in human populations.

These experimental results on the effect of density of population on the birth rate have been confirmed many times in my laboratory¹.

In all of these experiments so far mentioned, the effect of density upon birth rates was measured by counts of adult progeny flies (imagos) produced. This procedure left in doubt the point as to whether density produced its effect through an alteration of fecundity (egg production) or at some later stage in the process of reproduction. This doubt has now been cleared up by an elaborate series of experiments carried out in my laboratory during the past year by Dr. Arato Terao. In these experiments, careful counts were made of the number of eggs produced under different densities of population. The results will shortly be published in detail. Here it is only necessary to say that they show conclusively that the primary effect of density, in populations of *Drosophila*, is upon fecundity (number of eggs laid). The number of eggs produced per female per day decreases with advancing density of population according to the same type of curve as that shown for progeny produced in the last column of Table III.

So, then, it may be concluded that increasing density of population does in fact have associated with it in experimental populations of *Drosophila* just the sort of adverse changes in the birth rate which were postulated in the theoretical discussion in section IV of this paper. Elsewhere² evidence has been presented showing that the same kind of effect of density is observable in populations of other organisms.

The result of a large amount of experimental work regarding the effect of density of population upon mortality are now in process of publication in detail³. Only the broad outcome can be presented here.

¹ See PEARL, ALLEN and PENNIMAN, *loc. cit.*

² PEARL, R., *loc. cit.*, Chap. VI.

³ PEARL, R., MINER, J. R., and S. L. PARKER. "Experimental Studies on the Duration of Life. XI. Density of Population and Life Duration in *Drosophila*." *Amer. Nat.*, 1927.

This is done in Table IV, which gives the mean duration of life in days of *Drosophila* subjected to the indicated densities of population. The experiments involved 13,000 flies.

TABLE IV.

Mean Duration of Life of Drosophila at Different Densities of Population.

<i>Initial density</i>	<i>Weighted average mean density to which flies had been subjected up to time of death</i>	<i>Mean duration of life in days</i>
2	1.77	27.31 ± .58
4	3.30	29.32 ± .60
6	5.00	34.45 ± .65
8	6.68	34.20 ± .61
10	8.15	36.22 ± .72
12	9.72	34.31 ± .61
15	12.42	37.92 ± .66
20	16.69	37.07 ± .55
25	20.68	37.47 ± .49
35	28.85	39.43 ± .67
45	37.23	37.46 ± .51
55	44.65	40.04 ± .53
65	53.16	35.25 ± .45
75	59.66	32.34 ± .46
85	66.95	30.10 ± .36
95	74.50	27.17 ± .36
105	80.36	24.20 ± .32
125	94.38	19.60 ± .28
150	111.88	16.17 ± .24
• • 200	144.47	11.93 ± .20

What the figures in this table show is that, after a density of fifty-five flies per one-ounce bottle is passed, the mean duration of life steadily decreases as density of population increases. Another way of putting the same thing is to say that the death rates in these experiments increased with increasing density of population after density fifty-five had been passed. The figures for mean duration of life are necessarily determined by the values of the death rates at ages. Other experiments have demonstrated that, with extremely high densities of population, the

mean duration of life (or equally the death rates) approach an asymptote. In densities below fifty-five, after a relatively small initial rise, there is little change in mean duration of life (or death rates) with small increases in density.

VIII.

To summarize: A large amount of mathematical, statistical, and experimental study has brought to light the following broad facts regarding the general biology of population growth:

1. Populations of organisms of the most diverse kinds, ranging from bacteria and yeasts to man, are found statistically to follow in their growth a particular type of curve, the logistic.

2. Mathematical investigation shows that a curve of this type is necessarily generated under certain simple postulates as to the inter-relations between the two first-order variables, birth rates and death rates, and the second-order variable, density of population. One particular set of such postulates is that it shall be assumed, first, that birth rates are markedly affected adversely by small increases in density at relatively low densities, while after a certain density is passed further increases produce only slight decreases in birth rates down to an asymptotic limit; and, second, that death rates are insignificantly affected by increasing density at relatively low densities, while after a certain density is passed death rates markedly increase with increasing density up to an asymptotic limit.

3. Experimental investigation of populations of *Drosophila melanogaster* under controlled conditions shows that, in fact, the relations between density of population and birth rates on the one hand and density and death rates on the other hand which actually exist in such populations are in accord with those theoretically assumed in the preceding paragraph. In short, it is possible to account for all the main features of the growth of experimental populations of *Drosophila* by a simple hypothesis as to the correlated behaviour of three variables.

A great deal more work needs to be done on the problem, and the investigations are being continued in my laboratory. The present paper is to be regarded only as a progress report.

DISCUSSION.

Mr. J. B. S. Haldane (Great Britain): Professor Pearl has produced evidence of a very substantial character with regard to the laws governing the growth of human and animal populations, but there are certain points on which one would like to have his opinion. In the first place, the statistics for human populations refer to an undoubtedly exceptional period in human history, a period where fairly rapid growth was taking place in the majority of the countries studied. We know that there have been declines in population, and that in many cases those have been of a catastrophic character, due to famines, pestilence and wars, and Professor Pearl's own special work, as far as I can make out, gives us the decline in the population of *Drosophila* due essentially to famine. If one studied, let us say, the population of Ireland during the 19th Century, one would come across something of that kind. A question which I would like to ask is whether Professor Pearl considers that his theory, and the data available to him, give him reason to suppose that the population of a given area may come to decline in a relatively orderly manner without catastrophes such as famine or war, because if, I say deliberately, if, any regions of the world are overpopulated, we must undoubtedly hope that their population will decline in that manner rather than catastrophically.

The second point which I wish to raise is this. Under certain conditions, a new growth cycle does undoubtedly start. For example, Christopher Columbus, Sir Walter Raleigh or some such person started one in America. The conquest of Algeria by the French started a relatively small one there, and, what is perhaps most significant of all, some event about 1870, intervening on a preceding growth cycle, started one in the German Empire. One wonders whether, amongst the various catastrophic events going on at present, for example, the very great changes in the social organisation which have occurred in Russia and Italy, one may not find causes which will definitely upset the predictions made on the basis of the logistic law, just as such predictions made on the growth of the German population before 1870 would have been upset by subsequent events.

It seems to me that we have therefore in the world around us a fairly decisive experiment which will demonstrate the validity or otherwise of Professor Pearl's conclusions. I think we may say that if,

the Great War and the Russian Revolution do not seriously upset the cyclical growth of populations, it is very difficult to imagine anything else that will. If, on the other hand, such events as those have had a serious effect, we may perhaps feel it possible, by social organization of one kind or another, to affect what is at first sight a law of nature.

In animal populations, we may distinguish between two different types with regard to the laws governing population. We have the type exemplified by Professor Pearl's own work on *Drosophila*, where the primary cause stabilising the population is a fall in fertility with density, which is more important than the rise in the death rate. We have the other type which is exemplified by the work of Elton, for example, on wild populations of rabbits and other animals where the primary cause checking the population appears to be an enormous and catastrophic increase in the death rate, showing itself in epidemic diseases when the population reaches a certain level. The work of McKendrick has made it clear that in many cases, as soon as the population density exceeds a certain value, epidemics which would otherwise fade out will go through the whole population. It is clear that, socially, the more desirable type of check of the two is the *Drosophila* rather than the rabbit type, and that even in *Drosophila* the stable density is very much greater than the optimum density as judged by the length of life, which is as good a criterion as one can get.

I think we should be greatly interested if Professor Pearl would tell us how much greater the equilibrium density is than the optimum density as measured in that way. It might give us some indications to be applied to other fields.

Finally, with regard to the question of the oscillations round the stable state of the population, it is quite possible to discuss those mathematically, and the discussion becomes relatively simple in the case where the population density is primarily controlled by a birth rate rather than a death rate.

One can show mathematically that small oscillations in population are damped if, in the neighborhood of equilibrium, the birth rate falls off relatively slowly with increasing density; but if the birth rate is very sensitive to density, you will invariably get oscillations which will not be damped, or not be damped until they have become relatively large. They will not tend to peter out. If one may venture to suggest the meaning of that, it is that, if we are to avoid oscillations of an unfortunate character, in birth rates and other social conditions corresponding to them, we want to have a stable policy rather than a febrile one varying from moment to moment with regard to the whole problem of birth rate and that therefore this Conference will tend to diminish such oscillations if it is successful.

Dr. J. W. Glover (United States): Professor Pearl has made an orderly and convincing study of population growth and indicated by experimental means the approximate nature of the frequency functions of various organisms under controlled conditions. These determinations are fundamental in character because they are empirical valuations of growth functions and throw much light upon the problem of finding the underlying mathematical function, if such exists, connecting the force of natality, force of mortality, and other variables involved.

It is an observed fact that the growth of population follows a characteristic course. Dr. Pearl exhibits data for the yeast cell, an organism low in the scale of life. In his Table I the time, t , is the independent variable and the quantity of yeast, y , the dependent variable, and from the observations of y at unit intervals of time, the values of $\Delta y / \Delta t$, where $t = 1$, are obtained. The limiting value of this ratio when Δt approaches 0 is the instantaneous rate of growth and could easily be obtained by means of well-known formulas in finite differences expressing the derivative dy/dt in terms of the differences. The values given in columns (b) and (d) reversed remind one of the functions, number living, lx , and number dying, dx , in actuarial terminology. The nature of the frequency curve, however, is clearly shown as area increments in column (d). The last column (e) is $\frac{1}{y} \frac{\Delta y}{\Delta t}$ and the limit of this expression when Δ ap-

proaches 0 would give the instantaneous rate of growth of the population, and is similar in its method of derivation to the instantaneous rate or force of mortality in actuarial theory. It may also be expressed as the logarithmic derivative of y with respect to the time, $d \log y / dt$, and may easily be calculated in terms of successive differences of column (b).

I am particularly impressed by the new method of approach made possible by the advance of experimental methods in science, in the present case, biology. The recent outstanding work of Dr. Pearl has freed the investigator from the bonds of *a priori* purely mathematical determinations in his search for functional laws of population growth. A striking example of this is afforded by the history of the search for the law of human mortality.

Dr. Moivre, in 1725, first proposed a simple law, and justified it by accordance with observations, which were themselves very meagre. The law was to the effect that the number existing, $1x$, at each age is proportional to the difference between that age and the limiting age of life. It is equivalent to the assumption of a constant decrease in the probability of living.

One hundred years later, 1825, Benjamin Gompertz, an English

actuary, read a paper before the Royal Society proposing a law of human mortality. This was an entirely *a priori* conception based on the thesis that man lost a constant proportion of his remaining vital force in equal small increments of time, illustrated most simply by the exhaustion of air from a bell glass over an air pump by continuous strokes of the pump at equal small intervals of time. This led to the mathematical statement $\mu x = bc^x$, for the force of mortality, or $1_x = kg^{cx}$ for the number of survivors. Gompertz also mentioned, but did not develop further, the additional condition that there might be another factor affecting the rate of mortality which was independent of the age. This was later, 1860, developed by W. Makeham, in a paper in the Journal of the Institute of Actuaries, and led to the formula $\mu x = a + bc^x$ for the force of mortality and

$$1_x = ks^x g^{cx}$$

for the number of survivors living at age x . It is usually referred to as Makeham's Law, but was really due to Gompertz. It gives a close approximation to the rates actually experienced by human aggregates, following both the experience of census statistics and that of life insurance companies. The Makeham Law involves three constants and these are quite easily determined so as to fit the curve to a given set of observed values from ages fifteen to the end of life. The law does not hold, however, from ages 0 to fifteen.

The older writers were compelled to build their laws on *a priori* grounds, as in the calculation of the throwing of dice or the drawing of balls from urns of known content; their observations on human mortality were too meagre and uncertain to be of much assistance. They guessed at a law and then used it to represent experience.

Under the new conditions, with experiments well controlled, the procedure is exactly reversed. The biologist finds the facts under a variety of controlled conditions, determines the fluctuations of one variable while the others are held fast, and so discovers the main characteristics of the functional mathematical law and makes the attainment of its full and precise expression much easier for the mathematician.

The logistic curve is the one to which Professor Pearl was led by his experiments and it certainly, as shown in column (c), follows the observed facts very closely. The frequency function in column (d) would seem to furnish an interesting basis for study and will probably find an important place in future investigations and papers on population growth. When the true frequency function is once established, all relations concerning derived functions are easily obtained by mathematical processes.

There are many forces operating to affect the force of natality and the force of mortality, but undoubtedly the final impress of most of them is negligible when compared with the definite changes brought about by a condition so permanent in its action as a limited area. This limitation, which is of the nature of boundary conditions on a function in mathematics and in population growth, must quite definitely determine the parameters of the final state of equilibrium and fix the density as a function of the time.

The second and third types of experiment in which sub-optimal and optimal food rations are set up throw much light on the problem of limiting or static conditions — the asymptotic approach — in population growth. Perhaps the most important results are those showing experimentally the effect of density of population on birth rates and death rates. These are the fundamental factors which fix the limiting conditions both as to population and cycle or period necessary to attain static condition. Dr. Pearl gives the mean duration of life for various densities of population, but does not indicate the death rates upon which these values are based. The stability of the results is quite clear from the smooth variation of the expectation of life from density of 2 to 200 in Table IV; however, some additional light would be thrown on the subject if the death rates or tables of survival were also shown.

I am quite in agreement with Dr. Pearl that in great aggregates the so-called social and economic events have little ultimate effect upon population growth. They are relatively small cyclical fluctuations about a fundamental trend. This is well illustrated by the insignificant effect on life insurance companies by the greatest epidemics in their history. The small fluctuations seem important because we view them from the magnified position of the infinitesimal present; in the march of centuries these variations fade away and are absorbed in the trend determined by the immutable forces of nature as expressed in natality, mortality and world boundaries.

Dr. R. A. Fisher (Great Britain): Among the nations to which allusion is made as following in the growth of their population the logistic curve are mentioned England and Scotland. Nearly three years ago, Yule, in his Presidential address to the Royal Statistical Society, fitted a number of logistic curves to the census population of England and Wales and the result showed clearly the limitations of the logistic method of predicting the future course of population growth. I need hardly say that Yule disclaimed any such attempt at prediction. For the census year, 1921, the last census year in Great Britain, the logistic curve already exceeds the census population by

nearly two millions, an effect which Yule ascribes to the recent war and the following influenza epidemic.

There can, I suppose, be no doubt that Yule was right in the effects he ascribed to these two causes, but they constitute no mitigation of the failure of the logistic curve. Professor Pearl has rightly and courageously repudiated any such *ad hoc* excuses. The logistic curve must either succeed in representing the actual course of population growth, including all secondary causes affecting such growth, such as those specifically mentioned by Yule, or it fails in its general purpose. After all, it would be exceedingly rash to assume, even in Geneva, that the future will be entirely destitute of great wars or of great epidemics.

Yule indicates that, looking backward along the logistic, we find the 18th Century population greatly under-estimated.

If, on the contrary, we look forward to the population towards the end of the 20th Century, we find an ultimate stationary population for England and Wales of about ninety-five millions. Yule points out that this would not necessitate any uncomfortable degree of crowding, being about the density of population now living in the charming county of Warwickshire, and far less than that of Lancashire. Nevertheless, there is good reason to conclude that it is a very generous over-estimate of our present population tendencies.

As Professor Bowley in particular has emphasized, if we look forward twenty years, then that portion of the population who will then be over twenty years of age have already been born, and the number surviving at all higher ages will depend, apart from migration, only on the mortality to which they had been subjected. Moreover, the rates of mortality at fixed ages are well known and are not rapidly changing like the birth rate, and are not changing at every age in the same direction. Consequently, for any future date one can calculate, on a basis which will certainly contain no large and systematic departure from reality, the future population above a certain age. Below that age the numbers are less certain, for they depend upon future births. So in Great Britain the annual number of births registered has been decreasing, somewhat irregularly, since 1903, that is, for twenty-four years. At present the number seems to be decreasing more rapidly than ever.

When we find Professor Bowley taking for a basis as estimating the future population in the younger age groups a constant annual number of births equal to that of 1921, it is clear that he will not be led to any under-estimate in this more questionable part of his calculation. He finds, in fact, not for England and Wales but for the whole of Great Britain, that is, including Scotland, that the population will rise to a maximum of just under fifty millions at about the year 1971, and will thereafter

decrease. The discrepancy between this estimate and the ninety-five millions ascribed by the logistic to England and Wales alone is startling, but on examination the reasons for it become obvious. The simple logistic makes no allowance for a population to increase up to a certain point and then to decrease. The population was increasing rapidly during the 19th Century and consequently the logistic is forced to predict a rapid increase during the 20th Century. But the annual contingent of births has been decreasing in Great Britain for twenty-four years and this decrease is not slackening.

It is obvious that a stationary population can only be maintained in a steady state by a constant annual contingent of births. If the number of births falls off, the number of infants will soon fall off. Next, the decrease spreads into the children of school age. Later, the young men and women of reproductive age will decrease, and only after a long interval will the decrease affect the older age groups. Man is an exceedingly long-lived animal. In Britain, the number of children of school age is already decreasing and the number of women of reproductive age will, according to Bowley's calculations, reach its maximum about 1931, and will thereafter decrease. No future births can affect the number of women of reproductive age before 1940.

I have given an example of the failure of the logistic. Its general character, however, is such as to make it an admirable curve for interpolation over short ranges, and even over short-range prediction, provided we have not any other important relevant information. In the case of human populations, we possess in the recorded age of individuals every relevant information, which is of even greater importance than the census totals, and enables us to make a prediction with very much more certainty than can be made from any curve of census totals.

When we have such information, it would be foolish to ignore it, and as the British population exemplifies, it may point to conclusions very different from those indicated by the logistic curve. In experimental biology, the use of this curve is not even confined to growing systems; the decrease of a population, for example, of fungus spores exposed to an antiseptic may be represented, as Dr. Henderson Smith's experiments show, quite excellently by a logistic curve, or as experimentists usually call it, an autocatalytic curve.

It has been stated once or twice by biologists that there is no correlation between social and economic events and population. As an economist I can hardly agree with that view. One would not, of course, expect to find the correlation absolute in time. Economic events would not affect the population immediately.

These are purely experiments with regard to food supply, and

the insects or bacteria are isolated; that is, they have no natural enemies, either enemies which will destroy them entirely by eating them or enemies which prey on them and cause disease. In human populations, disease is a very big factor. It has been mentioned that epidemics do not cause a great effect, but I think that is only true of certain relatively small 19th Century epidemics; it is not true, say, of the Black Death, or of endemic diseases, especially those which attack infants.

I cannot myself see at the moment any close connexion between these experiments and our human problems. We have no very exact information before 1750, but, as far as I have studied this question from that period onwards, it is the decrease in the death rate which is the important factor until you come to the middle of the 19th Century. Until then the movements of the birth rate are almost negligible. After that, you have this decrease in the birth rate which, as is well known, is due very largely to human action of a rational character and has no connection with food supply. The chief drawback of the curve as applied to human populations is the assumption that relative growth rate is determined only by the size of the population. The influence of other factors is recognized in comparing different nations where, of course, different logistic curves are used; it should also be recognized in the history of a single population, where factors such as the spread of ideas, factors not rigidly connected with size of population, undoubtedly influence the relative growth rate.

Dr. F. J. Netusil (Czechoslovakia): Professor Pearl has given us a report of his attempts to find the laws governing the biological evolution of population. I am quite confident in saying that his logistic curve is a real expression of such biological law. It is shown that the law expressed by the logistic curve is really governing not only the growth of populations, whether actual or experimental, but also all other biological processes. I would like to mention the recent German book of Janisch, "*Das Exponentialgesetz*"¹, in which the author, without knowing anything of Pearl's work, comes very nearly to the same general conclusions as Pearl on material of quite different bearing.

I remember that Pearl's work has aroused quite serious opposition. But none of the criticisms went to the basis of the logistic curve. The curve is not only logistic but logical. The criticisms as to method are of minor importance.

I can understand some of the criticisms for they are the criticisms of certain economists, who see not only the primary

causes of the growth or decrease of population, births, deaths and migration, but who also have largely in their minds the secondary and tertiary causes, that is, the economic conditions which influence the primary causes. But, theoretically, these secondary and tertiary causes are not expressed primarily by the logistic curve itself, they have their expression in the upper asymptote. And it must be said here that the upper asymptote itself is governed by the law of the logistic curve.

The upper asymptote, which is the most interesting from the practical, economic and political point of view, is apparently composed of three groups of components. The first of them is represented by the inhabitable area of the world, which can be represented in the upper asymptote as the linear component, *i.e.*, a straight line. The second group is represented by the fertility of the arable area and so long as the arable area grows and so long as there grows also the possibility of higher crops, so long it can be represented as a logistic curve approaching some asymptote of its own. It can be deduced from very simple logic that this part of the upper asymptote of population growth has a form of a logistic curve. The third component of the upper asymptote is the standard of living. So long as the standard of living has the tendency to grow, so long its influence can be represented as a logistic curve of an inverted course. In short, the first and chiefly the third component of the upper asymptote prevents the growth of population, the second component supports the growth.

Now, the economists who do not consider the changes in economic life in very long periods see only the short-time breaks and therefore they do not believe in smooth evolution. Nevertheless, in a study of the population of Bohemia, I have shown that the most sudden changes in economic and political life manifest themselves in the population growth in the logistic form. We have records of population beginning with the year 1754 and for the first period of nearly a hundred years by three-year censuses. When we plot the records, it is quite apparent that all the changes in the numbers of population develop in the form of the logistic curve as subsequent cycles very often of very short duration of fifteen to twenty years. It was not necessary to make the data smooth by any mathematical formula, the rough data alone forming the logistic curve.

There are other experiments on artificial populations, namely, on bacterial populations. Professor Oskar Bail, of the German University of Prague, was the first to start sociological experiments on bacterial populations, and those experiments which I shall mention here are his.

Different kinds of bacteria were placed in test tubes in 5 cc. of bouillon and controlled as to the number. They always had

¹ Dr. F. JANISCH — "*Das Exponentialgesetz als Grundlage einer vergleichenden Biologie.*" Berlin, 1927.

an abundance of food. The culture was filtered and placed after certain periods in a fresh bouillon. The control of the fact whether the bacteria were in a state of reproduction was given by addition of bacterio-phage. We found that the bacterial population grows in number along the logistic curve to a certain stage of saturation of space, where in demographical terms the birth rate and the death rate were in equilibrium. This equilibrium lasted for some time and then there began a decrease of the number of bacteria. This decrease followed the course of the logistic curve, but in the inverse sense. The course of it was about three times longer than the course of growth. And, finally, the decrease of number was caused, not merely by deaths of already living microbes, but by still higher differences between natality and mortality. The mortality was increasingly higher than natality.

Another point is that different microbes needed different space. With certain microbes the space was saturated by a much lower number than by others, although the differences in the size of their bodies were not remarkable.

According to Professor Pearl, the density of population affects the birth rate. But here we see that the birth rate, so to speak, is permanently affected after a certain duration of highest density. Also when the density is afterwards lower and lower, the birth rate does not grow, but diminishes progressively till it vanishes absolutely. This means that, providing it were possible to make any comparison between human and bacterial populations, the life of any population is really limited by some not yet known absolute upper asymptote, even when the amount of food remains in abundance.

We cannot do anything against natural laws and so, if there is any absolute asymptote, as I believe there is, and if the life of human population is limited by it, then we can do nothing else but try to make the evolution of human population smooth. We have only one way of smoothing it, which is organization — the organization of the world in one political unit. Only the world as a unit is really self-supporting, only the world as a whole gives us possibilities of living our lives to the full. Therefore, the human population on the globe of the earth needs one organization which would embrace economic life, *i. e.*, the supply of food and of raw material in general, the organization of transportation and migration and the organization of industry.

I know that the time, not only for the decrease of the world population, but also for the state of its equilibrium is in the very distant future, but I know also that all wars have originated essentially in pressure of population. And it is the pressure of population which has brought together this Conference. I do believe that the chief objective of this Conference is international

peace. Otherwise it would have no meaning. And therefore, also, the discussion of the biological basis of the evolution of population must have as its underlying idea the idea of international peace.

† **Professor R. Goldschmidt** (Germany): We biologists must be careful in drawing conclusions from laboratory experiments upon the conditions in human populations. Dr. Pearl himself is cautious in this respect. In the case in question, Dr. Pearl has reported a very interesting experiment in which he showed that fertility in flies is diminished directly by crowding, by density of population. This is quite a surprising result if we look at it without biological knowledge of conditions in such a culture, but in insects fertility is entirely dependent upon the amount of stored food during larval stages. In a crowded population, of course, food is not present in sufficient quantities, and therefore fertility is directly diminished by lack of stored food in the larvæ.

Dr. Mabel Buer (Great Britain): Professor Pearl's point about the density of population affecting both the birth rate and the death rate was actually raised by a certain early nineteenth-century writer who was an opponent of Malthus and who said that the pessimistic views of Malthus were unfounded because obviously cities were growing and in cities there was a low birth rate and a very high death rate, and that therefore there was a natural check to population (see also page 57).

Dr. J. Bělehrádek (Czechoslovakia): Study of population growth of different countries from a biological standpoint has led to the important notion that growth of any population is governed by a mathematical law which is identical to that which governs growth of a single individual. Also in some particulars, *e.g.*, regeneration after wars and epidemics, population shows an interesting analogy with individual existence. Growth of population in Czechoslovakia, studied from this point of view, allows us to draw some further analogies of the same order which of course do not account for differences in primary causes of individual growth and population growth and therefore are of a merely descriptive character.

As regards the density of population, it may be shown that the western parts of the country are most densely populated, whereas the density is relatively low in the eastern parts. When the whole territory of Czechoslovakia is divided into a series of arbitrary territories of which the limits are perpendicular to the long geographical axis of the country, which goes approximately from the west to the east, and when density of population

is determined in each of these territories, it may be seen that there is a chief gradient going from the west to the east of the Republic, and some secondary gradients which do not interfere with the general course of the chief one. The industrial and general cultural development follow, in the main lines, the chief population density gradient. Metabolic and developmental gradients in individuals, discovered by Child, thus seem to have an analogy in gradients of a developing population.

The population of Czechoslovakia has not yet reached the point of inflexion of the general S-shaped curve. The formula of compound interest law may be thus used in this case and the rate of growth determined. Statistical data of censuses, reaching as far back as 1754, give following rates of growth for different provinces: Bohemia, 0.727; Moravia, 0.697; Silesia, 1.18. Different parts of the population are then growing at different rates. This variation in the rates of growth is still more pronounced in the development of cities and towns. The rates are for Prague 1.13; for Brno 1.02; for Moravská Ostrava 3.30. For similar variations in the growth of different parts of an organism, the term of *heterogony* (Champy, Huxley) is used in modern biology. Heterogonic growth of an organ may give rise to irregularities in the S-shaped curve of the individual growth (e.g., development of skeleton or muscular system in mammals). The same irregularities may be observed in some population-growth curves; they may be explained, in some cases at least, as an expression of heterogonic development of a definite part of the population.

It is probable that mathematical analysis of population data of other countries will discover similar population gradients and heterogonic growth.

Dr. van Herwerden (Netherlands): I have the following questions to ask:

(1) Is it permissible to consider migration together with birth and mortality as a biological primary factor? With human beings migration seems distinctly a social phenomenon. And is not equally migration in animals also connected with individuals who live in a certain social organization?

(2) Is there a special reason why Dr. Pearl did not use the Netherland statistics for demonstration of the logistic curve?

(3) Why does Dr. Pearl speak of a cycle of growth? The name cycle includes regression to the state of existence, for instance, vestrom cycle, and so on.

(4) In the *Drosophila* experiments with optima food conditions, there seems to be some heterogeneity in so far as in the old bottle, with unrenewed food, every day new flies developed

which during their larval state had not the optima conditions of the others. Is that perhaps the reason of the oscillations Dr. Pearl describes in his cultures with optima food supply?

(5) I should like to know if, in the experiments on the influence of density of population on mortality the flies always remain in the same bottle during the experiment. If this is the case, how is it known how long a certain fly lives after emerging from the pupa? If, on the other hand, the flies are transported in other bottles, there enters a new variable, a different food supply.

(6) Finally, as to the influence of density of population on mortality, is not the deterioration of the food (toxic products of metabolism in banana and yeast) intoxicating the flies, a factor of greater weight than Dr. Pearl indicates? Does this not account for the special acceleration of the death rate in the greater densities of population? It is therefore specially necessary to know if Dr. Pearl has or has not renewed the food during these experiments. My own experience with *Drosophila* is that premature death in the fly more often occurs by deterioration of food than by failure of food.

Dr. H. Sutherland (Great Britain): The logistic curve leaves us in the air. Dr. Pearl's assumption is that at this point a new state of circumstances will arise. Dr. Netušil appears to continue that curve.

There is a theory of population which I am quite sure no one will put forward at this Congress, the theory of Montesquieu, put forth at the beginning of the last century. He conceived the idea that the population of this earth has always been more or less stationary and that the population passed over the face of the world in great waves in which the crest was never too high nor the drop too low.

Dr. Pearl has dealt only with one secondary variable, namely, density. There are many secondary variables and the death rate, although it is of course a primary variable, is also a secondary variable since nothing has yet disturbed the Darwinian conclusion that fecundity is in direct relation to the chances of death throughout the entire animal kingdom (see also page 58).

*** Professor L. Hersch (Geneva):** If I have understood Professor Pearl rightly, the experiences which he has described to us concern the lineage of a single couple of flies. A certain number of flies were taken and allowed to multiply, but were not allowed to mix. This was not then a population, properly so called.

Would the phenomenon be the same if it concerned what one calls a population, that is, if it were composed of different descendants of mixed origin, instead of descendants of common

ancestors? Let us suppose that, in the course of the experiment, one adds to these flies other individuals of different origins; how will multiplication continue? I should like to know if experiments have also been carried out on mixed populations, and, if so, with what result? This is an important consideration from the point of view of the study of population, for in human society we have populations and no longer pure races. How does the phenomenon appear when these very different considerations are taken into account?

Another question: If, again, I have understood Professor Pearl, growth declines naturally and the curve approaches an asymptotic limit, because there is a fall in the birth rate and growth of the death rate. But, in present-day human populations, we have simultaneously decline of the birth rate and also a fall in the death rate, and I wonder therefore, this being so, if there is a real analogy between the two phenomena.

On the other hand, our attention has been rightly drawn to the possible danger of applying biological experiments to the conditions of human society. Be that as it may, the conclusions of Professor Pearl do correspond to many facts of population growth.

In the countries of Central and Eastern Europe, the birth rate has declined, slowly at first, and then more rapidly. The death rate, on the contrary, fell more rapidly first and naturally continued to fall. Thus, the natural growth of population will go on increasing until a given moment when there is reached a point of maximum natural growth of population. After this, the growth of population will go on declining, and will decline more and more in the countries of Central and Western Europe, so that we approach a state which may be stationary. Perhaps the birth rate will still fall below the death rate, and there will then be a decline of the population, but in any case we are certainly tending towards a population of which the growth is declining in a rapid and continuous manner.

Thus, the conclusions put forth by Professor Pearl correspond nearly enough to present-day facts, that there exist profound differences between the different elements from which the conclusions are drawn.

Professor J. S. Huxley (Great Britain): We biologists are all extremely grateful to Dr. Pearl for the fundamental, and in some ways unexpected, relations which he has brought out, among which we may mention the remarkable facts that there is an optimum degree of crowding of certain organisms as regards length of life and that density may actually decrease fecundity.

Granted that density does influence fecundity, by what biological method is this effected? Unless we know accurately how

this occurs in different types of organisms, we shall not be able to see beyond what one might call a preliminary mathematical analysis to knowledge or obtain information which will permit us to control the processes at work.

We already know various methods in which density may act. It may act through disease. There are numerous biological cases where that is so. In grouse in Great Britain, for instance, sheer overcrowding brings conditions to a point at which parasites, previously comparatively harmless, cause sudden epidemics. That has also been experimentally demonstrated with populations of mice, and there are some interesting conclusions of a similar nature drawn by Ross about human malaria.

Mr. Haldane mentioned the case of rabbits and other organisms, mainly mammals and birds, which have been ably worked out by Mr. Elton. In them there is a very remarkable fact bearing on Professor Pearl's contentions.

That is, that these animals, rabbits, lemmings, field mice, etc., have cycles in which the population increases gradually to a maximum, and then, through an epidemic, is brought rapidly down to a minimum. It appears that during the period just before maximum density, that is to say, while density is rapidly increasing and after it has already increased a good deal, fecundity, far from being reduced, is actually increased. In rabbits in Canada there are more broods in the year and more young per brood during the season just before that of maximum numbers than there are when the population is very few, and the Indian hunters actually prophesy the next season's relative abundance of rabbits by examining the number of embryos in those which they catch. A similar result emerges from Elton's work on field mice.

•One final point. In a number of the higher animals, especially birds, it has been very clearly shown that there exists a biological method of regulating population density, which Mr. Howard, who has devoted great attention to it, calls the territory system. The pair of birds occupies a certain area round the nest. In this case there is a maximum number of birds which can be supported in a given area, not owing to the direct pressure of food supply but through the operation of this instinct to defend a certain area round the nest. You never get real overcrowding. What happens is that, when you get to maximum numbers, a certain number of young birds fail to find breeding places, and there is either simple lack of breeding or there is mass migration to try to find other quarters. Now, when you get a population of that sort invading a new area, you speedily get a constant density in the central occupied regions, and only at the outskirts would you get any marked changes. It seems to me that in human life all such factors may be important secondary

variables, according to the way in which economic and social systems are organized, and I should be extremely grateful for any comments from Professor Pearl on the bearing of these matters on his theory of population growth.

Professor W. E. Rappard (Geneva): It is simply a question of method that I should like to put to Professor Pearl.

I find in his paper the statement, astonishing at first, that the statistics of the growth of population in the United States follow, as by chance, a logistic curve. But is this, indeed, chance? They date from 1790. This is not the beginning of society, or even, exactly, the beginning of the republic. Therefore, is it not chance? If the statistics began only from 1820, or even from 1750, it is evident that a quite different curve would be obtained.

It seems to me arbitrary to compare this curve of real population growth with a lineage which commences at a given moment with the mating of two insects, and to go to the extinction of this latter. That is a comparison of two things which, it seems to me, are quite incomparable.

Dr. F. A. E. Crew (Great Britain): The question that interests me particularly is that which is concerned with the definition of those agencies which are responsible for the flattening of the fertility rate with increasing density. In such populations used experimentally by Professor Pearl, one wonders if the agencies are those which would operate in the case of an unselected population, because if, in the case of a mixed population, there is an increase in the population number, it would seem that those selective agencies, normally operative, are in abeyance, and that into the population there comes quite a number of relatively physiologically unworthy stocks. If that is so, then the mere presence of such stocks in a mixed population would lead, for genetic reasons, to a lowered birth rate, and similarly to an increased death rate. Is Professor Pearl of the opinion that the agencies responsible for the flattening of the fertility rate in such populations as *Drosophila* and yeast are the same as those which operate in the case of an entirely heterogeneous population?

Professor Raymond Pearl (in reply): Mr. Haldane raised the question as to what starts new cycles of logistic growth. On this point I am not able to offer anything positive, but it is obviously an important element in the problem of population growth. It also obviously lends itself to experimental enquiry, and at the present time we have a number of experiments going on designed at any rate to throw some light on that

point. With regard to Mr. Haldane's second point, I am in entire agreement. There exists the clearest possible evidence that at various times and places in the past history of the world there have been gradual and non-catastrophic declines in the numbers of certain populations. It is a mistake, however, to suppose that such phenomena fall outside the scope of the logistic theory of population. Such a statement can only be maintained if attention is confined solely to the simple logistic curve. I have pointed out that there are a number of known phenomena with regard to population which could not be brought within the range of the simple logistic curve, and therefore the general logistic curve was developed. To this general curve the simple logistic stands in the relation of one particular case in the whole family of curves. Mr. Haldane also raised the point of what the relation was between the stable density and optimum density in experimental populations. The stable density in *Drosophila* experiments is of the order of three to five times the optimum density. With regard to Mr. Haldane's point about the oscillation of the asymptote, I may say our experimental work confirms the mathematical conclusion which he reached on the assumption that the birth rate was particularly easily affected by small changes in density of population. We have held them at the asymptotic population for considerable periods and obtained a considerable wave about the asymptote, and found that the birth rate is considerably affected by small changes in density.

Dr. Fisher's discussion relates mainly to the use of the simple logistic curve in prediction of the future growth of a given population. To take his specific example of the populations of England and Scotland, what I said was that these populations *had* closely followed the logistic curve so far as their accurately recorded past history goes. This is a simple statement of fact; it is a very different thing from saying that they *will* in the indefinite future continue to follow the same particular logistics which have described their growth so far during the present cycle. Certainly I have never been guilty of so rash a prophecy. All I have ever said was that, if the same forces, biological, social, economic or any other, which have in the past caused these populations to follow a particular logistic curve continue to operate in the future unchanged, it seems to me a not unreasonable inference that the populations will continue to follow this same curve in the future. Not having been endowed at birth with the divine gift of prophecy and not having had it vouchsafed to me since, I am unable to predict whether, when or how these conditions may change. I have always felt compelled to take the position that, if and when there was clear evidence that the conditions which generate a particular logistic have

changed, it would be necessary to examine all the data anew and see whether the whole recorded growth of the population could be described by another and different logistic curve or whether it would then be necessary to resort to some entirely different form of mathematical representation of the facts. So far that necessity does not seem to have arisen. Regarding Dr. Fisher's point that the logistic can do nothing in the case where the population first grows and then declines, that applies only to the simple logistic. I entirely agree with him as to the general usefulness of the logistic in describing many biological phenomena.

Dr. Netušil has made a contribution of great interest. A good deal of our experimental work, as yet unpublished, confirms his conclusions regarding the movement of the population at the asymptote under particular experimental conditions.

I entirely agree with Dr. Goldschmidt and have endeavoured in every paper I have written about experimental populations to emphasize the caution which must be exercised in applying any results derived from experimental populations to human populations.

I think, however, that the particular example Dr. Goldschmidt chose to illustrate his point is badly taken. In the case of *Drosophila*, the influence of density of population on the number of eggs laid may be said with absolute and complete certainty *not* to depend on "the store of food that has been already collected". I have been studying this matter in great detail, both statistically and biologically, and I am bound to say that the effect of increased density of the population on the rate of egg laying in *Drosophila* is immediate and direct and occurs whether the flies or the larvæ have previously been well or badly fed or crowded or not crowded. The physiology of the process by which this effect is produced lies along entirely different lines from those suggested by Professor Goldschmidt. I therefore think the caution should work both ways.

The point raised by Dr. Buer seems to me to rest upon a misunderstanding. I would never contend that economic forces played no part in the determination of the rate of growth of human populations or upon human fertility or mortality. On the contrary, I should be inclined to regard economic factors as of considerable importance, one of the most important environmental factors affecting human beings. What I meant to convey was only the relative unimportance of certain economic factors as compared with the basic first-order variables.

With much of what Dr. Sutherland said I am in entire agreement. It is not quite true, however, as he said, that we have carried the logistic curve only to the asymptote and left it in the air. On the contrary, in the experimental populations which

we have considered, extensive study has been made of what happens afterwards. What happens depends upon the conditions of the particular experiment.

Professor Huxley questions whether the effects of density which are known over a wide range of animal forms can be supposed to have a common biological basis. I am disposed to believe that we may have quite different effects, both quantitatively and qualitatively, produced by density of population in different organisms and circumstances.

SUPPLEMENTARY REMARKS.

Dr. Mabel Buer (Great Britain): One of the main results of the decreased death rate which began to have effect in Europe about 1750 was a stupendous increase of the European races which resulted in these races colonizing and dominating a large part of the world. The decreased birth rate, which did not occur in most countries until the seventh decade of the 19th Century, was for some time counterbalanced by a still further fall in the death rate.

At present, however, there is little room for sensational falls in the death rate in the more advanced countries, and the birth rate continues to fall. Europe, or at any rate Western Europe, and the countries peopled by Western Europeans are faced with stationary or slowly increasing populations (if we ignore the factor of migration). In itself this is not to me an alarming prospect. It is in fact a return to what was normal before 1750, but by method less wasteful than an appalling amount of uneffective child-bearing and wholesale slaughter of the innocents. At present the inhabitants of Asia and Africa appear to be increasing at an even slower rate. It is important to note that the slowness of their increase is due to the same cause as was the slow increase of pre-18th Century Europe, that is, to a high death rate and in particular to a high infantile mortality, due to lack of elementary hygiene. There is every sign that in a few years this will be remedied, and the change has already begun in India. It seems probable that we shall then have a period in the East corresponding to the first half of the 19th Century in

Europe, a period of a lower death and infant mortality rate (which, however, is still high according to our notions) and of a birth rate little, if at all, diminished. The result will be a rapid increase in population which may well be fraught with world-shaking consequences.

Dr. H. Sutherland (Great Britain): I do dissent from Professor Pearl's statement that the logistic curve "does take account of all these second- and third-order variables". He has referred to *a priori* logic in no measured terms — "that windbroken and spavined old stallion"; but I would remind him that, in point of fact and logic, the curve itself takes no account of anything at all. The curve is the inevitable product of many variables possibly up to the x order.

For my part, I accept the evidence of his experiments that density of population by itself will reduce fecundity, which must be most comforting to those who are haunted by the nightmare of an overpopulated earth. But density is not the only second-order variable. I submit that the death rate is not only a first-order variable, but also a second-order variable; and that the Darwinian conclusion still holds good — namely that, throughout all Nature, fecundity is in direct relation to the chances of death. For example, the conger eel, with many mortal enemies, produces billions of eggs, whereas the fulmer petrel, which has no enemies, lays but one egg a year. Both survive. For these and other reasons I re-stated in 1922 the law of Doubleday, who had laid undue stress on food, as follows: "In circumstances of ease, the birth rate tends to fall; in circumstances of hardship, the birth rate tends to rise".

There are other second-order variables more mysterious than those I have recalled. How is it that, in the salmon rivers of Scotland after one season of high mortality from floods or disease, the salmon coming up these rivers the next season are almost bursting with ova? It would seem that reproduction is governed by immutable laws, of which we are now aware of only one or two. Others, physical and possibly psychological, may yet be discovered.

THE DEVELOPMENT OF THE POPULATION IN ITALY

by

Professor A. NICEFORO.

The subject which occupies us here cannot be treated satisfactorily, except on a wider scale than in this paper. I can here only indicate the outlines and the salient points to which we must give our attention. But I hope to return to the subject in greater detail, for a more complete study of population in Italy.

It would be interesting to glance at the general development of the population in Italy up to 1914 (pre-war) from the days of ancient Rome, always keeping to the same limits of territory.

It must not be forgotten that the information we possess as to the numbers of inhabitants in those distant days is of doubtful value. Can we say that the Italy of Augustus — reckoning the boundaries of 1914 — really contained only seven to eight millions, as Beloch declares? Can we also accept Beloch's estimate for the Italian population in the 16th, 17th and 18th Centuries? It is sure that as we get nearer to the 19th Century, the figures become less liable to rouse our incredulity, but it is only from 1800 that we feel ourselves really on firm ground and can accept the estimates of the different States comprising Italy as a sound basis for a calculation of the total inhabitants for the total territory, as P. Castiglioni and R. Benini have done¹.

We shall not hesitate to make use of the learned researches of Beloch, and for later periods we shall reproduce figures taken from the estimates, already mentioned. These figures give us in tabular form the results of much research (see Table I).

This is what we may conclude from Table I and the diagram:

(1) That Italy in the 16th Century had only 11,165,000 inhabitants: and since, in the time of Augustus, we may reckon seven to eight millions, it follows that the fifteen centuries which separate the two epochs show an increase of 100 to 160 or forty per cent.

¹ G. BELOCH — "La popolazione del mondo greco-romano", in *Biblioteca di Storia economica*, t. IV, Milan, 1909, p. 394. G. BELOCH — "La popolazione d'Italia", etc., in *Bulletin de l'Institut internat. de statistique*, tome III, Rome, 1888. P. CASTIGLIONI — "Introduzione storica sopra censimenti", etc., Torino, 1862. R. BENINI — "La Demografia italiana in accademia dei Lincei", Roma, 1911.

(2) That the increase of the population was extremely slow from the middle of the 16th Century (11,165,000) to the end of the 17th, when it had risen to 13,180,000. This century and a-half gave an increase of only eighteen per cent.

We must not forget that, if the 16th Century is the age of the Arts and Academies, the century of Michelangelo, of Ariosto, of Tasso and Machiavelli and the 17th century the century of Galileo, the whole period was subject to wars and epidemics, some of which were on a tremendous scale. It is therefore not surprising that the eleven millions of 1550 had only risen to thirteen 150 years later.

(3) That, on the other hand, the 18th Century begins to show a more rapid increase. At the end of the century, the 13,180,000 have become 18,125,000.

The increase, comparing the end of the 17th with the end of the 18th is as 100 to 135 or thirty-seven per cent.

We must remember that, during the whole of the 18th Century, the material conditions of life were improving, science and literature were held in honour, new knowledge was spreading and epidemics became less violent.

(4) In the 19th Century the upward movement of the population becomes more rapid and more visible. The first half of the 19th Century gives an increase of the population from 18,125,000 to 24,348,000, which represents thirty-four per cent: the second half of the century brings the population of 24,348,000 up to about 32,400,000, that is, thirty-three per cent. The years from 1800 to 1900 give an increase of the Italian population from 100 to 174.

Add to those hundred years the twenty-five years of our century and the increase is as 100 to 214. That shows us that the 125 years of the 19th Century with the first quarter of the 20th Century have more than doubled the population, while in the earlier periods (1550-1800) even 250 years gave an increase of 100 to 165.

It is to be noticed that the figures in our Table II (1861 and following years), being taken from the census, take no account of Italians who have emigrated and are domiciled in other countries.

Of course the density of the population shows a constant increase, in proportion to the total increase.

We will not occupy ourselves with the hypothetical figures of the time of Augustus, or with those of 1550, thirty-nine to the square kilometer, becoming sixty-three at the beginning of the 19th century and 130 to-day. Hence the square kilometer three hundred years ago had one-third of its present population. But, if we go back only to 1800, we see that the density at that time (sixty-three per square kilometer) had increased by 1921 as 100 to 205: that is, it had doubled in 120 years.

It will be better to examine in greater detail the period when the census taken at regular fixed intervals gives us figures and results we can rely upon, keeping to the boundaries of the kingdom in 1913 in order that comparison of different periods may be easier.

Figures concerning the whole of this period are grouped in Table II. It shows year by year: ¹

- (a) the total number of inhabitants halfway through the year;
- (b) the total number of births;
- (c) the birth rate;
- (d) the total number of deaths;
- (e) the death rate;
- (f) the total excess of births over deaths;
- (g) the natural increase (births minus deaths) per 1,000 persons.

It would be easier to recognize at a glance the regular change in each of our series, if we calculate from each column of our Table II the five-year averages from 1873. Those of 1873 to 1907 are to be found in the paper already quoted. The others are taken from the figures of Table II. This gives a new list—Table III.

In this, the rates of births and deaths and of increase per 1,000 are only the simple arithmetical averages from the rates in the preceding table. Also, the figures indicating the excess of births and the deaths in the fresh table are only the differences between the five-year average of births and that of deaths in the same table.

What are the conclusions to be drawn from this new arrangement of our figures?

Let us take the period 1873-1912, so as to avoid for the moment the figures during and after the war, figures which are affected by the demographic anomalies produced by the world struggle.

It appears at first sight:

(a) That the total number of births, annually, during the whole of this period of nearly forty years, was always about a million, with a slight increase as from 100 to 111.

¹ For the years 1872-80, I have used the figures in the work of A. Musco — "Natural Movement of Italian Population", 1862-1907; for the following years, the figures of the *Annuario Statistico*, 1922-25, p. 388.

The figures for 1911 and following years are provisional.

Those of 1919 and succeeding years refer to the frontiers of 1913. (See note to table.)

This note refers to all the items, but under (d) the deaths in war are not counted.

(b) That the increase of the population was more rapid, as from 100 to 125.

(c) Now if the series of the averages representing the births is shown by a straight line and the series of averages representing the population by another straight line, we see that the first line (births) is almost parallel to the line of the abscissæ, its slope being 0.87 per cent whilst the second line (population) rises more rapidly with a rate of 3.30 per cent. The equation of the first (births) is $y = 1,082,250 + 94,524 x$, that of the second (population) is $y = 30,802,375 + 1,015,155 x$.

(d) The birth rate then, that is, the ratio between the total number of births and the population, of necessity, decreased. The equation is $y = 35.25 + 0.839 x$, the equation to the resulting line.

The ratio of the rate of inclination (-0.839) to the average (35.28) is 2.38 per cent.

(e) This comparative stability of the total number of births and the rapid increase of the population are alike the outcome of the profound changes in both phenomena. It is visible in the five-year averages from one period to another. There was, however, one period where the births were more numerous: that was from 1883 to 1887.

(f) Since the twenty-seven millions of 1873-77 give about the same number of births as the thirty-four millions of 1908-12, it is clear that during this period the birth rate declined considerably. It fell from 57.14 per 1,000 to 32.72 — that is, the decrease was as 100 to 88. We must notice that, if the birth rate is calculated in relation to the total number of the population, there will be an error: we must not reckon the total population, but women from fifteen to forty-nine years of age. This will enable us to make correct calculations and we get:

Specific birth rates.

Periods	Births per 1,000 women of from 15 to 49 years of age
1877-1886.	148
1886-1895.	149
1896-1905.	139
1907-1914.	131
1924-1925.	113 ¹

Here also we see that the birth rate has decreased, though it was stationary until 1895.

* * *

¹ The first four periods are taken from the *Annuaire international de Statistique*, The Hague, 1917, p. 55. For 1921, we have taken the female population of from fifteen to forty-nine years from the census of 1921. These last figures are calculated on the population of the after-war kingdom.

We can now draw our first conclusions and ask a question.

If the total births per annum remained almost unchanged and in spite of this the population had considerably increased, since there was no immigration into Italy during the period we are considering, to what is the increase due? Before answering we must examine the columns for deaths and death rate. Let us take Table III, the five-year averages, and we see:

(a) The 27,000,000 of 1873-77 show 800,000 deaths per annum: the 34,000,000 of 1908-12 show about 700,000 per annum. Hence the five-year averages are represented by the equation $y = 768,692.4 + 17,850.8 x$, which shows a decrease 2.33 per cent.

(b) The death rate, then, has diminished from 29.72 per 1,000: it has fallen to 20.80 per 1,000, that is from 100 to 70 between the first and the last period.

This fall in the death rate is a regular and important change, as we may see by examining, in Table III, the series of figures. It can be fairly well represented by a straight line inclining downwards, with the equation $y = 25.20 + 1.405 x$, which gives a decrease of 5.06 per cent.

(c) Consequently, the excess of births over deaths has gone on increasing from 1873-77 to 1908-12. It was 200,000 in round numbers at the beginning of the period and is 400,000 at the end; an increase as from 100 to 200. A straight line inclined upwards fairly well represents the continued increase. The equation is $y = 313,602.5 + 27,338.5 x$, an increase of 8.72 per cent.

(d) In like manner, the natural increase of the population rises from 7.42 per 1,000 at the beginning of our period to 10, to 11, to 12 per 1,000. These increases of 12 per 1,000 show the increase of the last period. Thus the increase has been as from 100 to 162. The series of eight five-year averages during this increase gives the equation: $y = 10.1 + 0.57 x$, that is, a line with upward inclination. The increase is 5.64 per cent.

We must notice that the development continues in like degree after 1919. Table III contains, for 1913-17 and for 1918-22, the five-year averages for the population within the pre-war frontiers. Table II gives also the results for 1924 and 1925, within the after-war frontiers. Apart from the results of the widespread Spanish influenza and the decrease in births caused by the war, we see that the changes we have been examining continue at about the same rate as before.

Let us now return to our question. How does it happen that there is such a remarkable increase in the Italian population, in spite of an almost stationary birth rate and no immigration?

In all works on political economy or demography, we find mention of the relation existing between the increase of produc-

tion of food supplies and of distribution and the increase of population as a proof that, with the increase of production, population increases, knowing it can be fed at the banquet of life.

Is this what has taken place in Italy at the end of the 19th and the beginning of the 20th Century? Production has certainly increased, as we shall see shortly.

But to correspond with the theory already mentioned, the increase should have been caused by a constant increase in the number of births, increased procreation following increased production.

Now this has not happened in the period we are studying. As already seen, the birth rate has remained almost stationary, and we see from the figures in Tables II and III that the increase is almost entirely due to the reduction of the death rate.

The reduction of the death rate is one of the salient features of the 19th Century, especially towards the end. It continues in the 20th Century, once the period 1914-19 has been passed. This reduction of the death rate is one of the results of various changes which mark the 19th Century, amongst which the increase of food supplies, the greater ease of distribution, the spread of economic activities take an important place, and lead to a rise in the standard of living, both material and mental.

The diminution of the death rate results from all these facts considered together; it is not due wholly to advances in medicine and hygiene, but is a fact that must be examined both from the biological and the sociological points of view. The 19th Century and the first years of the 20th have brought greater changes and improvements to the standard of life in a hundred years than all the centuries in the past. There is a greater difference in the standard of living, if we compare the beginning of the 19th Century and to-day, than if we consider the thousand years that separate Justinian from Louis XV.

We see that the fantastic dreams of ancient thinkers and the scientific anticipations of others — Francis Bacon, for example, flight, televisism, telephone, steamers — only began to be realized in the 19th Century. Our dreamers of the past did not foresee the increase in the duration of human life which is a fact to-day. First, famines were suppressed, especially the chronic food-shortage which was one of the causes of the anæmic appearance which (as Michelet tells us) we admire in the Madonnas and the statues of the Middle Ages. We find also much longer intervals between those terrible epidemics which often, in a year, killed more people than did famous warriors or long wars, sometimes (as in Justinian's reign) perceptibly diminishing the total population. All the facts we have mentioned must be taken into account in our examination.

I now add some figures which will help and show the economic expansion, as it concerns the Italian population during the period we are examining.

These figures show the total consumption of certain products for periods between 1880 and 1925 (Table IV).

It is well known how difficult it is to calculate correctly the food consumption of any population especially for meat, therefore my figures must be taken as approximate: they make it clear, however, that consumption of nearly all foods has increased, the decrease in maize being met by the increase in wheat. The decrease in oil is due to the use of butter in its place and to the increasing use of the seed oils.

All these figures should be examined and discussed, but it is hardly possible to do that here. We ought also to examine, for the same period, general economic life, the distribution of products and so on.

We find in Italy during our period an increase of economic activity, which is greater than the increase in the total population.

From this imperfect examination, may we not conclude that the material, economic and social progress of Italy, from the second half of the 19th Century to the present time, has brought about so marked a decrease in the death rate that the total population has increased very rapidly, in spite of the almost stationary birth rate?

We may say, then, that the increase in the population of Italy is due to the rise in the standard of living which has markedly decreased the death rate¹.

We cannot here touch upon the complicated but interesting question of the "laws" which, in general, govern increase of population.

Neither must we discuss whether the curve of increase depends, as Quetelet declares, on the fact that the sum of the hindrances of increase is as the square of the speed with which the population tends to increase, or whether it is possible to represent the increase of the population, for every phase or cycle of civilization (increase first very slow, then rapid, then slower and finally stationary), by one of those curves proposed by Verhulst, or by our learned colleague, Professor Raymond Pearl, or, again, whether we should accept one of the formulæ proposed by Gini and others, by which it is shown that populations, by exhaustion of their biological force, come to a standstill at a certain period of their evolution.

We have simply examined the increase of the population of

¹ Consult: A. NIEFFORO, "Les indices numériques de la civilisation et du progrès," Paris, 1921, Flammarion ed.

Italy, pointing out statistically that the cause of the increase is to be found in the decrease of the death rate.

Just a few words more.

If, after having asked why the population of Italy has increased and having answered the question, we went on to ask why the birth rate has decreased so that the increase of population is due to the decrease of the death rate, this is the answer.

During our period production and wealth have increased and the standard of living has risen; on the other hand, new wants have arisen even faster: the wants are sometimes imaginary but seem genuine to those who feel them. It is these ever-increasing desires that determine the number of births. Psychologists teach us that, when a desire is fulfilled, one feels, more strongly than the pleasure from the satisfaction of this desire, new needs bringing fresh desires and ever-growing aspirations.

Wants increase and multiply faster than wealth and they are continually outstripping the standard of life (see my book on Paris. — *Parigi una Città rimovata*, Turin, 1911). This is a dangerous path and may lead to the abyss, for progressive reduction of the birth rate leads to progressive diminution of the group. This is not yet the case with Italy, which is not threatened; it is only a general point of view.

TABLE I.

Some Information regarding the Increase of the Italian Population.

Periods	Number of inhabitants (in thousands)	Index numbers	Index numbers	Index numbers	Density
Period of Augustus	7,000 (?)	—	—	100	—
1550	11,165 (?)	100	—	—	39 (?)
1700	13,180	118	—	—	—
1775	16,500	150	—	—	—
1800	18,125	165	100	—	57
1825	19,727	179	109	—	62
1852	24,348	221	134	—	69
1862	25,017	227	138	—	85
1872	26,801	244	148	—	87
1882	28,460	259	157	—	94
1901	32,475	295	179	—	99
1911	34,671	315	191	—	123
1921	37,143 ¹	338	205	—	171
1925	38,713 ¹	352	214	553	130

¹ Territory of 1913. Taking the new frontiers, the population of 1925 was 40,064,000 at the end of the year and 40,423,000 at the end of 1926.

TABLE II.

Development of the Italian Population from 1872 to the Present Time.

Year	Population in the middle of each year (in thousands)	Total number of births	Birth rate	Total number of deaths	Death rate	Excess of births over deaths	Natural increase per 1,000 inhabitants
1872	26,884	1,020,682	37.97	827,498	30.78	193,184	7.19
1873	27,050	985,188	36.42	813,973	30.09	171,215	6.33
1874	27,216	951,658	34.97	827,253	30.40	124,405	4.57
1875	27,382	1,035,377	37.81	843,161	30.79	192,216	7.02
1876	27,547	1,083,721	39.34	796,420	28.91	287,301	10.43
1877	27,713	1,029,037	37.13	787,817	28.43	241,220	8.70
1878	27,879	1,012,475	36.32	813,550	29.18	198,925	7.14
1879	28,045	1,064,153	37.94	836,682	29.83	227,471	8.11
1880	28,211	957,900	33.95	869,992	30.84	87,908	3.11
1881	28,377	1,081,125	38.1	784,181	27.63	296,944	10.47
1882	28,564	1,061,094	37.1	787,326	27.6	273,768	9.59
1883	28,774	1,071,452	37.2	794,196	27.6	277,256	9.6
1884	28,984	1,130,741	39.0	780,361	26.9	350,380	12.1
1885	29,194	1,125,970	38.6	787,217	27.0	338,753	11.6
1886	29,404	1,086,960	37.0	844,603	28.7	242,357	8.3
1887	29,614	1,152,906	38.9	828,992	28.0	323,914	10.9
1888	29,825	1,119,563	37.5	820,431	27.5	299,132	10.0
1889	30,035	1,149,197	38.3	768,068	25.6	381,129	12.7
1890	30,245	1,083,103	35.8	795,911	26.3	287,192	9.5
1891	30,455	1,132,139	37.2	795,327	26.1	336,812	11.1
1892	30,666	1,110,573	36.2	802,779	26.2	307,794	10.0
1893	30,876	1,126,296	36.5	776,713	25.2	349,583	11.3
1894	31,086	1,102,935	35.5	776,372	25.0	326,563	10.5
1895	31,296	1,092,102	34.9	783,813	25.0	308,289	9.9
1896	31,506	1,095,505	34.8	758,129	24.1	337,376	10.7
1897	31,716	1,101,848	34.7	695,602	21.9	406,246	12.8
1898	31,926	1,070,074	33.5	732,265	22.9	337,809	10.6
1899	32,136	1,088,588	33.9	703,393	21.9	385,195	12.0
1900	32,346	1,067,376	33.0	768,917	23.8	298,459	9.2
1901	32,531	1,057,763	32.5	715,036	22.0	342,727	10.5
1902	32,700	1,093,074	33.4	727,181	22.2	365,893	11.2
1903	32,840	1,042,090	31.7	736,311	22.4	305,779	9.3
1904	33,016	1,085,431	32.9	698,604	21.2	386,827	11.7
1905	33,193	1,084,518	32.7	730,340	22.0	354,178	10.7
1906	33,325	1,070,978	32.1	696,875	20.9	374,103	11.2
1907	33,515	1,062,333	31.7	700,333	20.9	362,000	10.8
1908	33,827	1,138,813	33.7	770,054 ^a	22.8	368,759	10.9
1909	34,078	1,115,831	32.7	738,460	21.7	377,371	11.0
1910	34,377	1,144,410	33.3	682,459	19.9	461,951	13.4
1911	34,689	1,093,545	31.5	742,811	21.4	350,734	10.1

(a) 77,233 killed in the earthquake in Messina.

TABLE II (continued).

Development of the Italian Population from 1872 to the Present Time.

Year	Population in the middle of each year (in thousands)	Total number of births	Birth rate	Total number of deaths (c)	Death rate	Excess of births over deaths	Natural increase per 1,000 inhabitants
1912	35,026	1,133,985	32.4	635,788	18.2	498,197	14.2
1913	35,418	1,122,482	31.7	633,966	18.7	458,516	13.0
1914	35,859	1,114,091	31.0	643,355	17.9	470,736	13.1
1915	36,395	1,109,183	30.5	741,143 ^b	20.4	368,040	10.1
1916	36,714	881,626	24.1	721,847	19.7	159,779	4.4
1917	36,661	691,207	19.5	682,311	19.2	8,896	0.3
1918	36,279	640,263	18.1	1,116,132	33.0	- 525,869	- 14.9
1919	36,071	770,620	21.4	676,329	18.8	94,291	2.6
1920	36,366	1,158,041	31.8	681,749	18.7	476,292	13.1
1921	36,878	1,118,344	30.3	642,234	17.4	476,110	12.9
1922	37,390	1,127,444	30.2	660,411	17.7	467,033	12.5
1923	37,828	1,107,505	29.3	626,453	16.6	481,052	12.7
1924	39,917 ^d	1,124,479	28.2	662,870	16.6	461,600	11.6
1925	40,339 ^d	1,107,736	27.5	668,972	16.6	438,764	10.9

(b) 30,476 killed in the earthquake in Abruzzi.

(c) See note to table II.

(d) By the latest calculation, the figures of the population are: 39,547,000 in 1924 and 39,878,000 in 1925. For 1926, still at the half-year, the figure is 40,243,000.

NOTE TO TABLE II.

For the years 1915 to 1919, the number of deaths given do not include losses by war: only soldiers who died in hospital of wounds or of disease are included. If war losses outside the territory or in the field hospitals or on the field of battle are included, the figures will be: for the year 1915, 809,706 deaths (22.25); for 1916, 854,998 (23.29); for 1917, 927,884 (26.11); for 1918, 1,240,425 (25.05).

On the other hand, as regards the excess of births over deaths, if account is taken of the number of deaths through war, the figures will be the following: for the year 1915 the excess of births is 299,477 (annual growth per 1,000 inhabitants (8.23); for 1916, the excess is 26,682 (0.72); for the year 1917 there will be a loss of 236,677 (6.66); for the year 1918 again a loss of 600,162 (16.96).

TABLE III.

Summary of Table II.
(Five-year averages.)

Year	Population in the middle of each year (in thousands)	Total number of births	Birth rate	Total number of deaths	Death rate	Excess of births over deaths	Natural increase per 1,000 inhabitants
1873-77	27,381,618	1,016,996	37.14	813,725	29.72	203,271	7.42
1878-82	28,215,100	1,035,349	36.69	818,346	29.00	217,003	7.69
1883-87	29,194,283	1,113,606	38.14	807,074	27.64	306,532	10.50
1888-92	30,245,169	1,118,915	36.99	796,503	26.33	322,412	10.66
1893-97	31,295,940	1,103,737	35.27	758,126	24.22	345,611	11.05
1898-02	32,339,846	1,075,369	33.25	729,358	22.55	346,011	10.70
1903-07	33,348,072	1,069,070	32.06	712,493	21.36	356,577	10.70
1908-12	34,399,000	1,125,317	32.72	713,914	20.80	411,403	12.0
1913-17	36,210,000	983,718	27.36	684,524 ¹	19.18	299,194	8.3
1918-22 ¹	36,597,000	962,942	26.36	755,371	21.10	207,571	5.7

¹ Territories of 1913.² See note to Table II.

TABLE IV.

Per Capita Food Consumption in Italy for the Period 1884-1925.

	Periods			
	1884-1885	1901-1905	1909-1913	1920-1925
Wheat (kg.) .	123	152	164	183
Maize (kg.) .	76	74	82	68
Wine (litres) .	72	111	127	105
Oil (kg.) . .	5.49	6.17	3.83	4.14
Spirit 100 % (litres) . .	0.49	0.68	0.58	0.76
Beer (litres) .	0.56	0.89	2.04	3.28
Sugar (kg.) .	2.77	2.98	4.58	6.94
Coffee (kg.) .	0.42	0.54	0.76	1.19 ²
Salt (kg.) . .	6.68	7.26	5.89	8.05 ²
Tobacco (grammes) .	591	486	546	698 ²
Meat (kg.) . .	* 591	14 approx.	15 approx.	18 approx.

¹ From the figures given in the *Annuaire Statistique*, with the exception of meat. The figures for meat are taken from the surveys of Molinari (1925) and of Tagliacanne (1927), which include a summary of the many researches made on this subject (by Rasari, Zingali, Vinci, etc.).

² For 1924-25.³ *Idem*.

Summary of the Paper of Professor A. Niceforo.

1. The Italian population at the time of Augustus (territory of 1913) was probably about seven millions.
2. It is not possible to have exact calculations for the following periods, but we may estimate that in the 16th Century the population of Italy was eleven and a-half millions; in the 17th, thirteen millions; in the 18th, sixteen and a-half millions (according to Beloch). At the beginning of the 19th Century the population had reached eighteen millions.
3. During the 19th Century the increase became more rapid: twenty-seven millions in 1872; thirty-seven millions in 1921 (territory of 1913); thirty-nine millions (same territory) in 1925, and forty millions with the new frontiers.
4. Hence we see that the increase of population was very slow from the 1st to the 17th Century (wars, epidemics, catastrophes), but during the 19th Century, 50 years (1872-1921) give an increase greater than that of the preceding three Centuries.
5. How, exactly, has the increase come about during the second half of the 19th and the first quarter of the 20th Century?
 - (a) The total number of births has remained about the same, roughly one million a year with a very slight increase, and yet the total population rose from twenty-four to thirty-nine millions.
 - (b) There was no immigration.
 - (c) The total number of deaths was largely diminished from 850,000 *per annum* to about 650,000 *per annum*. Hence we see that the increase of the population is due, principally, to the decrease in the death rate.
6. During the period (1872-1921) there has been a marked improvement in the hygienic, economic and social conditions of the population.
7. Since the population increased rapidly (without immigration), while the total number of births remained almost stationary, it is clear that the birth rate (ratio between the births and the population) has decreased in Italy. There were about 248 births, in marriage, per 1,000 women in 1880; 226 just before the war.
8. The rise in the standard of living, the improved communications, the larger food supply have not resulted in an increased procreation; quite the reverse. But owing to the very large decrease in the death rate, population has rapidly increased.

SECOND SESSION.

Chairman: Professor W. E. RAPPARD.

Papers presented to the Conference:

OPTIMUM POPULATION, by Professor H. P. Fairchild.

FOOD AND POPULATION, by Professor E. M. East.

Supplementary Papers:

IS THE INCREASE IN THE POPULATION A REAL DANGER FOR THE FOOD SUPPLY OF THE WORLD? by Professor Jean Bourdon.

POPULATION AND FOOD SUPPLY IN INDIA, by Dr. Rajani Kanta Das.

CONSIDERATIONS ON THE OPTIMUM DENSITY OF A POPULATION, by Professor Corrado Gini.

SOME NEEDED REFINEMENTS OF THE THEORY OF POPULATION, by Professor T. N. Carver.

OPTIMUM POPULATION

by

Professor H. P. FAIRCHILD.

In the ordinary discussions of population, two inclusive assumptions are quite generally implied. The first is that the introduction of any voluntary regulation into this sphere must inevitably be followed by a decline in the birth rate. The second is that such a decline would be unfortunate. In other words, such discussions assume that a great many people are habitually having more children than they would wish to have, and that for some reason or other it is desirable that they should continue to do so.

It is not the purpose of this paper to examine the former of these assumptions, either as to its factual validity, or as to its explanation if valid. Rather do I invite you to consider the latter assumption, that for some reason it would be a calamity if married people should, as a rule, have only so many children as they wished, at least if the consequence was a fall in the birth rate.

There can be no doubt as to the prevalence and authority of the tradition of the desirability of a large and growing population. So deeply ingrained in human nature is this notion that only the analytically-minded ever think of questioning it. If it is critically examined, it is usually assigned to a few outstanding and easily comprehended causes.

The first of these is militaristic necessity or advantage. The force of this motive is obvious. As long as national existence or prestige can be maintained only by war, and as long as success in war depends on the number of fighting men who can be put into the field, the importance of a rapidly augmenting population needs no elaborate exposition.

A second reason may be called dynastic. When political conditions are such that a despotic ruler can say "*L'Etat, c'est moi*", or a dominant aristocratic class can look upon the mass of the people in the light of possessions, it is natural that the desire should exist that this basic source of wealth, prestige, and power should be as abundant as possible.

Scarcely inferior, probably, is the third cause of the prevailing tradition, religious zeal. It is inherent in the nature of religion that practically every sect should desire to increase the number of the faithful as greatly as possible, and, since new devotees are recruited mainly from present adherents, there is no better guarantee for the spread of the faith than a generous production of offspring.

Probably, also, there is a cause that may be called cultural, a sort of ethnic egotism that values so highly the distinctive traits of the group in question that it seems an obvious service to mankind to spread them abroad as widely as possible.

And, finally, there is sheer megalomania, an unreflective desire for bigness for its own sake.

Whatever the cause, the prevalence of the tradition is beyond question. Yet, on the other hand, certain terms in common use show clearly that, as soon as human reason is brought to bear on the question, it is realised that there is a limit to the desirability of gross increases in population. I refer to the words "overpopulation" and "underpopulation". By their very content, these terms imply that in some way or other there is a welfare element in population. The size of the population is judged in relation to some other interest or aspect of society, and is found to be either deficient or redundant. What is this criterion?

There might, conceivably, be several. Each of the causes of the ancient tradition that I have mentioned suggests a possible basis of testing population — by the wealth and glory of the king or nobles, by the power and prestige of the State, by the propagation of the faith, or by military effectiveness. Each of these, however, as we have seen, points to increase; they may explain underpopulation but they do not explain overpopulation.

What further interest can we find that is plainly prejudiced by an excess of population? There seems to me to be just one which is capable of being dealt with scientifically, viz., material well-being, or, in a more technical phrase, the standard of living. It is to this concept, and the relation between it and population, that I desire to call your attention in this paper.

As a first step in this enquiry, it is helpful to observe that the standard of living is one of four great factors, into which practically all the material aspects of social organization may be divided. The other three are land, the stage of the arts, and population. The conception of optimum population that I wish to set forth in this paper is so intimately dependent upon a clear perception of the relationship between these four factors that, at the risk of including some familiar and even elementary material, I venture to bespeak your attention to the subject for a few moments.

It is indicative of the retarded development of social science that scarcely one of these great concepts, upon which depend not only the principles of population, but all sociological laws and generalizations, has acquired a precise and uniform definition recognized by all workers in the field. It is therefore necessary, first of all, to indicate concisely in just what sense the terms are to be used in the present paper. And for clearness, it will be well, for the present at least, to consider them as attributes of a specific society.

In the term "land" are included all the natural qualities of that portion of the earth that fall within the domain of the society in question. This comprises, obviously, not only the soil itself, but all water, rocks, and the atmosphere. The term should be used to imply, not "the inalienable qualities of the soil," in the phrase of an older economics, for experience and modern science have shown us that there are few such, but rather those qualities which, at a given time, are strictly attributable to nature as distinguished from those, favorable or unfavorable, that have been produced by the hand of man.

The stage of the arts includes the totality of devices and expedients which the men of the society in question have developed for appropriating the natural supplies of the land, and making them available for human satisfactions. Into this category are marshalled all economic inventions and discoveries from the first stone hammer to the latest achievement in aerial navigation or wireless communication, in so far as they actually function in the life activities of the society. It includes both the material instruments themselves, and all the accumulated technique, scientific theory, and practical craftsmanship, upon which these material instruments rest, or by which they are utilised. All tools, machines, factories, steamships, railroads, agricultural implements, and telephone and telegraph installations on the one hand, and all the scientific theory and practical knowledge of engineering, mechanics, organization, finance, agriculture, stockraising, irrigation and drainage on the other hand, are associated in this stupendous complex. Finally, it should be clearly recognized that the stage of the arts also involves all the productive *qualities* of the people themselves, whether they be inventive facility, accumulated dexterities, mental alertness, or mere dogged industriousness. And this is true equally of qualities which at a given time are to be attributed to inheritance or to experience and environment. This consideration is of the greatest importance in properly adjusting the relationships of those who seek for human improvement through eugenic measures and those who emphasize population in its proper connotation.

Population, on the other hand, as interpreted in this discus-

sion, and I am convinced it is the only constructive and scientific interpretation, is exclusively a quantitative concept. It refers simply to the number of people constituting the society in question, quality being assumed. It is merely a question of counting.

The fourth factor, on the other hand, the standard of living, is a very complicated matter, but vaguely understood even by many who attempt to deal with it in an authoritative way. If space permitted, I could offer you an extraordinarily varied, and rather amusing, collection of definitions gathered from economic and sociological writers of the first rank. In general, these definitions waver between two diametrically opposite conceptions: that of an ideal, and that of an average. Strange as it may seem, the majority of writers seem to lean toward the notion of an ideal; a standard of living is that level of comfort that someone hopes to have, or wishes he had, or thinks he ought to have. Without lingering on the point, I may say that for myself it seems to me that the only objective, and therefore scientific, conception is that of an existing condition. Furthermore, it appears that the content of the phrase should be restricted to material, tangible goods that are susceptible of observation and measurement, ignoring all those spiritual or intellectual enjoyments which, however important, have no material basis and therefore are not susceptible of exact treatment. I therefore suggest, as a definition of the standard of living, simply the average level of comfort, including all material goods from the barest necessities to the most elaborate luxuries, enjoyed by the people (most helpfully considered in family units) of a given society at a given time.

Now between these four great factors there exists a complex of relationship so intricate and so thoroughly reciprocal that, in a very real sense, any one of them may be considered as the result of the other three, or the combination of any three as the cause of the fourth. How they shall be considered depends on the objective and point of view of a given enquiry. A student who is interested in explaining the land holdings of a particular society will find that they are the consequence of its stage of the arts, population, and standard of living, while one who seeks to account for the stage of the arts will find its genesis in the land, population, and standard of living.

Malthus (to whom I am sure all of us in this room acknowledge our profound indebtedness) was in pursuit of the principles of population. He therefore set up that factor as the objective of his researches, and consistently treated the other three as causative forces. As a result, we have to-day a comprehension of the determinative principles of population which has remained virtually unshaken for a century and a-quarter,

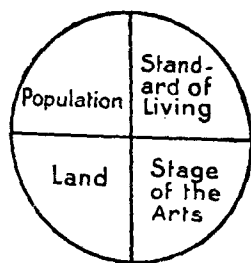
the changes during that period being mainly in the way of additions and amplifications, not of integral modifications.

But the overpowering achievement of Malthus has had two very important and strangely contradictory consequences. In the first place, his emphasis upon population has in certain quarters fortified the already prevailing conception of population, that is, mere numbers, as an end in itself, and has confirmed rather than shaken those who persistently cherish rapid growth for its own sake. On the other hand, his doctrine (not as fully developed as we could wish, but wholly implicit in all his discussion) that the tendency of population to increase is the one outstanding menace to human improvement has been seized upon by ardent but indiscriminating followers and assumed to mean that all population increase, at least all rapid increase, is to be deplored, and the only revision that any society should strive for is a revision downward.¹

It appears to me that the main basis of the confusion and bitterness that infest the question of population is just this pervasive, dominating, but, to my mind, wholly erroneous conception of population as an end in itself. I should like you to consider the suggestion that of all the four factors that I have outlined there is only one that can be justly considered as an ultimate human value. That is the standard of living. That, inevitably and inherently, involves human welfare. Each of the others has telic significance only as it affects the standard of living.

I therefore suggest that, as a matter of practical, scientific, social engineering, the standard of living should be accepted as the effect or result, and the other three as causative factors. The question of optimum population is a question of how varying sizes of population, given certain conditions of land and the stage of the arts, will affect the standard of living.

In the consideration of this problem, much time may be saved by the use of a simple little diagram.



¹ See "The Optimum Theory of Population" by LIONEL ROBBINS.

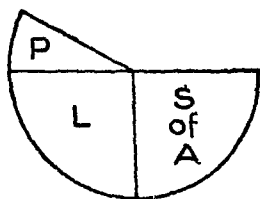
The circle represents a society, considered, for the moment, as in a static condition. The four quadrants represent the four factors of social movement in a state of adjustment, each to the others. The factors of population and standard of living are placed together above the horizontal diameter as being the two most likely to be looked upon as final social values; land and the stage of the arts are linked below the horizontal, as being obviously means to human welfare, and in little danger of being exalted into ends in themselves. Land represents the final source of all material goods of every kind; the stage of the arts the total equipment of the society for securing these goods, and applying them to the satisfaction of final wants.

With the commodities so produced, a population of a certain size is supported upon a certain standard of living. The whole population problem revolves around the questions as to how changes in one of these two factors affect the other, which of the two is to be regarded as predominant, and whether there is any inherent antagonism between them. The conventional view — almost the universal view before the day of Malthus — has been to regard the standard of living as the handmaid of population. The point of view that I am trying to establish is the reverse: that the only significance of population is found in its effect upon the standard of living.

The most immediate query is what happens to either one of these factors as a result of an increase in the other, the two factors at the bottom of the circle remaining unchanged? If the dividing line between them swings to the right, does it inevitably mean an encroachment on the standard of living? If it swings to the left, does it necessarily involve a diminution in population?

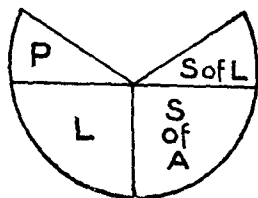
I do not hesitate to answer both these questions with an emphatic affirmative, granted the static condition of society that I postulated in the beginning. In an old society, where an equilibrium has been struck between population and the standard of living on the basis of an unchanging combination of land and stage of the arts, the only way that population can increase is at the expense of the standard of living, and the only way the standard of living can be improved is by reducing the population.

But it is quite obvious that this is not always the case. Societies are not always static. Let us consider a case where no such antagonism between these two factors exists. This is furnished, I believe, only by a peculiar type of society. Such a society possesses a very high stage of the arts and controls a large amount of land, but comprises a very small number of people. Such a situation may be represented as follows:



The consequence will be that such a society is not able to achieve its maximum standard of living just because of a deficiency of population. For it is a fact, too frequently ignored, that a combination of ample land with a high stage of the arts not only makes possible a large population, but *requires* a large population to produce the best results. This is partly a matter of mere division of labor in the conventional sense, partly a matter of types or organization, methods of industry, means of communication, etc., too obvious to call for detailed explanation. The types of industrial activity predicated by a high stage of the arts cannot be prosecuted most efficiently except upon the basis of a relatively dense population.

In such a situation, therefore, the standard of living will necessarily be low — low, at least, compared with what it might be — and may be represented thus:



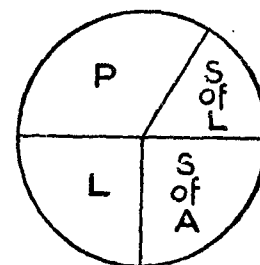
As long as these conditions prevail, both population and the standard of living may advance together, to their mutual advantage, until they meet at a common boundary. And it is virtually inevitable that they will so advance.

Such a situation may be properly defined as underpopulation, the only intelligible and acceptable definition that I have ever run across. (Few, indeed, of those who use the term most fluently even seek to define it.) Underpopulation is that state in a society when the population is too small to permit the most advantageous use of its land and stage of the arts and so the attainment of its maximum possible standard of living.

Broadly speaking, it is probable that this situation has been very rare in human history. Underpopulation is vastly less common than overpopulation. Probably the most notable

example is furnished by the societies of the American continents following their appropriation by the white race, and particularly by the United States. It is also true that this situation is by nature a very transitory one; that is one reason why it is so rare. In a state of underpopulation, the natural impulses that lead to multiplication are supported by economic incentives. Love and hunger pull as a well-matched team in the same direction. In other words, the characteristic Malthusian checks are not in operation. Inevitably, therefore, population increases at a very rapid rate. Malthus chose the American colonies as the best authenticated case of rapid increase on a large scale, and there is no doubt that for generations, even into the national period, our natural reproduction took place at the rate of doubling every twenty years, or possibly even fifteen in certain areas.

In a very brief period, therefore, the boundaries of population and the standard of living come together, and a very critical point in the career of the society is reached. Unless the society is very fortunate — and history seems to show that few societies have been so fortunate — the sector representing population will continue to increase and the dividing line will be forced over into the domain of the standard of living, resulting in overpopulation, which may be defined as that state in a society when the population is too large, on the basis of the existing combination of land and stage of the arts, to permit the society to maintain its maximum possible standard of living. This situation may be represented as follows:



The nature of overpopulation is much more easily grasped than that of underpopulation, having been long implicit in the extensive, though rather befogged, discussions of the Law of Diminishing Returns characteristic of the older economics.¹

The dividing line between underpopulation and overpopulation marks the point of optimum population. Below that point, as has been suggested, there is no antagonism between hunger and love. Above that line, instead of resembling a team harmoniously

¹ See LIONEL ROBBINS' monograph, quoted above.

working in harness, they become contestants, persistently pulling against each other in an implacable tug-of-war. No single piece of information is so important to any society as the determination of just where this point lies or will lie at any given time.

Consider as an example the United States, the most notable instance of underpopulation in modern times, perhaps in all human experience. During the colonial period, and for some decades of the national period, it seemed a self-evident fact (and it probably was a fact) that the one great need of the country was more people. Public sentiment and opinion, and governmental policies, conspicuously in the matter of immigration, reflected this situation. As a result there transpired probably the most stupendous increase in population that the world has ever known. The population of the United States grew from approximately four millions in 1790 to approximately seventy-six millions in 1900, a nineteen-fold increase in 110 years. Twenty-three persons are on record as having lived to see this change. Twenty years later the increase had reached more than twenty-six-fold.

All this is impressive and interesting. But the vital question is, What does it mean in terms of human welfare, that is, the standard of living of the United States? Is the country still underpopulated, or has it reached the optimum point, or has it perhaps already passed it? No one can say with assurance. There are many indications that the last answer is the correct one. At least, if the dividing line has not already been crossed, it must be very soon if the present rate of growth continues. Some of the other new countries like Canada and Australia at present believe themselves to be underpopulated, and are shaping their public policies accordingly. But it is as certain as anything in social science that they will soon be where the United States is now if present tendencies are continued.

It is obvious, then, that the most important task of applied social science is to provide means for determining the point of optimum population for various countries and for the world as a whole, and predicting it for the future. It is equally obvious that it is a task of stupendous — for the present, insuperable — difficulty. For it is clear that, if this problem is to be reduced to terms of scientific and mathematical exactitude, a first and indispensable step is a technique for measuring each of the factors involved. A moment's thought will show that at the present time there is only one of these factors that can be measured with even approximate accuracy. This is population, which, as has been said, is merely a matter of counting. With the wide spread of accurate census methods has come the possi-

bility of reckoning the rate of increase or decrease of population to a minute fraction of a percent, of comparing rates between different countries or the same country at different times, of drawing diagrams, extrapolating curves, and in all ways applying full statistical methods. This much, at least, we have to be thankful for.

But nothing even approaching this degree of exactness is possible with any of the other three factors. We can indeed measure land in one of its aspects — area, and we habitually do so. We also put together our measurements of population and land and derive figures of what we call density of population. This may be represented by the simple formula

$$\frac{P}{L} = D$$

It is indicative of our recognition of the vital nature of this correlation that we attach so much importance to this estimate of crude density, which in point of fact has almost no significance at all. For area of land, taken by itself, means almost nothing in terms of human welfare. The importance of land depends fully as much upon its productivity, including both agricultural fertility and mineral and other resources, as upon area. Instead of dividing population by land area, it should be divided by a quantity representing area times productivity.

$$L = a \times p$$

We can, fortunately, make some progress in measuring productivity, but not enough as yet to enable us to set up a mathematically exact and genuinely relevant index of population density. Some of you may have heard, as I have, Mr. Tsurumi, the eloquent and liberal exponent of Japanese attitudes, attempt to meet this situation by reducing the figures of population density in Japan to terms of arable land. This is suggestive, but even if it could be done so precisely as to include the factors of fertility in the land, it would still be only partial.

But suppose it were possible to determine an exact index of density of population, even this would not indicate the bearing of changes in population upon human welfare, that is, on the standard of living. For there is also the factor of the stage of the arts to be reckoned with, and, as we have seen, the significance of increases or decreases of population is itself dependent on the stage of the arts. If there were no such thing as optimum population and every decrease in population were necessarily advantageous, then it would be possible to incorporate an index of the stage of the arts into the denominator of the fraction from

which density is derived, so that the formula would be (letting A stand for the stage of the arts)

$$\frac{P}{L \times A} = D$$

D would then be always an inverse index as regards human welfare, and we could establish the simple formula (letting S represent standard of living)

$$S = \frac{1}{D}$$

But we have seen that this is emphatically not the case. The relation between population and stage of the arts is such that at times D is an inverse index and at others a direct index, changing from one to the other at the point of optimum population. Before the formula can have utility for social engineering, it must be so devised as to indicate precisely how fast this point is being approached from one direction or the other, and when it has been passed. I confess frankly that I am not enough of a mathematician to imagine how such a formula should be constructed, nor even to suggest how an index of the stage of the arts might be devised. But I am convinced that essentially these steps are necessary before optimum population can be dealt with in a fully statistical manner.

As a final step in the application of the statistical method to this problem, there must be a general technique for measuring standards of living, by which, in the last analysis, the whole situation is to be judged. We must be able to know with preciseness whether the standard of one country is higher or lower than that of another, and whether the standard of a given country is rising or falling, and at what rate. This is an aspect of the problem to which, if I may be permitted to say so, I have devoted some little time and effort. Attempts are sometimes made to approximate the standard of living of a society by estimating *per capita* income. This is suggestive, but not conclusive. For the standard of living, while dependent on income, is not immediately a question of income, but of outgo. Two societies might have the same *per capita* income, but if they were so situated and organized that one was required to put a large part of its income back into fertilizer or into the maintenance of expensive capital equipment, while the other could use the great bulk of its income to ultimate satisfactions, there would be a great divergence in their standards of living. I have not, however, gone further than to attempt to work out a technique for the measurement of the standard of a given group

within a given society. I have not attempted to measure the standard of a society as a whole. I will not prolong this already too protracted discussion by describing the details of this method, more than to say that, following Engel's well-known work, I rely upon a fixed budget of necessities (food, shelter, clothing, and fuel) to determine the proportion of income devoted to this group of expenditures, and use the remaining percentage, available for "culture wants", as the index of the relative height of the standard. I am inclined to think that, if developed in competent hands, this technique might be adapted to much wider uses. It may be of interest to note in passing that, as a result of my studies of the unskilled wage-earning class in the United States, I am convinced that there was a distinct decline in the standard of that class from, say, 1890 to 1914. I do not attribute this entirely to population increase, foreign immigration undoubtedly having a profound influence.

Such, it seems to me, are the steps that must necessarily be taken in order to reduce the problem of optimum population to a mathematical basis, and surely social science could render no greater service to mankind than to accomplish this immense task. For myself, however, I wish to say candidly that I am not of those who believe that nothing is scientific that does not rest on a completely mathematical or statistical basis. I believe that commonsense and logic are just as useful implements for human improvement, and even for intellectual attainment as mathematics. Once the concept of optimum population is fully established, results of immense value can be obtained by an intelligent, matter-of-fact survey of existing conditions, and sound public policies may be based on the conclusions. It needs no statistical demonstration to convince one that China is overpopulated under present conditions, or that the United States is better off to-day with one hundred and ten million people than it would be with five millions.

Indeed, I think a warning may be drawn from Malthus himself as to the menace of introducing a mathematical relationship where no such relationship exists, or where, at least, none has been established. The most effective attacks on the Malthusian theory have been launched against what is assumed to be his central thesis — that population tends to increase at a geometrical ratio and food at an arithmetical ratio. The point is made with entire cogency that there is not the slightest evidence that food tends to increase at an arithmetical ratio. (In point of fact, as far as there is any tendency whatever of food to increase, it is a geometrical ratio much faster than that of population.) This main prop having been knocked out, it is assumed that the whole theory collapses.

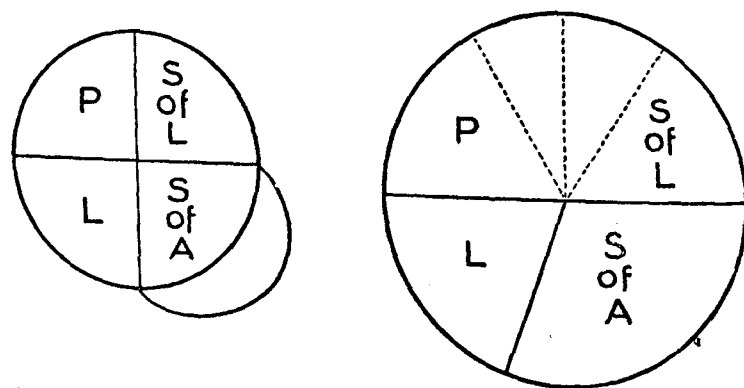
Now, we all know very well that Malthus not only did not

say that food tends to increase at an arithmetical ratio, but that he took particular pains not to say it. What he did say was that an arithmetical ratio might be assumed as the outside limit of what we had a reasonable right to expect.¹ But his correlation of ratios was such a simple and easy concept as to win immediate adoption by the naturally indolent human mind. Malthus' doctrine would have lost nothing, but have been much more firmly buttressed, if he had not attempted this mathematical comparison at all.

Perhaps a word ought to be added as to future developments. How is a country that has reached the stage of optimum population, or perhaps passed it, to progress? If it is definitely overpopulated, one way for it to progress is to reduce its population. This is not a way likely to be adopted voluntarily, and as for the alleged beneficent effects of war, the World War proved beyond a doubt that under modern conditions war is not a remedy for overpopulation.

Instead of bringing relief, war leaves affairs in a worse state than before.

The sources of genuine progress are found in increases of land, or in improvements in the stage of the arts, and for the conceivable future hope lies almost entirely in the latter. Reverting to our diagram for a moment, an improvement in the stage of the arts may be indicated by a bulge in that quadrant.



This means an opportunity for reestablishing the equilibrium on the basis of a larger circle. Either population may be increased or the standard of living raised, or some enlargement made in both. But it is most important to recognize that, in the case of a society that has reached the point of optimum population, an improvement in the arts provides for only a certain

¹ "Essay", second edition, pages 11, 12.

maximum enlargement in the upper half of the circle, and no more. It may all go to population, or it may all go to standard of living, or it may be divided between the two. But by no possibility can the maximum go to both at the same time. It is for an intelligent society to decide which it shall be. And if I have succeeded in making myself clear in this discussion, there can be little doubt in your minds as to what, in my opinion, the decision will be on the part of a truly wise society.

FOOD AND POPULATION

by

Professor E. M. EAST.

The members of this Conference have gathered here because they realise the extent and the meaning of the changes occurring during the last generation in this little terraqueous globe, which Voltaire so aptly called the lunatic asylum of the universe. The world has been explored from pole to pole; its resources have been chartered, from aard-varks to zymogens. The seas are dotted with ships; the lands are meshed with railroads. Our hands, our voices, stretch from continent to continent. We have become neighbors, whether we cared to be neighborly or not. In a century of industrialization, the population has risen from 900 millions to 1,850 millions — an increase probably greater than that of any previous age, since a continuous increment at the current rate would make a theoretical Adam and Eve contemporary with the great Augustus. The population problem, therefore, is not a problem to be considered in the fulness of time. With the world spotted with archipelagoes of untracked wilderness, it may not have been a pressing question; to-day its claim for public recognition cannot be lightly cast aside. Even the publicists who treat the matter with levity and

contempt seem to realize the truth of this assertion. Their feverishly optimistic exhortations, in and of themselves, show a fear of consequences in the present trend of affairs that is poorly screened by bluster and bravado. Those who study the rapidly rising figures in the census returns and who keep tally on the diminishing reserves of arable land certainly do not laugh.

The question proposed for solution, that of a just peace between the two basic instincts of mankind, nutrition and reproduction, is one which will not solve itself, as many people have supposed. Such a pleasing eventuality requires a diminishing human fecundity, for which there is no evidence. In fact, the biologist of to-day can find no flaw in Darwin's conclusion that civilization enhances fecundity. A satisfactory adjustment of these two embattled urges can be made only if man assumes the social direction of his own evolution. The ideal is an artificially standardized optimum of population, where distress and misery are at the ebb, where sunshine, good cheer, and happiness are at the flood. It is a population large enough for the efficient production and distribution of the comforts of life, and small enough to permit social, ethical, and esthetical advance. We can at least visualize this point, even if we can never attain it, as a sort of generalized maximum reached just before the combined efforts of society pass into the era of diminishing returns.

The facts being what they are, presumably nothing is to be gained by presenting vague platitudes on the food resources of the world. Obviously, any effort at enhancing agricultural efficiency, unsupplemented by population restriction measures, will bring about no more real improvement in the situation than will the furious exertions of the squirrel in his revolving cage. We merely raise more wheat to feed more men to raise more wheat.

If this Conference results in the formation of a permanent International Union for the study of all matters connected with population increase, however, the agricultural phases of the matter should receive attention. For these reasons, I have felt that I might utilize the time allotted to me most effectively by outlining a few of the concrete problems that such a Union might be more competent to solve than other agencies.

Of first importance, in my estimation, is the collection of adequate statistics by standardized methods. The International Institute of Agriculture at Rome is admirably fitted to act as a clearing-house for such data. Though hampered by lack of funds, it is doing an admirable work. I criticize neither its ideals, its personnel, nor its methods. Yet the data which it issues are

not satisfactory to the critical-minded statistician. Only a few countries have reasonably sound systems of agricultural book-keeping, and these systems, having been developed independently, are not comparable in type or accuracy. The data for the rest of the world consist of indifferent guesses.

Each of us can formulate problems which might be solved if comparable agricultural statistics for the entire world were made available as speedily as domestic and international scandals are spread by our various news agencies. I will mention three.

There is not likely to be a general underproduction of food for years to come; yet each year there is a glut in some localities and a scarcity in others. Am I too optimistic in believing that, if the areas planted to various crops were known, if the prospective harvest were accurately forecast, if the final yields were quickly and precisely determined, that much human misery could be avoided?

I feel sure that considerable progress could be made in avoiding overproduction and underproduction of specific commodities with the resulting extremes of price-fluctuation, and in providing better distribution facilities and workable credit systems in districts which happen to be temporarily unfortunate.

It might also be possible to study effectively the variations in diet forced by different densities of population. We have some knowledge of the proteid-energy ratios required by man and of the effects caused by the deficiencies in the vitamins; but we have no precise and comprehensive knowledge of the advantages and disadvantages of the primary and secondary foods in various combinations. And these are practical matters. For example, marked changes are now taking place in the dietary habits of the people of the United States. Economists view the trend with interest, and are able to resolve some of the more important factors causing it. Yet the mere observation of past events is not satisfactory. It would be more gratifying if the experience of the older countries, critically evaluated, could be correlated with physiological and agricultural knowledge, to serve as the means of guiding future changes into desirable channels.

More important still for the world at large is to have satisfactory data from which to draw conclusions as to economic policies in agriculture. May I call attention to a few comparative statistics regarding the productivity per acre and per person engaged in agriculture in certain countries?

The figures were calculated by investigators in the United States Department of Agriculture.

Countries	Year	Acres per agricul- turist	Production index per unit area	Production index per agricul- turist
United Kingdom	1901	7.1	177	126
France	1901	7.3	123	90
Germany	1907	7.1	167	119
Hungary	1900	7.1	113	80
Belgium	1900	5.3	221	117
Italy	1901	4.7	96	45
United States	1900	27.0	108	292

These figures are in striking contrast to each other. Belgium is the most efficient country in food production per unit area — twice as efficient as the United States. The States, on the other hand, lead in production per man engaged in agriculture with a figure two and a-half times as high as Belgium and six and a-half times as high as Italy; and these figures are reflected in the wage-scales of the various countries.

I feel some embarrassment in presenting these calculations. The citizens of the United States are too often held up to the people of Europe as horrid examples of pitiable money-chasers who have been fortunate enough to have great stores of natural wealth to be exploited. In its sinister sense the charge is untrue. The country is blessed with a redundancy of natural resources and has not had to meet all of the population difficulties faced by the older nations. But there are other new, under-populated, rich countries with which invidious comparisons might be made. The people of the United States work short hours and receive high wages for one reason only, because they have made machines work for them.

As my colleague Professor T.N. Carver has so often pointed out, every civilization of which we know anything has been based upon parasitism. The finer things of life— art, science, and literature — have been the products of a vicious system, a system of slavery, of peonage, of the exploitation of human labor. A few favorites of fortune were able to cultivate learning and beauty because they could shift the burdens of existence to other shoulders. If democracy is to guide us successfully to a higher civilization, the machine must be the slave which it exploits. Only by such an expedient are high wages and light work possible. Either we must make inanimate machines serve us, or we ourselves must be machines.

Now I have not the slightest idea as to what opportunities

exist for machine-power to take the place of man-power in the more densely populated countries where every unit of land must be made to give the highest possible yield; but I am convinced that in no other way can there be any relief for the agricultural laborer. Either his productiveness must go up or he must work long hours for the mere necessities of life. And I am further convinced that we can solve this problem only when we are able to study the complete returns from the agricultural laborers of the world at large.

Two other problems of prime importance, which require pooled knowledge of various kinds, have to do with the economic adjustments which must be made in certain countries as population density increases. The situation is roughly as follows. The production of cheap synthetic food is a dream and will remain a dream for generations. I should prefer to call it a nightmare. The potential food supply of the seas, lakes, and streams is relatively unimportant. The effort of the human race to expand its numbers is limited to the produce of about thirteen thousand million acres of tillable soil, two-fifths of which is now under cultivation. And since it takes at least two and a-half acres to support each individual under the present standards of agricultural efficiency, it is clear that the world can sustain only five thousand million people, unless unforeseen radical discoveries in science bring about revolutionary changes in our economic system. At the current rate of increase, this number would be reached in about a hundred years. Of course, saturation points vary with changing conditions, and that of the world in terms of population will mount with the rising temperature of scientific progress. Nevertheless, any reasonable premises for calculating the speed at which we are approaching this sorry goal give us results of the same general magnitude.

Actually, the world will not reach a saturation point in population in a single century or in several centuries, since the growth-curve will be characterized by ever-diminishing increments during the latter part of its course. I mention the present speed of growth and the short period of time it would take to fill the world with people if that rate were to be maintained because it helps one to appreciate the seriousness of a matter upon which our proposed Union might gather data of practical value.

There is considerable evidence to support the belief that the point of maximum population increase has recently been passed, and that henceforth mankind will meet more repressive factors than stimulative factors. In itself this fact is not especially disheartening, for under normal conditions of homogeneous growth it might be possible to counteract the effects of the Malthusian law through the gradual reduction of the birth

rate that is taking place throughout the world. But growth is not homogeneous. There are overpopulated countries and underpopulated countries; and this fact has led to a peculiar economic situation for which remedial measures seem less hopeful. I refer to the conditions existing in Western Europe.

There is only one reason why the tide of population could wax so great during the past century. There was a plenteous reserve of new land; and mechanical invention made it possible for a given unit of man-power to bring this land under cultivation more rapidly than population growth in the newer countries demanded. Natural increase in these frontier nations has been high in consequence; nevertheless, a surplus of food has been available for export to the older countries, there to act as a tonic on the birth rate. This rapid development has led many people to believe that Malthusian consequences have been evaded for all time. The truth is just the opposite. Instead of escaping the trap, we have been pulling its jaws together with both hands. With the fingers of the right we have reached out to gather the fruits from every available acre of virgin earth, thereby providing the means for populous towns and cities to spring up in every quarter; with the left, we have handed over the surplus spoils to the older centers of civilization, thus encouraging them to expand beyond the potentialities of their own holdings. The result is that the contingent food reserves of the world have shrunk at double pace.

Though I realize that data do not exist from which to draw rigorous conclusions, I feel that there is something fundamentally unsound in the expansion of Western Europe and of Japan on such an economic system. There are between eighty and eighty-five million people in Europe who must be fed with imported food. The only countries from which they can obtain it in quantity are the newer countries, where extensive farming still prevails because the population has not caught up with the system. There is food specialization and exchange in all countries, of course; but, generally speaking, the imports balance the exports. Only such countries as Canada, Australia, and Argentina are making the exportation of food their primary business; and these countries are doubling their own populations in from twenty-five to thirty years and becoming self-supporting in the matter of manufactured goods in the meanwhile.

Canada seems large when viewed on the Mercator projection map; but reduced to proper scale, the barrens and the icy wastes excluded, it shrivels up like the "Peau de Chagrin". Australia has a gross area as large as the United States; agriculturally it is less than one-fourth as large. Argentina has the lowest density of population for fertile countries within the temperate zone; but Argentina has decidedly limited potentialities. The

time when all of these countries must lock their food-export warehouses and set guards at the doors cannot be very far distant.

One may perhaps visualize the future of these foreign pensions for overpopulated countries by assuming that they will follow the general course taken by the United States. There the history of the country as a whole does not begin until about 1850; yet, in less than seventy-five years, diminishing returns in agriculture have apparently set in. The food-export balance is practically negligible and the country is very nearly self-supporting in manufactured goods.

I may be over-pessimistic in regard to the desirability of population expansion on the commercial basis that Great Britain, Holland and Belgium have adopted and which is being imitated by other countries; but there certainly are many facts which support the idea that it is an irrational and deceptive system. More precise figures might be obtained if the various Governments could be persuaded to study the situation carefully. If the conception I have outlined is erroneous, the fact could be demonstrated; if it is sound, conditions might be remedied, while there is yet time, by modifying governmental policies.

These matters are sufficiently perplexing, however long or short may be the time until each nation must be more or less completely supported by its own agricultural efforts. There is an interesting and important problem in this connexion, however. Large areas of fertile tropical soil exist, the potentialities of which cannot now be calculated. If these lands could be developed as rapidly as the lands of the temperate zone have been developed, the Malthusian law might again be temporarily suspended. If heat, disease, and other natural obstacles to conquest are to make the settlement of such territories a slow process, on the other hand, then population increase within the areas concerned will take care of all products. There will be no surplus. This is another matter needing prolonged investigation. Only when the facts are known can reliable conclusions be drawn.

In addition to these economic problems, there are numerous experimental problems in the solution of which it would be advantageous to have international cooperation. I shall mention only one — one which gave me my introduction to scientific methodology nearly thirty years ago. I refer to plant nutrition. Extraordinarily scant progress has been made, considering the rapid development of chemistry and physics, on soil problems. The soil bacteriologists appear to be making the greatest strides. The soil chemist and soil physicists have been relatively unproductive. This is a grave matter. The prosperity of the human race depends, in last analysis, upon the soil. We ought to know just what is occurring in the various soils of the world.

What are the reserves of soil fertility? How are they utilized by the different crops? How fast do the various elements become available? What are the losses by weathering and leaching? What are the effects of different systems of culture? What practical agronomical systems will be the most effective in maintaining soil fertility?

I doubt whether any one nation, working alone, can solve these questions satisfactorily within a reasonable period. Working together, it might be possible. If scientists came to some agreement on the basic principles involved, general agricultural policies might be formulated. If this is done, statesmen may see the difficulties to be avoided, and may come to a happy solution. Whether this is to be accomplished through the cooperation furnished by associations of the type of the League of Nations, or by some other means, I do not know; but it does seem that there must be either agricultural and political isolation involving tremendous difficulties or political union of a harmonious character.

DISCUSSION

***Mr. H. Brenier** (France): As to my title for venturing to differ from Professor East, may I mention that eighteen years of my life have been spent either in travelling over South-western China or in studying economic problems in the Far East, which contains about half the present population of the world. It seems rather bold to make any prophecy or proposal without taking into account fifty per cent of humanity.

Professor East says, for instance, that the resources of the rivers and lakes as to food are not interesting. Yet the surface of the North Sea is 225,000 square kilometers, on which there are edible sea fish. If you add the enormous resources of fresh-water fisheries in China, there are plenty of fish to be had, and I would remind you that half of humanity does not eat beef, but eats fish.

Professor East suggests that it might be possible to study effectively the variations in diet forced by different densities in population. I quite agree. It is not only a question of density,

however; it is also a question of practical dietetics. The facts as to the composition of different animal and vegetable foods and as to variations of diets according to climates cannot be lost sight of if any reasonable conception is to be formed as to the real wants of man. Diets must necessarily differ according to climates and not only according to densities.

Monsieur Maurel, a French physician, has shown that the number of calories necessary for a male adult, weighing fifty-five kilograms and performing light work, varies theoretically from 1,650 calories in hot seasons in hot climes to 2,750 in cold seasons in cold climes.

Another point, the ubiquitous soja bean contains far more proteid than beef (thirty-three per cent instead of twenty or twenty-one). Everybody in the world need not feed on the celebrated Anglo-Saxon roast beef. Why on earth should Chinese, Japanese, or the Annamites I know something about, be obliged to give over a part of their soil to beeves when soja gives them quicker returns on a far smaller area, and a more nourishing element?

I cannot accept Professor East's minimum of two and a-half acres *per capita* for the nourishment of man. It depends, once more, upon climate and soils. Two and a-half acres may be the figure for the United States. In Java people are actually living on an average of twenty per cent of a hectare (one-fifth of two and a-half acres) *per capita* for rice. Of course they import rice, but not to more than ten per cent of their production in bad years. And they do not eat rice only. In French Indo-China and many parts of China, two crops of rice can be harvested on the same field.

***Mr. Louis Varlez** (Belgium): Monsieur Maurette is unfortunately unable to attend the session this afternoon, and has asked me to read for him this brief discussion of the report of Professor Fairchild.

We may say there is optimum population in a country when the capacity of production balances the consumption of its inhabitants at a reasonably high standard of living. If the population can be fed without productivity being carried to its full capacity, the country is underpopulated; in the reverse case there is overpopulation. Optimum population is therefore a state of equilibrium. This equilibrium is never definitely established. It may be disturbed by various circumstances: such as discovery of fresh mineral resources which increase those resources of the sub-strata of the earth which are immediately exploitable; improvement of communications, encouraging exports and leading to a more intensive cultivation, the development of careful breeding, in fact, purely agricultural conditions

becoming partly industrial; some scientific discovery which modifies the conditions of life and gives value to raw material, which the country has always produced, but has been unable to utilize before.

In order that the increase in the capacity for production should become a real increase in production, all these instances of increase in capacity require a corresponding growth of the density of population relative to that density which was required to obtain an optimum balance in previous conditions.

Examples of the destruction of the balance by increase of the capacity for consumption are increase of population, by excess of births over deaths, and rise in the average standard of living so that the needs of the consuming population are increased.

The balance which is destroyed by the two factors indicated above can only be restored by three means: birth control, the emigration of a part of the population, or increase of production.

From this we see that there is no one optimum state of population true for all countries and all times, but a series of optima varying with each country, and in each country with different periods of time. The optimum population of a tropical forest or of a desert will have a very low density. This might be modified by the discovery of some precious substance which could be utilized and might bring about the formation of a village and so lead to ploughing or irrigation, thus increasing the capacity for production. Optimum population in a pastoral country, or one with primitive cultivation, will have a low density. The density will rise for a cattle-breeding country and be higher still with intensive cultivation — hence the optimum population in a country will vary as the character of its agriculture changes. In manufacturing countries, the optimum population will vary, the density being higher as machinery is perfected.

We now must ask whether a country which has attained optimum population should, under all circumstances, attempt to maintain the balance existing between capacity of production and consumption. Let us consider, for example, a pastoral country, with a small population, living in comfort. Its soil, climate and position would enable it to become a country with intensive cultivation and to export cereals and cattle to manufacturing countries. To carry out this change, useful to other lands, such a pastoral country would need a larger population. Has this country any moral or economic right to try to hold to its former optimum, or should it, by harder work, by financial sacrifice and by accepting immigration, attempt to reach a higher grade of civilization, a change which will not perhaps increase the wellbeing of its present inhabitants, but will make it a more efficient factor in the development of the world of which it is a tiny part?

The same question may be asked with regard to a country of an advanced agricultural type, which, by the discovery of mineral resources, is enabled to become a manufacturing country. Should it cling to its old condition, quiet and happy, or throw itself into industry, with costly plant, outside capital and immigration? The old optimum population would be destroyed and a fresh balance would have to be created, but the country would have a greater productivity and therefore be more useful to humanity.

Conclusion. Optimum population varies according to conditions, and we might better speak of optima.

Every country, in considering what is the optimum population for it, must take into consideration, not only the nature of its resources and the present density and standard of living of its population, but the conditions in other countries. This becomes more and more important as the feeling of solidarity amongst nations, even those widely separated, becomes stronger.

Colonel Sir Charles Close (Great Britain): It is essential that, in every single question of this type, geographical surroundings should be taken into account. The other point I have to make is that the word "optimum" is apt to give to those who have not read up the subject at all an idea that there is a certain numerical population which is in all respects the best. I think Professor Fairchild made it quite clear that that idea of optimum has reference only to certain conditions.

There is an old saying that all statesmen ought to work for the greatest happiness of the greatest number. That is one idea of an optimum. Another idea is the greatest amount of material wellbeing, which Professor Fairchild has put before us. There is another idea that you often find in books on the subject, the idea of the maximum output of human energy, and there is another idea which perhaps I ought not to mention here, the eugenic idea of the largest number of people who are perfectly fit, morally, mentally and physically.

By optimum population, Professor Fairchild means that population which is neither too great nor too small, having regard to the material wellbeing of the individuals composing it. It is, no doubt, perfectly fair to start the discussion of this difficult subject by a consideration of definite and relatively simple factors, such as the "average level of comfort". We may suppose that, as the number of human beings in any country increases up to a certain point all goes well; then there comes a time when the factors dependent on pressure of numbers begin to overbalance the factors tending to an increase. But, as a fact, there never has been a time when the pressure of numbers has not been felt. The point of reflexion is by no means

necessarily the point of optimum population. We have, at present, no means of determining the optimum point, except in a general way; but we may very well agree with Professor Fairchild when he quotes as an example the overpopulation of China, or says that the United States is better off with its present population than it would be with the five millions which it had in the year 1800.

Material wellbeing, however, is not the only criterion, as we all know, for an optimum population. The expression is sometimes used in relation to the output of human energy, and the optimum population in that connexion is the number which will produce the greatest return per head. The two ideas have much in common, for wealth and material wellbeing are closely allied, but the latter is more comprehensive, and it might be a convenience if, in general, an optimum population were taken as that number which resulted in the greatest amount of material wellbeing. This is an idea somewhat similar to that of "the greatest happiness of the greatest number". Much depends upon the use to which the material wellbeing is put. A population may be so circumstanced that it does not apply its surplus over its "fixed budget of necessities" to suitable objects. A less wealthy country may be more cultured, and it is culture of mind, body, and spirit that really matters. If an "optimum population" were taken to be that which has the largest number of men and women who are fit, morally, mentally, and physically, we should have set before us an ideal which would be of service in all our discussions of the many ramifications of the population problem.

***Professor S. Kohn** (Czechoslovakia): The notion of optimum population arises as soon as one leaves aside extreme points of view: that of the optimist, who affirms that the growth of the population can never be a danger to wellbeing, since each new citizen adds to production as much as he consumes; and that of the pessimist, who affirms that the growth of the population leads unconditionally to the impairment of the welfare of the population. As soon as one admits the possibility of the following conditions, that the growth of population can increase or reduce the standard of life, the examination of the effect of these conditions on actual societies and research into the extent of the optimum quality become an essential task in the science of the population.

Further, the importance of the problem is fairly well established in the report. Professor Fairchild considers as the most important factors population (P), the standard of life (S), the soil with its potential productivity (L) and what he calls development of the arts. He says that, if the growth of the population

can only take place at the expense of the standard of life, the formula of the phenomenon will be simple: the fraction $\frac{P}{L A} \div D$ would furnish a special index of the density of population, which could be considered as the inverse index of the standard of life S. In other words, the fraction $\frac{L A}{P}$ would give a direct index of the standard of life.

As Professor Fairchild says with justice, the relation between the population and the stage of the arts sometimes gives a direct and sometimes an indirect index of the standard of life. He concludes, therefore, that the formula mentioned is too simple to give an adequate picture of the phenomenon. But let us try to find this formula, let us try to express in an exact and mathematical manner the standard of life in relation to population; let us try to continue along this line of thought in order to get a more exact idea of the relation of the factors in question.

First, let us ask why the formula $\frac{L A}{P}$ gives sometimes a direct index and sometimes an indirect index of the standard of life. The principal cause is that population enters virtually as a factor, not only in the denominator, but also in the numerator. Population is not only the magnitude by which the quantity of goods produced and available should be divided. It is also a factor on which the quantity of goods produced depends in a positive sense. We should therefore rather write: $S = \frac{L A P}{P}$ it being understood that P in the numerator represents quite a different thing than when it appears in the denominator, and that the factors in the numerator are not at all simple multipliers, the relation between them being much more complex. What are the various circumstances by which an increase in the amount of potential labour (P) can affect the quantity of goods produced?

There are three influences which play the biggest part: (1) the economic and biological laws which determine the yield of successive expenditures of labor and capital employed in agriculture and also in industry; (2) the accumulation of capital without which potential labor cannot be applied to production, a question to which an insufficient amount of attention has been paid in the discussion of the problem of population; (3) technical progress in the strict sense of the word.

As for the denominator and its influence on the index S, we are not concerned here with simple division, because it is not simply the arithmetical mean which interests us, but the most

frequent magnitude, the "mode" (to use a statistical term). That is why we must study the curve of the division of wealth among the population.

Such questions have been discussed by economic science for a very long time, but it is only in the last century, particularly in the last ten or fifteen years, that a clear tendency has shown itself to support economic theory by the empirical study of facts, a study which, by the very nature of the facts involved, must be statistical. Further, it is not empiricism without deductive reasoning, but a synthesis of the two. It is in the country of Professor Fairchild that this work is pushed forward most actively, but other countries contribute as well. This new direction of economic science promises, in my opinion, to have very valuable results, and has also contributed to the perfecting of statistical method.

Let us also examine the following problem: How does the movement of population respond to the limits imposed by the means of subsistence? This problem constituted perhaps the most important point of the Malthusian discussion of the theory of population. The solution given by Malthus was that it is by "repressive checks" (misery and mortality) and not preventive checks that population is adapted to the means of existence. After the experience of half-a-century of a falling birth rate, and also of war and the aftermath of war, we cannot look for much restriction from such a solution.

This being admitted, the study of the relative effect of each of these checks becomes one of the important tasks of the science of population. In the population policy of our times, there arises not only the consideration that the growth of population should not exceed optimum population, but also the consideration that preventive checks have a more or less lasting bearing on the standard of life. That is why a careful study of the reactions of the movement of population to the different economic factors should in the future attract our very serious attention.

Dr. J. W. Glover (United States): I think that the mathematical consideration of this problem is a fundamental one. Professor Fairchild has told us that four variables (I think he has great confidence in limiting them to four) determine the population problem: one is land, another the art of living, another population, and another the standard of living. The diagram he gave suggests there is a linear relation between them, and that $aA + bL + cP + dS = 0$. He said that if any of the three are given the fourth is known. I am sure Professor Fairchild did not mean there was such a simple relation as a linear one connecting these quantities. There may exist, however, a more complex

functional relation, such as $F(A, L, P, S) = 0$, and all that we are talking about is how to find this function.

What is land? It is the whole earth. I am quite sure it is not necessary to talk about Great Britain or the United States or India; the final limitation on population is the earth. Why? Because the variable A, the improvement of the arts, is rapidly bringing the nations together. I prepared the United States life tables, and in order to compare mortality in the United States with mortality in other countries, I studied the mortality columns of a dozen or more countries, including India. The rate of mortality in India was so high that half of those born failed to reach the age of twenty. In the United States and in most of the other countries, eighty to ninety per cent reached the age of twenty. One could take the life table of Great Britain or France and determine the population of a city in those countries more accurately by knowing the deaths in that city during an intercensal year than is usually done by arithmetical and geometrical progression in the census offices. That shows how stable these rates are.

The variables are the standard of living and stage of the arts mentioned by Professor Fairchild which determine the effect on natality and mortality. The higher the stage of the arts the more able are we to save our infants and improve the mortality over the whole range of the life table. I know that the mortality curves of humans, rabbits, flies, and even telegraph poles follow the same type of curve. I have calculated the mortality rate of railroad ties and telegraph poles, and I know they follow similar laws. The chief differences observed are in the parameters in the functional relation, and these lead to reasonable values of the expectation of life in every case.

Dr. G. W. Silverstolpe (Sweden): Professor Fairchild has, in his most interesting paper, laid a solid theoretical foundation of our discussion, and I think there is very little, if anything, to add to his analysis of the problem of optimum population.

It has been said, however, by some that population, as influencing the standard of life, is not merely a matter of counting; for a steady flow of new lives may mean a strong incentive to new inventions, while a stagnant population may lose the very power of progress. But, as everybody knows, in former times, say, in the 16th to 17th Century there was a formidable flow of new lives, for ten or fifteen children were born in most marriages; and yet the methods of production remained upon the whole the same, and the high nativity resulted, of necessity, in a high mortality. If really a high nativity brought along with it a sufficient supply of new inventions, we should, of course, have no population problem at all. It has also

been said that new methods of production, when and if they appear, move the optimum point of population upwards. As Professor Fairchild has already pointed out, there is truth in that assertion. A hunting tribe has its point of optimum, an agricultural population has another and higher point, and an industrial population a still higher one. But it is not true that every new invention means a moving-up of the optimum point, for, once the division of labor has been fully developed, it is possible to profit by new inventions and new methods of production without any further increase of the population. It may be added that the perfection of the means of communication has a tendency to lower rather than to raise the point of optimum since with cheap and rapid communications the population may remain sparse and yet profit by the division of labor. Now, it seems to me to be, if not strictly proved, yet in some degree probable, that most countries of the world have come on the wrong side of the point of optimum; and I have learnt, with the utmost interest, from Professor Fairchild's paper, that he is apt to place, on the long list, the name of his own country, the United States. If the United States has enough people to develop its extremely rich natural resources, and I venture to think that the intuitive knowledge thereof lies behind the immigration restrictions, Europe must have, *a fortiori*, more than enough, for all European countries wish to send emigrants across the Atlantic.

It remains, at all events, a fact that nothing has done so much in opening people's eyes to the meaning of the population question as the American immigration legislation. In my own country, Sweden, it has, within a short time, caused an almost complete change in public opinion on these matters. Nowadays, very few people look upon birth control as an evil and nobody becomes really alarmed when the statisticians tell us that, with the prevailing rate of nativity, the population will, within a comparatively short time, show a state of stabilisation. There may be, as in other countries, some anxiety that the decline of the births when once begun will never cease; but this idea seems to be founded on historical analogies, which, I think, will prove to be wrong.

The way of stabilization: that is the way all European peoples have to go — even all the nations — who wish to conserve that surplus of production over the bare necessities of life which makes culture possible.

Dr. Warren Thompson (United States): I cannot accept the definition of standard of living which Professor Fairchild proposes. I am decidedly opposed to thinking of optimum population in terms of economics of population growth entirely. The standard

of living is not an entirely economic affair, and to limit the definition to economics is arbitrary. It cuts out some of the most important elements of what most of us understand by the standard of living.

No one can travel widely in Europe without being forcibly struck by the great differences that exist between peoples whose incomes in terms of purchasing power are practically the same. It is because of its great difference and because people who know how to make their incomes go further than others have a better standard of living on the same purchasing power, that I do not think the standard of living can be regarded as a purely economic affair.

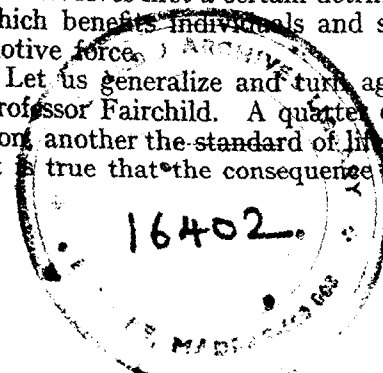
Another reason is that optimum population does not merely mean that population which can produce and consume the largest amount of economic goods. Optimum population means the best population, the population that is needed or that can survive under the best conditions that it proposes for itself. Those conditions may not be by any means the largest possible consumption of economic goods. There are a great many other values in life which are not included under that head at all as, for instance, the education which parents get from their own children.

An optimum population in the purely economic sense might easily dictate that people should not have children under certain conditions; but it is quite possible that an optimum population from the standpoint of the development of human character and of the broader spiritual values in human life might require that we should keep up the population beyond the point where it could be supported at the maximum standard of living about which Professor Fairchild speaks.

***M. Eugène Dupréel** (Belgium): I wish to make here an observation which I consider absolutely essential from a scientific point of view. It is that a distinction should be made between density and growth. Density is a result and growth is a state. A society can be in a state of growth, in a state of declining numbers or in a state of stability.

There exists in effect a causal relation between the numerical growth of society and its progress, between the numerical decline of a society and its deterioration. The growth of population involves first a certain detriment, but this causes a reaction which benefits individuals and society. The detriment is the motive force.

Let us generalize and turn again to the simplified circle of Professor Fairchild. A quarter of the circle represents population, another the standard of life, a third the stage of the arts. It is true that the consequence of the growth of population is



pressure on the standard of life. But the social phenomenon does not stop there. The pressure extends to the third quarter. The growth of population introduces a tension into this population which does not exist in a stationary population, and which exists still less in a declining population.

Is there a relation of cause and effect or any relation at all between growth, stability and decrease of population on the one hand, and general progress, civilization on the other? My profound conviction is that there is indeed such a causal relation, that it is the growth of the population which is the cause of progress, and that it is numerical decline which threatens the whole society with deterioration.

Dr. A. Koulischer (Russia): I should like to call your attention to a point of view which is generally overlooked in the discussion of population problems. One considers an isolated country and says such and such is its birth rate, such its growth, such its natural and artificial resources. If one reflects for a minute, however, one sees all at once that this problem of an isolated population does not exist. In reality, the whole area within which migration is possible is a unit. If, within one part of this area, there is a relation between population and the means of subsistence which is exceptionally favorable in comparison with the other parts, there is evidently a tendency to equalization which shows itself in migratory movements.

It may be said with justice that these tendencies are never completely realized. They can be hindered by natural and artificial barriers. Here a rather unpleasant fact appears, and I do not think that we shall accomplish any useful work at this Conference if we do not look this truth in the face. If persons deprived of food are not allowed to enter a territory where they think it can be found, it is evident, and all world history proves it, that they will try to make an inroad by force. Overpopulation implies migration, and migration almost always implies war.

There is, however, an exception. The 19th Century is an exception for all problems of population. It was the only epoch in the whole history of the world when great migratory movements took place without war, and there is the corresponding fact that it was the only epoch in world history when international migration was free. There existed then a kind of universal citizenship right. I do not wish to commit the youthful error of saying the emigration was peaceful because it was free. No, I say that migrations were both peaceful and free. These two facts are explained by exceptional circumstances of which enough has been said. Now there are no isolated migratory movements of a population; there are no longer isolated migratory movements. All movements are related to one another. I do

not say that the war was a consequence of migration, but very often it has been the cause.

There is yet another point of view that should not be forgotten, that is, there is a vicious circle: war is a means of reducing population, and at the same time it seriously hinders the production of food resources. My predecessor on this platform said that a pressure of population was accompanied by a development of the inventive spirit. That is true, but the inventive spirit comes too late, when it is preceded by the spirit of geographical expansion brought about by such circumstances as I have just described.

***Mr. August Isaac (France):** It seems to me that, in all the material submitted to us, insufficient attention has been paid to the imponderable elements. Now, we know that these elements, too often ignored in our modern society or in the great economic facts which cause opposition between nations, are sometimes those very elements which determine the solution to be applied to these problems. I have seen to-day, and you also have seen, certain apparently scientific demonstrations, and we have heard to what conclusions these demonstrations may lead us. It is not difficult to guess that, in the minds of those who have come together here in order to make these scientific demonstrations, there is the thought that population should be reduced by artificial means. That is the factor that will one day appear to the nation or the whole civilised world. How shall this come about?

We are told that Malthus rendered a great service to ignorant humanity. He wished to reveal to us the evil of an excess of births and overpopulation in relation to the development of food resources.

There is a country in which the ideas of Malthus are often, too often, put into practice. That country is, unhappily, my own. You know the history of the French population; you know the history of its civilization, you know the difficulties with which it is confronted. There are those who think that we must at all costs avoid an increase of population or men will die of hunger. But Malthus did not foresee the development of the means of communication, the development of the great invention of the French scientist, Denis Papin, the steam engine, the railway, the steamship, and after that electricity, the telephone and the wireless. He did not foresee the progress of chemical science or its effect on systems of culture.

***Mr. Paul Haury (France):** Professor Fairchild has failed to realize the part which human effort plays in raising the standard of life of the individual, of the family, when it is a large family,

and, through that multiplication of effort, in raising the general standard of life of society.

When, to represent society, he drew this fixed circle, it seemed to me that he forgot the essential characteristics of humanity, the knowledge of production, invention and creation.

It is a fact that the population of a country increases, a fact that the numbers of human units become greater, but the number of possibilities open to society is, by the same fact, wonderfully increased.

Professor Fairchild seems to have forgotten that a static state of society does not exist in reality. It is only an abstraction. Society is gradually growing. Professor Fairchild himself found it necessary to enlarge his circumference, or rather to add an element which represents the labor resulting from the growth of the population. By a singular contradiction, he has failed to recognize the fact that this element added to society is not simply added, but constantly grows.

Dr. C. V. Drysdale (Great Britain): The question of optimum population is a matter of very great importance. It is certain, in spite of what has been said by many people, that there can be no question as to the necessity for some limitation of population. The Malthusian principle is as fundamental to society from the sociological standpoint as the law of gravitation is to astronomy. The question of what should be our standard of control is, however, one of some difficulty. I venture to suggest that the simplest principle is that of the highest physiological wellbeing.

If we wish to ascertain what is to be the optimum population, it is obviously that state when we have the best physiological conditions. These are best indicated by the average duration of life. When we speak of optimum, we are not concerned with density, which may vary under different conditions of fertility of the soil, individual progress and other factors. We should seek to ascertain how the maximum duration of life can be obtained. That is the most useful criterion, not only for population, but for all other problems of statesmanship. Longevity is impaired not only by poverty but also by excessive luxury; and the community which has the highest longevity must be regarded as the best, not only from the economic but also from the moral standpoint.

†**Dr. R. Goldscheid** (Austria): I agree entirely with the speaker who has stated that there are various population "optima". But it is necessary to consider one population optimum, because this is identical with the economic principle. The economic principle demands that we should aim at obtaining the greatest useful result with the least output of energy. Translated

into terms of population questions, it means that the most useful results in reproduction must be attained with the smallest expenditure of effort. We must learn to aim at obtaining the rates of population increase which we desire with the lowest figures for births.

A second ratio must also be taken into consideration: that between quantity and quality of the next generation. We know that essentially the quality is determined by the quantity. Now, when we so often hear that, in those countries where the population has decreased either temporarily or for good or that it stagnates, there the figures for the birth rate increase, then we may look upon that as a sermon with a moral which cannot be put into effect, because a deep-seated connexion exists between the economics of production and those of reproduction, and because, as a matter of fact, production can only be rationalized if one undertakes to rationalize reproduction just as intensively and intelligently. If, therefore, in a country the increase in births is reduced, that means that in order to save people there must be less waste of people, and then the adaptation will be carried out better than at present where human beings are worn out prematurely and in great numbers.

Economics consists of economics of merchandise and of people. It is not until we consciously develop economics with reference to human beings and when we learn to put capital that lies in humanity to an economic use that we shall obtain at the time the optimum density for a definite period and according to the culture in question so that economy of reproduction will thus be the basis of economics generally. It is for this reason that I warmly welcomed the convening of this Population Conference, because I hope that it will strengthen in mankind the consciousness that the economy of reproduction is the foundation of the welfare of humanity.

***Mr. Rocco Santoliquido** (Italy): Professor East says: "It might be possible to study effectively the variations in diet forced by different densities of population. We have... no precise and comprehensive knowledge of the advantages and disadvantages of the primary and secondary foods in various combinations."

The Sanitary Commission of the Allied countries which functioned at Paris from 1915 to 1920 was led by the events of the war to make enquiries into the physiological problems of a normal diet which should suffice to keep a human organism in health without erring on the side of excess or want. *Neither too much nor too little* is the formula of good commonsense. It is also the formula to which physiological and medical analysis leads and the knowledge acquired in the course of the world war only serves to confirm this.

The Sanitary Commission of the Allied countries had to leave aside economic considerations in its studies. It wished to maintain the prestige of disinterestedness. Its conclusions were simply based on technical and hygienic considerations.

Before the war, modern physiologists in almost every country tested and proved the truth of the conclusions of the American Chittendon and the Dane Hindhede. Expressed as simply as possible, these conclusions of Chittendon and Hindhede were the following: The number of calories which the German school considered as necessary for a good working diet was much too high. Above all, the quantity of proteids could be reduced to almost half that which was formerly considered indispensable.

The almost revolutionary work of the American physiologist appeared only about a dozen years before the war, but it was only during the war that the new ideas were recognized in science. Rations in all the armies were restricted to a greater or less extent.

The Sanitary Commission of the Allied countries¹ wished to pay due acknowledgment to the Germans and in the following terms recognized "that the Germans knew how to adapt themselves to necessity, and more, that in their wise application of all science to the art of war they did not fear to carry out to the extreme the suggestions of physiology and modern hygiene in the matter of the feeding of the population and the armies. Before the war their military ration was as much as 5,000 calories. To-day the number of these calories has been reduced to half. These enormous reductions have cut deeply into the feeding of the majority of the enemy troops, and yet their offensive power, and their resistance do not appear to be diminished in any way".

There is nothing true in the idea that any fixed form of rations represents the essential factor for physical resistance. The history of the social disturbances which have shaken the world and of the various dominations which have succeeded them shows that the particular properties of diet (amount of calories contained) is of no account as a factor of domination and victory.

The Commission of the Allied countries made the following declaration regarding the problem of food supply: "We are not occupied with the necessities of the moment, whether the diet decided upon should be this or that for material or moral reasons. Our conclusions are not only for the times in which we live; they should have a more general bearing and establish the results of scientific investigation as regards food supply. It is not the laboratory alone which furnishes these results; the factors which control life itself must also be taken into consideration. Observa-

¹ *Bulletin of the International Office of Public Hygiene, Paris, May, 1918, pp. 516-517.*

tion of social phenomena is necessary for the examination of these in their integral parts".

***Mr. Jean Bourdon** (France): I find Professor East's reasoning is not in accordance with the present state of science. I refer in particular to the assertion that civilization causes an increase of fertility. It is the same assertion as that the development of food resources causes an increase in the birth rate. Such ideas might have been held about 1850 when no statistics or census reports were available, but to-day it cannot be overlooked that such statements are no longer tenable (see also page 111).

Dr. R. K. Das (India): The population of India is about seventeen per cent of the world's total at present. In the last fifty years, the increase has been only about twenty per cent, as compared with forty-seven per cent in Europe. The serious factor is the inescapable conclusion that the productive power of the people has not grown within a century or more, on account of political, social and economic conditions. There is now a more or less common standard of judging the population of a country, and no one can fail to adopt that without detriment to the growth of the national welfare. From that point of view, it is my estimate that in India to-day there is twice the number of people who could have a proper opportunity for material and moral development (see also page 114).

Professor H. P. Fairchild (in reply): I wish to thank Professor Glover for two things. In the first place I wish to thank him for emphasizing the fact that the factor of land is a constant. That is the starting-point of all sound understanding of the population question. Nevertheless, as far as any given society is concerned, even land becomes a variable, and that is where we meet one of the profound differences between the population problem of humanity and that of the lower organisms used in laboratory experiments. Man influences and affects his own land setting. He improves it and he injures it. He fertilizes it, but he mines the coal and iron and copper, and in too many cases depletes the fertility of the soil. It is a question in my mind whether the whole earth, the land itself, is at the present day not less capable of supporting human life than formerly. We get more out of it, but I fancy that, if humanity with its present mastery of the arts of life were put down on the earth as it was 10,000 or 20,000 years ago, it would find a better earth for human vitality than it has to-day. Professor Pearl creates a fixed and artificial environment with a certain amount of food available and watches results. A man, it appears, with his own universe and his arts gets vastly more

out of it than a primitive man, but in so doing he depletes the resources of the population to a very considerable extent.

Secondly, I should like to thank Dr. Glover for his device for recollecting my four factors, but in that connexion we must not forget that there are high Alps and low Alps, and whether one prefers to live in the high Alps or the low Alps is a matter of taste. Arguments about optimum population have been answered here by statistics of maximum populations. Those are two entirely different things and which you prefer is a matter of taste and therefore not debatable.

I chose the standard of living as the criterion for population growth because it seemed to me the most nearly axiomatic of several criteria that might be mentioned. If we are to see our way through this problem clearly, we must never forget that some criterion must exist. We have been invited this afternoon to give up eating roast beef in favour of a diet of fish and beans. Why? In order that a maximum population may be maintained. We are told what we could do if we gave up our animal diet, which is expensive, and turned to wheat, which is less expensive, and gave up our wheat and turned to potatoes, which are still less expensive. There is no society, I suppose, that could not support more people if it were willing to pay the price. But do we want to pay the price? In other words, what is the other criterion? Frankly, maximum population is of no ultimate value whatsoever.

Professor Thompson has suggested a very interesting criterion. He said we should consider the population that is needed, but needed for what? He suggested as an alternative the education of parents by their children. A perfectly logical and comprehensive alternative, but there again the question of values arises. If to any one the extra education that parents get from five or six children poorly nourished, ill-fed, is sufficiently greater than the education which the same parents get from two or three children well-fed, comfortable and happy, it is not debatable; it is a question of which you prefer.

The nearest approximation to a ground upon which we can all get together is the general material level of comfort; the esthetic arts, the mental outlook, the joys of family life, all of which are valuable, do not so clearly and accurately display a relationship with the size of population. This concrete tangible conception of the standard of living is much more demonstrable than any of these other desiderata.

Professor E. M. East: I hardly want to say anything except Amen to what my colleague Professor Fairchild has said. I shall not quarrel with the mere matter of what is negligible and what is not negligible in the way of sea-food and these

various things, or with the question of just how much available land there is in Canada or others of the new countries. I have studied those things as carefully as my time and ability have permitted and have published my findings elsewhere. In a discussion of matters of sea-food (meaning freshwater food at the same time) with a number of workers along those lines in the United States, the maximum estimate that any one made was eight-tenths of one per cent. I call that negligible from a general world standpoint. The minimum estimate, from a man well qualified to speak, was one-tenth per cent of the total food supply of the world.

SUPPLEMENTARY REMARKS.

Dr. R. R. Kuczinski (Germany): Professor Fairchild states that, in the past, population has been tested by the wealth and glory of the king or nobles, by the power and prestige of the State, by the propagation of the faith, or by military effectiveness. He refutes all those standards which point to a constant increase of population and considers as the only valid test the standard of living, which he defines as the average level of comfort including all material goods from the barest necessities to the most elaborate luxuries. This optimum seems to coincide with the one established by Professor Wolfe, of Ohio State University, who proposed as test the *per-capita* income of ultimate consumers' goods. In the latter part of his paper, Professor Fairchild, however, seems to modify his text and proposes to determine the proportion of income devoted to necessities and to use the remaining percentage, available for "culture wants", as the index of the relative height of the standard. But the difference between those two tests is perhaps not very large. What is more important is that neither of them, I am afraid, will serve the purpose, and this for three reasons.

(1) It is in many cases impossible to foresee the trend of the standard of living. Germany, with forty-five million inhabitants at the beginning of the 'eighties, had apparently passed the optimum point. She seemed absolutely overpopulated. The standard of living was constantly decreasing and she lost each year hundreds of thousands of emigrants. Thirty years later she counted twenty million inhabitants more. In spite of an

excess of births of 800,000, immigration exceeded emigration and the standard of living had enormously increased.

(2) In some countries like the United States, the average standard of living is so high that there is hardly any reason for laying much stress upon its further increase. All that seems desirable is a more even distribution of the national income; but this apparently has little to do with the absolute number of people, since the contrast of misery and wealth is stronger in the United States than in other countries which certainly are more overpopulated. I venture even to say that, if the United States with double her present population were to have an average standard of living by ten per cent lower than the present one, but with a better distribution of the national income, I would see no reason why she should restrict her population in order just to maintain the present average.

(3) In fact, neither the average standard of living nor the income percentage available for culture wants will furnish a satisfactory criterion, since both may increase in a society where the wealthy get richer and the masses get poorer.

While, then, the standard of living may help us to find the optimum population, we should be careful not to take it as the only guide. It should be supplemented by other tests, and this Conference will have accomplished a great deal if, on the basis of the most suggestive paper of Professor Fairchild, it succeeds in establishing a satisfactory definition of the optimum population.

The second task will be to ascertain the best means for obtaining and maintaining that optimum population. Theoretically, there exist eight such means: increase or reduction of births or deaths, promotion or restriction of emigration or immigration. But some of those means are objectionable and others cannot be satisfactorily applied. An increase of deaths involves such heavy sacrifices that it should never be attempted. Restriction of emigration interferes so essentially with modern conceptions of personal freedom that it can hardly be recommended. Promotion of emigration, on the other hand, seldom works satisfactorily because those who are ready to emigrate often are just those a country would better keep. An increase of births has frequently been aimed at but never with real success. If, then, the increase of births or deaths and the promotion or restriction of emigration are to be discarded as objectionable or impracticable, there remain but two means to increase a population: reduction of deaths and promotion of immigration; and two means to restrict the size of a population: restriction of births and restriction of immigration.

*Dr. V. G. Babecki (Poland): A certain density of population is necessary for the maintenance or development of the standard

of life. It is not possible to ascertain what is the best standard of life. What is considered the best to-day may be rejected to-morrow. For the time being, it is of much greater importance to consider the quality rather than the quantity of the population.

IS THE INCREASE IN THE POPULATION A REAL DANGER FOR THE FOOD SUPPLY OF THE WORLD

by

Professor J. BOURDON.

Every year England, Germany, Italy and Japan increase their population by some hundreds of thousands. In the Anglo-Saxon countries there are people who consider this increase as a danger to civilization.

First, they point out the danger — perhaps imaginary — to the world's food supplies. The population of the world has increased from 682 millions in 1810 to 1,700 in 1910 and 1,800 millions to-day. It is true that it is difficult to give figures that are exact, but one question is if in these figures there is any approach to exactitude. There are, even yet, countries that have no census. In China, for example, we have calculations that differ by as much as 150 to 200 millions; this lack of certainty is a serious defect but it is not the only one we find in any calculation of the world population. Would not the true scientific position be, to put the world population at so much on the highest estimate and so much on the lowest and to allow a margin of two or three hundred millions between the two extremes.

A hundred years ago wine and meat were, in general, consumed only by the richer classes. The people are very much better fed to-day than at the beginning of the 19th Century; this is a proof that the food supply has increased, not only as rapidly as, but more rapidly than, the population.

There are those who say that Europe is overpopulated because she does not produce all the food she consumes and has to buy outside her boundaries. Europe buys food and pays for it with her manufactures: this is international commerce, which, as elementary works on political economy and our own commonsense will tell us, has grown up as communications

became easier and allows every country to acquire what it needs in exchange for what it produces. This is usually considered advantageous for all. If (apart from questions of exchange) there are difficulties to-day, it is because the overseas countries have developed their manufactures. Throughout the world industry is extending faster than agriculture and towns are becoming larger at the expense of the country. The danger that threatens us is not overpopulation, but overindustrialization.

The agricultural production which gives us this increased food supply is obtained from a part only of the land fit for cultivation: the distribution of the world population is proof of this.

Europe has 460,000,000 people for 10,000,000 square kilometers; China proper 300 to 400 millions for 4,000,000 square kilometers; India 300 millions for 3,500,000 square kilometers. Outside these three regions we find a few densely populated districts, Japan and the Antilles for instance, but these are unimportant compared to the whole of the surface of the earth, with only these three regions densely populated. Even in these regions there are districts undercultivated.

Russia could certainly, with a better technical education, support more than twenty inhabitants to the square kilometer.

We see, then, that the three densely populated regions with 17,500,000 square kilometers have two-thirds of the total population of the globe. They do not entirely support their population since Europe imports food, but, except in England and Belgium, the greater part of their food supply is home-grown. For the rest of the world, we have on 120,000,000 square kilometers, 600 to 700 million inhabitants, one-third of the total population for eight-tenths of the land.

We must deduct 12,700,000 square kilometers at the Poles, 7,500,000 square kilometers for the Sahara and other deserts, but there still remains a vast extent of good soil, not yet cultivated. The increase of the world population has not yet excluded the food supplies; it has not, in fact, overtaken them. Long periods will pass before the danger, spoken of as close at hand, will become a reality.

The real problem for us to-day is that created by the unequal distribution of the population. Certain groups have too great a density, and of these groups some need more land to cultivate. We say some of these groups and not all: some have no emigration, as amongst the Germans in 1880-90, some 200,000 left their homes every year, but to-day fewer emigrate from Germany than from France, fewer in total number and still fewer if we take into consideration the total population of each country. Italy has many emigrants, but most of these go into factories, not into agriculture.

In order that a nation may reasonably ask for more land to cultivate, it must show an increasing number of land workers who in a new country will continue the same work. This is not the case in Germany and much less than is supposed in Italy.

Therefore, neither of these countries can justly uphold the claim to increase of territory which they put forward, or which is put forward for them.

Should the claim be made, it must not be satisfied at the expense of the French colonies, of which none can take a large number of European landworkers. Most are in a tropical climate, where the European cannot work on the land, and North Africa, which is temperate, has such a numerous native population that there is no room for millions of Europeans.

The Western nations of to-day seem hardly prepared to send out the true colonist, the pioneer ready to break virgin soil. This task needs great physical energy and offers but a hard life. The people possessing the aptitude for this life are found more rarely as civilization advances. We find them amongst the Japanese and Russians and that is why their emigrants are ready to become workers on the land and need fresh territory. If we disallow the claims of these nations, we may provoke a conflict, for their claims rest upon a real economic need, while those of Germany and Italy come from a desire for predominance.

Conclusions. The world is still underpopulated. The increase of the population may continue for a long period before becoming a danger to the food supply. The economic difficulties which are attributed to overpopulation are really due to the fact that agriculture has been neglected for industry. It is absurd to ask for more land to cultivate when the number of landworkers is constantly diminishing, as is the case in almost all Western countries. Only Japan at once, and Russia, as soon as conditions give her an increase of population by decrease of the death rate, can justly ask for fresh land to cultivate. Now, the only fertile soil with a temperate climate and a small native population is to be found in Canada, Australia, New Zealand, the temperate zone of South America and the south of Siberia.

Any attempt to distribute the population of the world, not from a national point of view, but from wider considerations, say the point of view of the League of Nations, would allot to these countries the surplus populations of Japan and Russia.

POPULATION AND FOOD SUPPLY IN INDIA¹

by

Dr. R. K. DAS.

In 1921, India had 319 million inhabitants or seventeen per cent of the world's population. In forty-nine years, from 1872 to 1921, the population in India increased by 113 millions, of which fifty-nine millions were due to the territorial expansion and census improvement, thus leaving a real increase of fifty-four millions or twenty per cent, as compared with an increase of forty-seven per cent in Europe in fifty years, from 1870 to 1920.

This slower growth of population in India is due to the higher death rate rather than to the lower birth rate. While, from 1880 to 1910, the average annual birth and death rates in England and Wales, France, Belgium, Germany, Italy and Spain were respectively 3.11 per cent and 2.20 per cent, thus leaving a surplus of 0.91 per cent a year, those in India from 1885 to 1910 were respectively 3.64 per cent and 3.08 per cent with a surplus of only 0.56 per cent a year. During the last decade, the death rate in India amounted to as much as 3.41 per cent as against the birth rate of 3.69 per cent, thus leaving a surplus of only 0.28 per cent a year. From 1885 to 1921, the average rate of growth was, however, 0.48 per cent a year.

At the rate of growth of 0.48 per cent a year as above, the present population of India would amount to 325 millions. What would be the rate of growth in the future is a matter of speculation. But it might be safely assumed that various social movements, especially those for health, would decrease the death rate, and, at a very conservative estimation of an increase of 0.5 per cent a year, the population in India would, in all probability, amount to 370 millions in 1950.

¹ References:—Census of India, Agricultural Statistics of India, Statistical Abstract for British India, *Annuaire statistique*, International Agricultural Statistics, World's Almanacs, Finch and Baker's Geography of the World's Agriculture, Das's Production in India, Wastage of India's Man-power (*Modern Review*, Calcutta, April 1927), etc.

Natural Resources.

Of the world's land area of 57.2 million square miles, India occupies 1.8 million square miles or 3.2 per cent. Excluding the uninhabitable regions of the earth, the comparative land supply in India is, however, much higher. While the density of population per square kilometer is 72 in France, 130 in Italy, 134 in Germany, 154 in Japan, 189 in Great Britain, and 256 in Belgium, that in India is 68.

What is more important to a country is the proportion of its arable land, in which the advantages lie with the new countries like Canada, Argentina, Australia and the United States, where *per capita* arable land varies from 2.94 to 1.17 hectares. The *per capita* arable land in India is 0.49 hectare as compared with 0.57 hectare in France and 0.73 hectare in Spain. It is much lower in Italy, Germany, Belgium, Great Britain and Japan, varying from 0.32 to 0.10 hectare. To these must be added fresh- and salt-water fisheries, in which India is fairly rich.

Forests and minerals are also important resources to a country, both for their direct and indirect use. In the supply of forests, countries like Brazil, Canada and the United States have the advantage. The forests, including permanent pasture, in India are rich in variety, but limited in quantity, being only 0.13 hectare *per capita*, as compared with 0.30 hectare in Italy, 0.53 hectare in France, 0.83 hectare in Austria and 1.1 hectares in Spain. The minerals in India are similarly rich in kind, but poor in quantity, except in iron and water. India possesses 1.1 per cent of the world's coal reserves and 2.2 per cent of the world's petroleum resources, but stands fourth in the possession of the world's richest iron-ore deposits and third in that of the water-power resources.

National Productivity.

In spite of her fairly large resources, India is the poorest country in the world, both relatively and absolutely. The *per capita* national income is Rs 74 or £5.5 a year as compared with £72 in the United States, £50 in Great Britain, £38 in France and £30 in Germany. What is more significant is that from one-third to two-thirds of the people have been variously estimated to be perpetually on the verge of starvation. Taking for granted that a person needs a food supply of 1.27 million calories a year, the *per capita* food supply in India, as estimated a few years ago from the yield of the principal crops, amounts to 0.83 million calories a year or one-third less than what is absolutely necessary. When it is considered that India's imports in foodstuffs amount to a negligible quantity and that she has to export a large quantity of foodstuffs as well as raw

material for the payment of foreign rule and investment, the extent of food shortage in India becomes still more evident.

The fundamental cause of India's poverty is the lack of growth in productive power in proportion to the increase of population within a century or more. The low productivity of Indian agriculture is best indicated by the per hectare yield of 6.9 quintals of wheat as compared with 26.7 quintals in Belgium, and 14.4 quintals of rice as compared with 34.5 quintals in Japan. In agricultural efficiency, India stands only twenty-second among the different countries of the world with an index number of 85 as compared with 221 in Belgium. There are several factors which have contributed to the low productive power or industrial inefficiency in India, such as starvation and disease, illiteracy and ignorance, social customs, industrial systems and political conditions.

The pertinent question is whether India can increase her productive power and supply the needs of her present population. In his treatise on "Production in India", the present writer has estimated that, provided the arable land could be used for two crops a year on the average, three-fourths of the soil fertility as well as other resources could still be available for productive purposes. But the possibility of their utilization depends upon the efficiency of labor and the sufficiency of capital. That Indian workers have a potential efficiency as great as that of any other people has been clearly shown by the investigation into the conditions of Hindustani workers on the Pacific Coast, which the present writer undertook for the United States Bureau of Labor Statistics in 1921-22. But by far the major part of India's man-power is underfed, diseased, illiterate and unskilled. India is equally deficient in the possession of her social capital. Machinery and mechanical power have up to this time been applied to only an insignificant part of her industrial life. Nor are there large social savings which could be transformed into working capital in the immediate future.

The prospects of rapid increase in productivity are not, therefore, very bright. Moreover, the more or less limited supply of forests, fisheries and minerals, even when fully developed, can scarcely supply the growing needs of the progressive civilization of such a vast population. Of the arable land, about fifty-five per cent is already in use and any intensity in cultivation would operate only under the condition of diminishing return, especially in India, where land has been cropped from time immemorial without any return in the form of fertilizers. The appropriation of the other forty-five per cent of the arable land would require irrigation, drainage, fertilization, acclimatization and other scientific treatment. In short, it would take at least two generations before India could acquire industrial skill and social capital

for the application of modern science and invention to the full utilization of her resources, and thus be in a position to solve the problems of the present food shortage, but in the meantime the present population would increase at least by fifty per cent, if not more.

Nature of the Problem.

Both the insufficiency of resources and the inefficiency to develop them have made India one of the most overpopulated countries of the world. The effect of overpopulation is manifested in several ways: First, *famine and epidemics*; the former, for instance, caused the death of five millions in 1895 and 1899-1900, and the latter of 8.5 millions in 1918-19. Second, *high mortality*, which is 3.06 per cent as compared with the average of 1.45 per cent in England and Wales, France, Belgium and Germany. Third, *low longevity*, which is only 24.7 years in India as compared with the average of fifty years in England and Wales, France, Germany, Holland, Norway, Italy, United States and South Africa. When fifteen years are taken out for childhood, the average manhood period thus becomes less than ten years in India as compared with thirty-five years in the above countries. Fourth, *widespread illiteracy*, which amounts to ninety-four per cent of her population. Out of eighty-four million children between the ages of five and fifteen, 76.4 millions or ninety per cent have no provision for elementary schooling even to-day. That more than nine-tenths of the people are ignorant of modern science and philosophy can be easily imagined.

What is the extent of overpopulation in India is hard to estimate, for lack of sufficient data. The optimum population of a country depends upon the cultural ideal of the people, as determined by natural resources and industrial efficiency. But there is growing a more or less common standard of life, which all countries sooner or later must adopt for the moral and material benefit of their people. Judging from that standard, some rough idea may be had of the extent of overpopulation in India from the following facts: First, the food shortage in India amounts to about one-third of the required amount and, excluding exports, to much more than that, as noted before. Second, the food consumption of a Madras prisoner amounts to 741 pounds a year as compared with the *per capita* consumption of 2,664 pounds in the United States. The food in India is not only small in quantity, but also poor in quality, and the food consumption of the majority of the people in India falls far short of this amount. But taking this amount as the national average, the *per capita* food supply is much less than one-third of that in the United States. Third, in a recent article for the *Modern Review*, Calcutta, the present writer estimated that one-third of India's man-power

was lost through under-employment and another third through inefficiency brought about by disease and illiteracy. Fourth, on the basis that a person needs about 2.5 acres of arable land for a decent living, as claimed by some writers, the optimum population that India with her 480 million acres of arable land could ever support would be 190 millions, but since at present only fifty-five per cent of this area is cultivated, the present optimum that India can support would be only 106 millions or about one-third of the present number.

All these facts indicate that only one-third of the present population could live in India with proper facilities for the development of their body and mind and for the achievement of the highest degree of self-expression. Even with "plain living and high thinking", which has been the ideal of Hindu civilization, one is inevitably driven to the conclusion that there exists in India to-day, under the present state of her industrial efficiency, double the size of the population which could live with a moderate degree of opportunity for moral and material development.

CONSIDERATIONS ON THE OPTIMUM DENSITY OF A POPULATION

by

Professor C. GINI

The first point to make clear when we speak of an *optimum* population density is for whom does this density represent the *optimum*: is it for the individual or the State? It is true that the State is an aggregate of individuals, but not only of individuals to-day but also of posterity.

Now that which may be regarded as the best for those actually existing in the State may not be equally so for the State considered as an entity in itself.

It is true that the life of present-day individuals stretches out into the future, and that family affection, ties of friendship

and relationship often result in as great a concern in what will take place after the individual's death as in his own immediate affairs. These emotions do not sway all, and, even in those who are affected by them, the influence exerted is not always the decisive one. At all events, and bearing in mind all the considerations above mentioned, there can be no doubt that the concern of individuals for future events is much weaker in intensity and limited in time than the interest of the State.

Thus, indeed, in judging as to what must be regarded as the optimum of population, as in judging any other phenomenon of which the future issue may be different — if not indeed contradictory from its immediate effect — the State is inclined to attribute a greater importance to future results than is ever accorded them by individuals.

A striking example of this divergence in appreciation is afforded by the point of view regarding a reduction of the birth rate.

From many points of view, this undoubtedly represents an advantage for the generation in which it takes place, and possibly for that immediately succeeding, inasmuch as it diminishes for the former the burden of children, thus enabling them to be better educated and to grow more robust and better fitted for the trials of life. On the other hand, by reducing the population, it enfeebles the military strength of the State, and, by starting the nation on a downward path on which experience has shown it is difficult to pull up, it may even definitely compromise national development in the near or distant future. We can readily understand that the individual lends a readier ear to the first considerations, while the latter cannot be disregarded by the State.

Obviously, then, the point of view of the individual must be harmonized, and actually was, is, and will be harmonized with the national point of view.

But the point of equilibrium depends upon a multiplicity of circumstances and, above all, on the inclinations of the individual, so that it would be vain to attempt to determine it *a priori* in a general way, regardless of the particular national psychology. Admitting for a moment that we may fix the point of equilibrium between the individual and national points of view for a certain population of given psychological tendencies — even yet a judgment regarding the optimum density of a population would work out very differently according to time and place.

In quiet times, when neither near nor remote menace of war appears on the horizon, it is quite evident that the requirements of national defence lose importance as compared with considerations of immediate economic advantage. And it is also clear

that, even for military requirements themselves, the question of the actual mass of the population will be relatively less or more important according to the size and technical development of armaments. The consideration of the size of the State may, however, be decisive.

It can matter little to Belgium, and evidently nothing at all to Luxemburg, for example, from the point of view of national safety, whether its own population remains stationary or grows even by fifty per cent. On the other hand, for nations like Italy, or France, whether they count sixty rather than forty million inhabitants may be a decisive fact. Whenever a State rises to dimensions or to a power which are well beyond those of possible competitors, the numerical question of population from the military point of view may lose much of its importance. This is the case to-day regarding, for example, the United States, and it might to-morrow be the case in Russia. Geographical position is another of those considerations which may decisively influence our conclusion. A nation isolated from others by the sea, trusting for security to naval forces, needs a much smaller number of men for its defence than a continental Power, and may thus be indifferent to an approach more or less rapid towards the static condition of population. Those nations, on the other hand, whose frontiers lie inland, tend to attribute to a highly numerous population much greater military importance, particularly if their boundaries are without natural defence.

The optimum demographic density may further be dependent on the characteristic of the territory and on the social life. In a dense population it is evidently easier to maintain order. Density stimulates intensive agriculture, the subdivision of big estates, and thus secures the disappearance of malaria; it leads to the construction of aqueducts, canals, and similar works contributing to the public profit. It further makes profitable the construction and use of railway communications, tramways, riverways, harbors, and ports, even in localities which are naturally little adapted thereto, and it contributes powerfully to the development of the higher forms of culture, such as conferences, theatres, concerts, congresses, all of which presuppose a crowd of spectators in order to make them possible. It gives to the market for artistic, scientific, and political publications the size which alone enables them to take firm root, and to spread the thought of the nation beyond its national frontiers.

And so it comes about that the population density required to enable a people to expand its aptitudes to the full is highest when external difficulties are greatest, when geographical climatic conditions are the least favorable, and where public order is most difficult to enforce and culture slowest in developing.

Many of these circumstances are met with in Italy. This

probably explains why the great increase of the population which has been observed during and since the war — although it happened in a period of disturbance and worldwide economic crisis — has rather accelerated than slowed down economic reconstruction in comparison with other countries, such as France and the Balkan States, which were equally tried by war.

Strong currents of emigration are by many regarded as a sure sign that the desirable density of a country has been exceeded. From my point of view this is a mistake. The fact that many migrate from a country means nothing more than that many promise themselves more favorable conditions or a pleasanter life in other lands. But, quite apart from the possibility of mistaken appreciations, it may happen, and frequently it does happen, that their departure actually does harm to the nation, which was not, in point of fact, oversupplied with men.

An emigrant's savings, which often enrich the families left behind by him, in part compensate and in part mask the harm which emigration has done; it sometimes happens that the difficulties which are feared by many from the reduction of the outflow are belied by the facts. This at least has occurred in Italy. The reduction of emigration to almost negligible numbers, not only has not damaged the country, but it has considerably advanced the agricultural economy of those regions from which the stream of emigrants was chiefly fed.

It is to this that is due the fact of great significance that in many regions the price of the landed property has risen greatly since the war, and this particularly in the case of the less valuable lands, which need for their productivity a larger supply of labor and which in the past were neglected on account of rural emigration.

Another error which, in my opinion, is often made in judging the optimum density of population is due to the failure to appreciate duly the influence which variations in that density may have on the accumulation of wealth.

It is an admitted fact that as population grows the national income grows, but many believe that, if the total amount of property to which work is applied remains unchanged in quantity or slightly increased, the national income will not grow proportionately to the population, so that the *per capita* income would diminish and either the standard of living or the amount of savings would inevitably decline.

This argument would be flawless if the stimulus to work and to save were as great in the case of a stationary population as in that of one increasing more or less rapidly. But this hypothesis does not correspond to facts. The fact that when the population is growing the family fortune is inadequate to allow of the children living on the same standard as their parents

is a most effective inducement to them to work more and to save more. Therefore, as the population increases, productive effort and thrift increase *pari passu*, and this increase added to the increased mass of workers, and often to the other favorable circumstances above examined arising from the greater density of the population, may determine an increase of total income greater than the increase of population.

The comparison of the economic progress realised by France and by Germany in the pre-war period does not favor the theory that it is a stationary population which promotes the most rapid growth of the average *per capita* income.

Thus we see that, in general, population density acts as a stimulus to national qualities, and more especially that the increase of that density acts as a stimulus to work and savings. But these stimuli may be more or less needed, and their effect may be greater or less, according to the psychology of the population. Where the individuals of a nation are gifted with a high degree of initiative, a very high form of civilization may be obtained even with a meagre population; although we cannot hide from ourselves that in all epochs it was in the most densely populated zones that the highest manifestations of the civilization of the period have appeared. Other nations, on the other hand, may, in order to reach up to their full measure, need the stimulus of a dense population, to which, be it noted, they respond admirably. Finally, a nation may be so torpid as to remain passive even under such a stimulus, and for these the increment of population density may, instead of being a spur to progress, become a source of permanent economic crises. The Scandinavian people, Italians, and the population of some parts of China, may perhaps be adduced as examples of the three types sketched.

In conclusion, the question of optimum density of population is not a theoretical question which can be solved by generic formulæ, but is one which presents itself in the most varied forms in various times and regions, and which in every age and every region is open to a different solution in accordance with the greater or less prevalence which is given by the varied instructions of the several peoples to the individual or to the national point of view.

SOME NEEDED REFINEMENTS OF THE THEORY OF POPULATION

by

Professor T. N. CARVER.

(1) That there are powerful motives which, if not counteracted by prudential reasons, will lead to marriage and the begetting of offspring is a matter of experience. (2) That in a prosperous country the average pair is physically capable of producing, bringing to maturity and marrying-off more than two children is a matter of observation. (3) That, if they continue to do so, each succeeding generation will be more numerous than the preceding is a matter of arithmetic. (4) That, in any given state of scientific knowledge, there is a limit to the quantity of food that can be grown on a given area of land is a matter of geometry, that is, of the limited space in which plants can spread their roots in the soil and their leaves in the air and sunlight. (5) That, long before this absolute limit is reached, the returns from increasing efforts to increase the yield of a given area of land begin to dwindle is a matter of experimental proof, having been demonstrated over and over at various agricultural experiment stations, besides being one of the largest facts in history, explaining, as it does, most of the migrations of peoples and struggles for markets.

These five verifiable propositions are the basis of current theories of population. They are all truisms and therefore uninteresting to the newsmonger; but truisms are at least true, which is more than can be said of many interesting and original statements.

On the basis of these truisms one must conclude, if one is disposed to reason about them, or one can determine empirically, if one prefers that method, that every population inhabiting any given area must eventually do one of two things: it must either become stationary or it must manage to draw its subsistence from wider areas. It can become stationary only by balancing its birth rate and its death rate. This can be done either by decreasing its birth rate or increasing its death rate. It can

draw its subsistence from wider areas either by migrating to those areas or by extending its markets, that is, by selling to the inhabitants of sparsely populated outside areas the finished products of indoor industries in exchange for the food and raw materials produced on those outside areas.

A given population must eventually	become stationary by means of	a decreasing birth rate or an increasing death rate.
	or	
	draw its subsistence from wider areas	by migrating or by extending its markets.

Empirical observation shows that populations usually follow all these tendencies, though one or more may become dominant. On the basis of their dominant tendencies they become either pent up or expanding, that is, they continue, in the main, to live within their historic boundaries or they tend to expand either their ownership or their commercial influence over wider and wider areas. Those who live the pent-up life either reduce the birth rate as in France, or they suffer from overpopulation and a high death rate as in China and India. Those who live the expanding life either migrate to new areas, as did the Greeks when their civilization was expanding, and as English-speaking peoples have been doing for the last three hundred years, or else they develop their indoor industries, as England herself has been doing for a hundred and fifty years, bringing raw materials from sparsely populated areas, working them over in her indoor industries, selling the finished products back to the inhabitants of the sparsely populated areas and living on the profits of the transaction — taking the profit largely in the form of food, also imported from sparsely populated areas.

The life of any given people is either	pent up, resulting in	birth control (France) or overpopulation (India and China)
	or	
	expanding, resulting in	migration
		commercial expansion
		robbing lower races of their land (English-speaking peoples) or emigrating to superior industrial countries in search of jobs (Southern and Eastern Europeans) or struggle for markets (every commercial nation) or international rivalries (every commercial nation)

II.

Overpopulation for the world as a whole is a theoretical possibility for the future, but not a present actuality. Local congestion is a term which describes such countries and sections as seem to be suffering from too great density. But occupational congestion is a present reality in every civilized country with the possible exceptions of the United States and Canada, and even these countries are not wholly free from it. By occupational congestion is meant a condition in which certain occupations are overmanned. This usually means that certain other occupations are undermanned. In other words, it means a lack of balance among interdependent occupations, and all occupations are becoming interdependent. For example, if, in any community there should happen to be more hod carriers than are needed to work with the existing number of brick and stone masons, that community is overpopulated with hod carriers, however sparsely its territory may be populated. Moreover, hod carriers would suffer from low wages or unemployment and be about as badly off as they would be if the whole region in which they lived were too densely populated.

At the basis of the general population theory is the important factor of balance between land and people. Too much land and too few people mean, of course, a low state of civilization. Too little land from which to draw subsistence, or too many people dependent upon it, means, on the other hand, an intense struggle for existence and a low standard of living. This idea of balance among the different factors is capable, however, of much wider extension. In these days of highly organized industry, there is the same need for a balance between different kinds of labor as there is between labor and land. This was acutely illustrated in the days immediately preceding the so-called industrial revolution of the 18th Century by a lack of balance at various times between weavers and spinners. At one time there were not enough spinners to supply yarn to the weavers. At another time there were not weavers enough to weave the yarn supplied by the spinners. In these modern times of extreme specialization, the illustrations could be multiplied by thousands.

Occupational, like local, congestion is a physical fact which lies deeper than forms of social or industrial organization. It is as likely to exist under communism as under capitalism. The remedy is the same in all cases. The congested occupations must be relieved of their excess numbers. This can be done in either of two ways, first by thinning out the numbers in the overcrowded occupations, second by increasing the numbers in

the undercrowded occupations. In the case of the hod carriers in the above illustration, the remedy would be either to decrease the number of hod carriers or to increase the number of brick and stone masons.

In general, the occupations requiring little skill or special training tend to be overcrowded and those requiring much skill and long courses of training to be undercrowded. The most acutely undercrowded are the higher managerial positions, which, for purposes of this discussion, shall be called those of invention, investment and management. This is not a necessary situation, but its remedy requires a more far-reaching and constructive program than most of our statesmen or social reformers have yet been able to plan.

Undoubtedly one cause of the lack of occupational balance is the differential birth rate. The inordinately high birth rate among the ignorant and the unskilled, and the low birth rate among the business, professional and scholarly classes would naturally, in the absence of a sound system of popular education, tend to keep the lower occupations overcrowded and the higher ones undercrowded. By a sound system of popular education is meant a system which enables every person to acquire the training and skill necessary for success in the highest and most remunerative occupation for which his natural or inherited ability would make it possible for him to be properly trained. Even where such a sound system exists, the differential birth rate throws a heavier load upon it than it would have to carry if the birth rate among different classes could be more nearly equalized. It is in this connexion that birth control bears on the only really acute population problem, namely, occupational congestion.

As already indicated, a sound system of popular education is a means of restoring an occupational balance. The most important element in such a system is commonly overlooked. It is not enough merely to enable unskilled manual workers to become skilled manual or even clerical workers. It is most important that as many as possible be trained for those occupations where men are scarcest, that is, for the highest occupations. So far as industry is concerned, these are those of the investor, the inventor and the manager. The scarcity of first-rate inventors, investors and managers is everywhere the limiting factor in industrial expansion. Any country in which this scarcity is acute will always show a congestion of the manual trades, as evidenced by low wages, unemployment or emigration. Any country in which inventors, investors and managers are numerous and of high ability will show an active demand for workers in the lower grades. That is, there will be high wages, general employment, or immigration.

One of the most specific cures for low wages and unemployment in England would be for Oxford and Cambridge to start first-rate graduate schools of business, and to use their vast influence to turn the best minds of England for a few generations toward business pursuits. If the country could mass its best intelligence for a few generations on industrial problems, its industries would so expand as to employ at high wages all its working population and to attract immigrants from other countries. It would then have an immigration rather than an emigration problem. On the other hand, one of the surest ways to create unemployment, low wages and poverty is to develop a supercilious attitude toward business, to turn the best minds of the country into the so-called genteel professions and to leave industry to second- and third-rate minds. Second- and third-rate minds can never run first-rate industries nor pay first-rate wages to large numbers of workers. Whatever else a country might achieve which turned its best minds away from industry or failed to give them adequate industrial training, it could never achieve the elimination of low wages, unemployment and poverty except by wholesale and forced emigration or drastic birth control among the manual workers.

Occupational congestion is similar in certain fundamental respects to local congestion. As pointed out above, local congestion is a lack of balance between two factors, workers and land. Occupational congestion is a lack of balance between different kinds of labor. Local congestion may be cured in either of two ways, first, by reducing the number of workers, second, by increasing the amount of available land. Occupational congestion may likewise be cured in either of two ways, first, by reducing the numbers in the overcrowded occupations, second, by increasing the numbers in the undercrowded occupations.

The possibility of overpopulating the world, while a real one, is too remote to interest the popular mind. Local congestion is a present reality only in certain Oriental countries and does not excite the Western mind except when those old countries threaten to flood the labor markets of the Western countries with cheap labor, which would result in occupational congestion even in new and sparsely populated countries. Occupational congestion is an acute problem, or threatens to become acute in every industrial nation. The fear of it is at the basis of all laws for the restriction of the immigration of laborers.

It should be pointed out that there is another kind of immigration problem besides that of the immigration of laborers. There has been some immigration into Mexico and the Philippines from the United States, but the immigrants have not been wage workers and they have not competed with wage workers of those countries. The immigrants from the United States have

been inventors, technicians, investors and managers. Instead of competing with native laborers, they have increased the demand for and raised the wages of the native laborers. The only ones with whom these immigrants have competed were the limited number of native inventors, technicians, investors and managers. These are the only ones who have objected to these immigrants. The reason for this opposition has been similar in principle to that for the opposition of American wage workers to immigrant laborers. If immigrants to the United States had been mainly of the employing class, that would have changed the occupational balance in favor of American laborers. It would have tended to congest the higher rather than the lower occupations.

This proposed refinement of the theory of population, throwing the emphasis upon occupational rather than territorial congestion, is important not only for the clarification of theoretical discussion, it is also intensely practical. It points the way to the only constructive or permanent remedy for low wages, unemployment and mass poverty. If this problem can be intelligently handled, there will be no more underpaid occupations. The only cases of poverty which will remain will be those individual cases of incapacity or misfortune with which charitable organizations have to deal, and even these will be greatly reduced in number.

THIRD SESSION.

Chairman: Professor J. HUXLEY.

Papers presented to the Conference:

DIFFERENTIAL FERTILITY, by Professor A. M. Carr-Saunders.

DIFFERENTIAL INCREASE IN THE POPULATION IN FRANCE AND IN THE WORLD, by Professor Lucien March.

DIFFERENTIAL BIRTH RATE IN GERMANY, by Professor A. Grotjahn.

RESULTS OF DIFFERENTIAL BIRTH RATE IN THE NETHERLANDS, by Professor H. W. Methorst.

SOME ITALIAN ENQUIRIES INTO DIFFERENTIAL REPRODUCTIVITY, by Professor Corrado Gini.

Supplementary Papers:

PSYCHOLOGY OF THE FALL IN THE BIRTH RATE, by Dr. Julius Tandler.

FERTILITY IN MARRIAGE AND INFANTILE MORTALITY IN THE DIFFERENT SOCIAL CLASSES IN STOCKHOLM FROM 1919 TO 1922, by Dr. Karl Arvid Edin.

DIFFERENTIAL FERTILITY¹

by

Professor A. M. CARR-SAUNDERS.

The term differential fertility may be used in a wide or a narrow sense. In the narrowest sense, it means no more than differential natality. In the widest sense, it means the varying rates of contribution to the adult ranks of the next generation made by different groups of the population. The members of any group form a certain fraction of the population and their descendants may form the same, a greater or a smaller fraction of the next generation. When the descendants form a greater or a smaller fraction, fertility is differential. It is in this latter sense that the term is used in this paper.

In order to study differential fertility it is necessary to be able clearly to mark off certain groups or sections of the population and to obtain vital statistics for the group or groups selected. The groups can then be compared one with another or with the population as a whole of which they form a part. Groups may be marked off because the members exhibit common sociological or common biological characteristics or they may be at the same time both sociologically and biologically distinguishable. The nature of the criterion employed to mark off groups has no relevance to the study of differential fertility. It becomes of importance only when we go on to examine the results. It is proposed here in the first place briefly to study some evidence bearing upon differential fertility in England and Wales in respect of groups distinguished by social status, location and achievement.

The Registrar-General has devised a classification intended to separate occupied males into "different social grades".

¹ The earlier part of this paper is taken from the final chapter of a book to be published shortly by the Oxford University Press and called "The Structure of English Society".

Every occupation recorded in the Census is allocated to one of the following eight social classes:

- | | |
|----------------------------|-------------------------------|
| Class 1. Upper and Middle. | Class 5. Unskilled. |
| Class 2. Intermediate. | Class 6. Textile Workers. |
| Class 3. Skilled. | Class 7. Miners. |
| Class 4. Intermediate. | Class 8. Agricultural Lab'rs. |

It would be possible to allocate all occupied males to the first five classes, in which case all those comprising what is usually known as the "working class" would fall within Classes 3 to 5. In fact, members of the working class engaged in the textile, mining and agricultural industries are not included in Classes 3 to 5, but are allocated to Classes 6 to 8 respectively. Two principles are thus followed in making this classification. The social standing of those following any occupation is the criterion in respect of allocations between the first five classes. Thus a clerk is placed in Class 1 and a shop assistant in Class 2 though the latter may have a higher income than the former. To illustrate the nature of the occupations of those falling into Classes 3 to 5, an example may be taken from the railways. Guards fall into Class 3, pointsmen into Class 4 and porters into Class 5. In spite of the fact that the criterion is primarily one of social status, it is clear that Classes 1 to 5 are also distinguished by economic and occupational differences. Members of Class 1, for instance, have on an average higher incomes than members of Class 2, and members of Classes 1 and 2 include those following professional and commercial occupations, whereas Classes 3 to 5 include those following manual labor occupations. In the case, however, of Classes 6 to 8, the criterion is primarily occupational, though it must be remembered that working-class followers of these occupations alone are placed in these classes.

The Census of 1911, but not that of 1921, included questions in respect of each married woman as to the number of years the marriage had lasted, the children living and the children who had died. Information as to the occupation of the husband was also given on the returns. It was thus possible to obtain information regarding the effective fertility of marriage in the different social classes in 1911. By effective fertility is here meant the number of children surviving per 100 families in each class. The facts disclosed are illustrated in Table I, which summarizes the data for marriages in which the wife had not attained the age of forty-five years in 1911. It will be seen that, when the first five social classes are considered, effective fertility increases regularly with descent in the social scale. With regard to members of Classes 6 to 8, it has to be recollected that, if

instead of being allocated to these classes, they had been distributed among the first five classes, they would all have fallen within Classes 3 to 5, though the members of each of the Classes 6 to 8 would no doubt not be found to contribute equal proportions to Classes 3 to 5. Bearing this in mind, it is worthy of note that members of Class 6, the textile workers, have an effective fertility between that of Classes 1 and 2. The birth rate of textile workers is relatively low and their child mortality is relatively high. Miners (Class 7) and agricultural laborers (Class 8) have approximately the same effective fertility though they reach the result by different paths. The former have a high birth rate and a high child mortality and the latter a lower birth rate and a lower child mortality.

TABLE I (a).

England and Wales 1911. Marriages where the Wife had not attained the Age of forty-five at Census. Total and Effective Fertility and Child Mortality classified by Social Status (as indicated by Husband's Occupation) for all Durations of Marriage.

	Social Class							
	1	2	3	4	5	6	7	8
Children born per 100 families	190	241	279	287	337	238	358	327
Children dead per 1,000 born	116	147	167	173	206	200	213	131
Children surviving per 100 families . . .	168	205	232	237	268	191	282	284

(a) *Journal of the Royal Statistical Society*, May 1920, p. 410.

The differences between the classes in respect of effective fertility as shown in the above table are due in part to differences in the number of children born to married women irrespective of age, in part to differences in respect of age at marriage and in part to differences in child mortality. We are, however, not concerned here with the relative parts played by each of these factors, but with the net result of these factors taken together, because our object is to throw light upon the contributions made by each class to the next generation. There is still another factor affecting these contributions which has not yet

been mentioned. We refer to differences in the amount of marriage within each class. The best indication of the frequency of marriage would seem to be the proportion of married men aged forty-five to fifty-five per 1,000 occupied males of the same age in each class. These proportions are as follows:

Class 1	829	Class 5	758
Class 2	849	Class 6	842
Class 3	851	Class 7	819
Class 4	850	Class 8	735

(Census of England and Wales 1911, Vol. XIII, Part 2, p. LXXIX.)

If we take the proportion of married men in the earlier age groups, the figures depend largely upon age at marriage; if we take the later age groups, they are influenced by the mortality of wives. The figures for the age group 45-55 provide us only with rough indications of the amount of marriage. Accepting them as such, we see that Classes 1 and 5 marry least. Therefore the contributions of these classes as a whole to the next generation will be less than the number of children surviving per family suggests. Since the average number of children surviving per married man in Class 1 is 1.68, in Class 2 is 2.05 and so on, and since the indications are that 829 occupied men out of 1,000 in Class 1 marry and in Class 2, 849 and so on, it follows that, when considering families of continuing fertility in 1911, there will be per 1,000 occupied males (married and unmarried) in each class roughly the following average numbers of legitimate children:

Class 1	1,393	Class 5	2,031
Class 2	1,740	Class 6	1,608
Class 3	1,974	Class 7	2,310
Class 4	2,014	Class 8	2,087

These indices of the amount of marriage in each class can also be applied to marriages of completed fertility in 1911, when the results came out as follows:

Class 1	2,437	Class 5	2,941
Class 2	2,895	Class 6	2,787
Class 3	3,251	Class 7	3,645
Class 4	3,222	Class 8	3,359

Two conclusions follow from a consideration of the above figures. First, differences in the amount of marriage considerably affect the total contributions of the classes to the next

generation. Secondly, there is a connexion between high social status and low effective fertility. The second conclusion is of such interest that it may be illustrated by a further analysis of these data. Two examples must suffice:

1. If those following Class 1 occupations are divided into two groups according to social status, then the first group consisting mainly of those following higher professional occupations is found to have 174 children surviving per 100 couples as against 187 for all couples in Class 1 for marriages of continuing fertility. Since the rates quoted here are standardized for age at marriage and since there are considerable differences in age at marriage between these two sections of Class 1, these rates do not fully illustrate the differences in effective fertility between them. (Census of England and Wales 1911, Vol. XIII, Part 2, p. LXXXV.)

2. If those within a single industry, railway employees for instance, are considered, it is found that officials and clerks falling within Class 1 have seventy-eight per cent of the average standardized fertility; engine-drivers, guards and signalmen falling into Class 3 have ninety-one to ninety-eight per cent; pointsmen falling into Class 4 have ninety-eight per cent, and gangers, laborers and porters falling into Class 5 have 101 to 109 per cent. (Census of England and Wales 1911, Vol. XIII, Part 2, p. CX.)

While these data demonstrate a marked relation between high social status and low effective fertility, they do not show that low social status and high effective fertility are equally closely connected. For marriages of continuing fertility in 1911, the differences between Classes 3 to 5 are small when amount of marriage is taken into account. For marriages of completed fertility at the same date, Classes 4 and 5 make smaller contributions than Class 3. Marriages of completed fertility, however, mostly date from many years before 1911 and, as we shall see later, the further back in time we go, the less the differences between the classes in respect of fertility seem to be. Therefore these latter figures are not representative of modern conditions and are to be explained as illustrating a period when class differences had not assumed their present intensity. Lastly, these data illustrate the presence of cross-currents. The manual workers in the textile industry (Class 6) who would, if allocated to the first five classes, fall into Classes 3 to 5, make a contribution less than that of Class 2 but greater than that of Class 1.

Turning now to groups of another kind, those distinguished by place of residence, we have the following table:

TABLE II (a).

The Ratios of the Number of Children born and of Children surviving per 100 Couples (wife under forty-five years of age at Census) for Certain Classes of Area and Sections of England and Wales to the Corresponding Figures for the Whole Population taken as 100.

	England						Wales		England and Wales	
	North Children		Midland Children		South Children		Children		Children	
	born	surv.	born	surv.	born	surv.	born	surv.	born	surv.
London . .					99	98				
County boroughs	102	97	102	100	88	90	107	105	101	98
Other urban districts . .	99	97	97	100	89	93	112	109	98	98
Rural districts	107	109	103	109	96	103	110	112	103	108
All areas .	101	98	100	102	95	97	110	109	100	100

(a) Census of England and Wales 1911, Vol. XIV, Part 2, p. CXXII.

This table enables us to compare different regions, the North, Midlands and South of England in the first place, and London, county boroughs (large towns having not less than 50,000 inhabitants), small towns and rural areas in the second place. In addition, since in Wales there is a distinct national group, it enables the only comparison to be made which is possible between such groups in the area under consideration. Using the figures for surviving children as the criterion, three points call for notice. The rural districts make a larger contribution than the urban districts, the Midlands of England than the North or the South, and Wales than England. The superiority of Wales is noticeable for all classes of area.

The remarkable fact, however, is the smallness of the differences. It is possible, it is true, to find much larger differences between small areas as between towns when they are compared

one with another. But these differences are due to factors unconnected with location. Of this one example must suffice. Between 1881 and 1901-3 the standardised birth rate decreased from 35.66 to 23.71 or thirty-four per cent in Burnley, from 32.31 to 26.83 or seventeen per cent in London and from 32.47 to 30.83 or five per cent in Liverpool. The fact that Burnley is a textile town accounts for the difference between Burnley and London. The fact that Liverpool has a large Catholic population accounts for the difference between London and Liverpool. Thus these marked differences between the three towns are at least very largely due to factors other than those arising from differences in respect of location.

The mention of Catholicism directs attention to the problem of the difference between religious groups in respect of fertility. There is no religious census in England and for our information we depend wholly upon unofficial data. These are not satisfactory, but in view of the interest of the matter it may be worth while quoting some information from Catholic sources. The Catholic diocesan returns for 1924 record 67,565 baptisms and 20,398 marriages. The ratio of baptisms to marriages is 3.3 to 1. The ratio of births to marriages for the whole country for the same period was 2.4 to 1. This would seem to suggest that the Catholic birth rate is to the general birth rate as roughly 3.3 to 2.4 (Catholic Directory 1926 P.V.).

Thirdly, we have groups distinguished by what may conveniently be called achievement. Achievement may be positive or negative, meritorious or otherwise. A considerable amount of scattered information exists regarding various groups which come under this heading. A few facts may be quoted regarding mentally defectives as an example of lack of achievement, regarding criminals as an example of non-meritorious achievement and regarding those who perform well in intelligence tests as an example of positive achievement.

There is no information which enables us to compare the contributions of mental defectives as a whole with that of the rest of the population. If we knew how many defectives there were and what proportion of them were segregated, this information would be of some value as an indication of the extent to which reproduction by defectives was rendered impossible. Information of this nature is very incomplete. Taking an average of the more conservative estimates of the incidence of mental defect in England and Wales, we get a ratio of 5 per 1,000. This would give 190,000 defectives. The tendency, however, is to raise the estimate. On January 1st, 1926, 53,664 defectives were being dealt with in one way or another. (12th Annual Report of the Board of Control, pp. 71, 72 and 87.) It may

be assumed that these 53,664 were rendered incapable of reproduction for the time being. It thus seems that, unless those defectives who are not being dealt with are much more fertile than the population as a whole, the entire group of defectives is not making a contribution to the next generation which in proportion to their numbers is equal to that made by the remainder of the population. A small investigation by Dr. Sayer has indeed shown reason to suspect that families from which defectives come are more fertile than other families in the same social grade. But in any case it scarcely seems probable that the rate of contribution of the mentally defectives is larger than that of the rest of the population. The same probably holds good of the criminal class. Dr. Goring made an elaborate study of the records of 3,000 convicts and came to the conclusion that the ratio of the absolute fertility of criminals to the absolute fertility of the general community was roughly as five to eight. (Goring — "The English Convict", 1919, p. 245.)

There are various pieces of evidence bearing upon the contributions of those marked out by the possession of more than average intellectual powers. One of the most recent and most interesting investigations approaches the matter indirectly. Sutherland and Godfrey Thomson worked out the correlation between size of family and intelligence as given by intelligence tests applied to 1,924 elementary school-children in the Isle of Wight. They found a negative correlation of 0.218 (*British Journal of Psychology*, 1926, XVII). Other evidence goes to confirm this result, namely, that the more intelligent parents, intelligence being estimated in various ways, make a somewhat smaller contribution to the next generation than the less intelligent parents.

Some reference may now be made to evidence of changes in the rates of contribution made by various sections of the population. The information gained by the Census of 1911 was used to construct tables for marriages dating from 1851 and onwards similar to that reproduced in Table I for 1911. In general, these data point to the fact that the further back the tables are carried the less evidence there is of class inequality in respect of fertility. Dr. Stevenson suggests that "if the comparison could have been carried twenty years further back, a period of substantial equality between all classes might possibly have been met with". (*Journal of the Royal Statistical Society*, May 1920, p. 417.) With respect to changes now in progress, the following table shows the birth rate per 1,000 married men in the eight social classes for 1911 and 1921.

TABLE III (a).

England and Wales: Legitimate Birth Rates in certain Social Classes, 1911 and 1921.

	1911 Births per 1,000 married men under 55 years of age	1921 Births per 1,000 married men under 55 years of age
1. Upper and middle class . .	119	98
2. Intermediate . .	132	105
3. Skilled workmen .	153	134
4. Intermediate . .	158	153
5. Unskilled workmen .	213	178
6. Textile workers (not incl. above) . .	125	110
7. Miners <i>do.</i>	230	202
8. Agricult. laborers <i>do.</i>	161	155
9. Working classes . .	175	152
All classes	162	141

(a) Figures for 1911 from the Annual Report of the Registrar-General 1912, p. xxiii. Figures for 1921 were supplied by the courtesy of the Registrar-General and are as yet unpublished.

Unfortunately, however, so far as this particular question is concerned, the occupational classification was completely revised in 1921 with the result that the figures for 1911 and 1921 of Table LXXXII are not wholly comparable. In 1911 the

classification was largely industrial whereas in 1921 it was occupational as well as industrial. These changes made possible a more satisfactory allocation of occupations to their several social grades. In consequence, the proportions of occupations falling into the different grades are not the same in 1921 as in 1911. One example of this is that the present Class I now comprises little more than that upper section of the old Class I, to which reference was made on page 134. In spite of these drastic changes in classification, which vitiates comparison between 1911 and 1921 in any detail, certain broad conclusions can be drawn with safety. The fall in birth rate with the rise in social scale which was apparent in 1911 is no less striking in 1921. Also, the fact that in every single class the birth rate is less in 1921 than in 1911 points to the strong probability that this decline is general and not confined to any one section of the population.

We have seen that differences in the rates of contribution to future generations made by different groups at any one time or by the same group at different times are due to differences in the birth rate, the child mortality rate and the amount of marriage. Differences in the birth rate are due to differences in age at marriage and in the number of children born to married women irrespective of age. It can be shown that the latter factor is more important than the former. Thus if we construct an index for the birth rate of England and Wales and put it at 100 for 1921, we find that allowing for age it was 150 and not allowing for age it was 166 in 1871 (Registrar-General's Statistical Review, 1922, p. 139). Thus the greater part of the decline in the birth rate has been due to a decline in the number of children born irrespective of the age of the mother. Again, if instead of taking crude rates for the fertility of the marriages shown in Table I, we allow for later marriage in the higher social grades, we get the following figures for number of children born per 100 families:

Class 1	213	Class 5	317
Class 2	248	Class 6	247
Class 3	278	Class 7	348
Class 4	285	Class 8	320

(Journal of the Royal Statistical Society, May 1920, p. 410.)

The range of variation is somewhat reduced, but the major part of the differences remains.

Differences in the birth rate are more important than differences in amount of marriage or in child mortality so far as contributions to the next generation are concerned. Differences in the number of children born to married women irrespective

of age are of more importance than differences in age at marriage. It can further be shown that many facts support the conclusion that differences in number of children born irrespective of age are due to greater deliberate limitation of families in some groups than in others and that no facts are inexplicable on this hypothesis. The following facts must serve as examples.

1. The decrease in the general birth rate began in 1877 and corresponds in time with the Bradlaugh-Besant propaganda ("The Fruits of Philosophy" was published in 1876).

2. The decline has been most marked in those classes—namely, the higher social grades—most likely to be influenced by the propaganda.

3. Where the birth rate does not increase with decline in social status, as, for instance, among the textile workers, it is noticeable that special circumstances prevail, as for instance in the case of textile workers, the employment of women and their crowding into factories, which would permit and facilitate the spreading of the idea of family limitation. In this connexion it is interesting to observe the superiority of spinners over weavers of cotton in respect of the birth rate which amounts to between eight and nineteen per cent. Spinning is mainly a male and weaving a female occupation. (Census of England and Wales, Vol. XIII, Part 2, p. cxii.)

4. The figures for the Roman Catholic birth rate, for what they are worth, support the same conclusion.

5. When the fertility of wife's age at marriage is examined, it is found to fall for increasing age at marriage in all groups except that of the higher section of Class 1 (chiefly higher professionals) for marriages dating from 1906 to 1911. (Census of England and Wales, Vol. XIII, Part 2, p. lxxxvii.) This remarkable exception to the general rule is explicable on the assumption that very early marriages in this section are especially improvident and demand severe restriction from the first.

6. "The fertility of non-domestic coachmen, grooms, motor-car drivers and gardeners is in all cases definitely higher than that of those following domestic employ". (Census of England and Wales, Vol. XIII, Part 2, p. cx.) It is well known that the possession of a large family is a drawback to those desirous of obtaining and keeping domestic employment and it is reasonable to suppose that the lower fertility of domestic employees is due to deliberate limitation of the size of the family.

We arrive therefore at the conclusion that differential fertility is in the main due to more deliberate family limitation in some classes and groups than in others. It is not known with any precision what part contraception plays in family limitation, though it is obviously of great importance. It only remains to say something about the results of differential fertility.

If groups exhibiting differential fertility are distinguished only by sociological characteristics, the results will not be negligible, though they will not be of the same importance as when the distinctions are biological. Confining what we have to say to biological results, we have to enquire what biological distinctions, if any, exist between the social classes. Many investigations, among which the most extensive are those made on some 13,000 school-children in Northumberland, show that those following different occupations differ significantly though not greatly in respect of that aspect of intelligence that is measured by tests. In general, intelligence declines with descent in the social scale. Thus the Northumberland investigation showed that children of professional parents had an average intelligence quotient of 112.2, of shopkeeping parents an I.Q. of 105, of metal-workers and shipbuilders an I.Q. of 100.9 and of those following low-grade occupations an I.Q. of 96. Putting the results in another way, the children of brain-workers had an average I.Q. of 106.6 and of manual workers an average I.Q. of 98.6. (*British Journal of Psychology*, XIV.) Accepting these differences as at least indications of inborn differences, though admitting that differences in upbringing may not be without influence, it is plain, when we study Table I and the figures as subsequently elaborated, that the best endowed with that aspect of intelligence which is measured by intelligence tests make the smallest proportional contributions to the next generation. This conclusion is borne out by those enquiries which attack the problem directly and aim at measuring the fertility of the more intelligent. When the enquiry is pressed further, it is found that the upper section of Class 1 consisting of those following the higher professional occupations make a markedly smaller contribution than do members of Class 1 as a whole. This section is presumably the most intelligent section of the population.

The converse does not altogether hold true whether we judge by differential class fertility or by the indications gained from a study of mental deficiency. The contributions of Class 4 and 5 are larger but not very much larger than that of Class 3. There is no reason to think that mental defectives are contributing more than their proportion to the next generation. The suggestion, therefore, is that, while differential fertility is acting unfavorably upon that feature of mental endowment that is measured by tests, this result comes about chiefly on account of the small contributions made by the more intelligent.

Intelligence is but a part of mental endowment. But we know nothing regarding the distribution of other mental qualities between the classes. It is true that a case can be built up to show that certain valuable temperamental qualities are prob-

ably found more frequently in the higher than in the lower social grades. On the other hand, this may be countered by arguments tending to show the converse regarding other valuable temperamental qualities. We are almost equally ignorant regarding the endowment of the classes in respect of physique, including all that goes towards providing the foundations of health and vigor. One of the few indications of any importance is derived from measurements of men during the war whose occupations were known. Miners and agricultural laborers came out at the top of the list when those following different occupations were graded in respect of physique. When we remember that miners and agricultural laborers make the largest proportional contributions to future generations, it seems difficult to accept the suggestion that physical endowment is at present unfavorably affected by differential fertility.

Summarizing the position, attention may first be called to the possibility of swift and important biological changes under existing conditions. These conditions are the different rates of contribution by different social classes and groups to the next generation and the fact that men taken individually are found to be very unequally endowed in respect of inborn qualities. These conditions make changes possible. Changes will occur in proportion to the extent to which men are segregated out according to their innate endowments into different classes and groups which reproduce at different rates. Hence arises the urgent need for research in two directions.

We require up-to-date information as to rates of contribution. For this we must rely upon the Government census and registration departments. In England we owe a deep debt of gratitude to the census authorities who prepared the questions in the 1911 Census from the answers to which the valuable figures quoted above were prepared. We may deplore the omission of these questions in the 1921 Census which makes it impossible to bring those figures up to date. Again, we require information concerning the endowment of different groups and here once more we must be dependent upon Government departments, which alone are capable of conducting a census of physical and mental capacities. It is to be hoped that one result of this Conference will be an attempt to persuade Governments to use their powers to gather this indispensable information.

We may then note that existing data, incomplete as they are, afford strong evidence of the unfavorable effect of differential fertility in respect of at least one important quality, namely, intelligence. And, in connexion with this, attention may be called to another feature of modern times. Society is engaged in elaborating and applying mechanisms of various kinds, vocational guidance, for instance, which are intended to sort

out more efficiently than at present persons of different inborn endowments into different classes. This cannot but result in making the effect of differential fertility still more unfavorable.

Lastly, the most important immediate factor in producing differential fertility is found to be the differential use of family limitation. It follows that, if we wish to lessen the gaps between the classes, we must attempt to bring into play, or inhibit as the case may be, those more remote factors which either induce or prevent the employment of family limitation. Among these more remote factors, one of the most important is access to knowledge of effective contraceptive methods.

DIFFERENTIAL INCREASE IN THE POPULATION IN FRANCE AND IN THE WORLD

by

Professor L. MARCH.

[Translation from the French.]

Experiments carried on in one country and the discussions to which they have given rise indicate that the problem of population must be examined from three different points of view, economic, political, and eugenic, each of which, to the far-seeing and disinterested observer, presents a tremendous complexity. And, first of all, the question must be regarded from two different angles, the individual and the collective aspect. The individual aspect is not the least complicated. At times the unit is governed only by his instincts, and nature, therefore adjudged cruel, regulates life by death; so that, with a high mortality which is usually accompanied by much suffering and less degeneration, survival of generations amongst

these purely instinctive creatures, surpasses that of those generations who are the progeny of instinct tempered by intelligence and who have a high social value. But these latter in their turn sometimes condemn themselves to leave no descendants at all in a few generations.

It is a well-known fact that the increase of population is very different in different groups. Further, everyone knows that this increase depends on three factors, natality, mortality, and the balance of migration.

Thus, in a period of about thirty years, from 1870 to 1915, the population of the United States increased by about 140 per cent while that of France grew only by about 10 per cent. The major part of this difference was due to migration, but we find differences of the same order when we consider natality and mortality. It can be roughly judged by comparing the number of births of live children per 10,000 inhabitants during the period 1906 to 1910: in Russia 453, in France 199; the number of deaths for 10,000 inhabitants during the same period: in Russia 285, in France 192, in Denmark 139. And even in the same country striking differences can be seen in comparing regions or groups, but in France certain departments have long been losing their population; the population of regions counting less than 2,000 inhabitants aggregated, represented in the middle of the 19th Century three-quarters of the population — the moment is near when it will represent no more than half. Towns of more than 100,000 inhabitants represented already in the middle of last century eight per cent of the population; now they hold fifteen per cent. Here, again, migratory movements are the chief cause of these changes, for, if natality has any effect at all, it has more a retarding effect, because it is often strikingly higher in the country than in towns.

Migratory movements, we may add, have equally well-known causes; the attraction of new countries, the hope of wealth, the attractions which cities offer; enlarged resources and pleasures over those of the country, the attraction of industrial, commercial or liberal professions, which give more regular and more remunerative employment.

As to differences in natality, these also may be explained by economic reasons, or by environment; a numerous family is a less heavy charge in the country than in towns, and, further, in the country, it often becomes a source of profit by reason of the work which the children can undertake as they grow. Against this, we may note that forethought often acts in a contrary direction. The soil does not produce more in proportion to additional numbers cultivating it, and fear for the children's future may perhaps join with more selfish considerations in

leading to a restriction of births, and this particularly in those districts which are emptying themselves in favor of towns.

At all times, and everywhere, the cost of children and, recently, concern for their future, have been the determining causes in family limitation. What has changed is the mode of limitation — exposure or murder of the new-born is often succeeded by abortion and voluntary contraceptive measures.

This charge is more or less grave, or, at any rate, appears so to interested eyes when we can analyze it by comparing the fertility of marriages. Let us first, for example, consider the French families, of which in 1906 the married head was sixty or sixty-five years of age. In these families the number of children born was 360 per 100 families, taking all categories together; and it was pretty much the same among the employing and upper classes; was over 400 amongst the laborers; and dropped to about 300 amongst the employees.

If we compare persons of independent means with the employing classes, we observe that the former have rather fewer children than the latter, that is, the employing classes have more children than persons of independent means. Further, the employing classes may be differentiated according to professional groups, the industrial group having more children than the agricultural, and these latter more than the commercial, who further surpass in fertility the intellectual and academic professions. Equally interesting distinctions appear when we consider industries or particular regions. Thus, the workmen who have the most numerous families may be found amongst the miners and the textile workers in the northern region, while the home weavers have fewer children. In agriculture, the farm servants have fewer children than the independent laborers; and, naturally, the domestic employees in the towns, whether it be in shops or in personal service, have very few children. Thus, we may generalize by saying that industrial workmen whose work is regular and usually plentiful have many children. Artisans, on the contrary, have few, and individuals whose conditions both of employment and of dwelling are but ill-suited to family life have fewer yet. We see working, therefore, the two factors which determine family limitation and number of descendants, the actual conditions of life and the future of the children.

If the coal-miners in the North and the Pas-de-Calais have many children, it is because, in this industry, laborers are always too few; the father knows full well that his son will never lack work.

Similarly amongst the masters, those who direct large concerns in centres of great expansion as in the North have many children,

for the simple reason that, thanks to their activities, their many relationships, and their capital, they can assure the future of their progeny. Those, on the other hand, in small industries and the small agriculturists are often concerned at the difficulties which they will find in fixing a settlement on their children.

It is sometimes said that natality is governed by the economic considerations of the actual moment. This is quite an incomplete statement. In an enquiry made in 1907 into the families of public servants, it was shown that, all things being equal, the fertility of marriages shrank as the income rose. And the preceding remarks indicate that it is equally superfluous to maintain that the increase of wealth is the cause of infertility. The actual conditions of existence, or the desire to obtain better conditions, the anxiety to leave one's children on the same social level as oneself and to prevent their falling into a lower class, are really what influence parents in regulating the number of their children; and as the mortality of these children is being progressively reduced, thanks to the progress of science and to the rising standard of living which allows of their better treatment, the number of births tends everywhere to drop.

Except in a relatively small number of cases (some bearing witness to an almost heroic self-denial, others, where sometimes alcoholism plays a big part, bearing witness to less noble instincts), one may say that in France, for a considerable time and without any propaganda having been necessary, limitation of families has been general and it is a result of rational forethought.

But reason is not always a sufficient basis. When applied to individual conditions, it may have a result which is contrary to the interest of the whole. Thus for example, certain regions of France are being depopulated, fertile land is abandoned by the natives, sometimes, happily, to the advantage of foreigners. Thus, this limitation may have consequences which become detrimental to the general economic condition of the country, and, furthermore, creates a peril to the national advance, and it may finally even endanger the quality of the race, through an insufficient renewal of the various social strata, and a lowering of the type of future generations. Many thinkers have been struck by this situation. Active propaganda exposes the danger which menaces the group. Legislation has intervened to encourage natality by reducing the financial burden of a family and by proscribing any contraceptive propaganda. And industry has made a magnificent effort to compensate for the cost of a family independently of the salary or wage. The results of this compensation already appear to be appreciable. At the last Congress of the Industrial Unions for family allowances,

figures were brought forward to show that natality in working-class families rose between 1914 and 1926. One big industrial concern — Michelin et Cie., — has published the results of its allowance system. In those districts where its workmen live, they have more children than the other inhabitants and the number of these children grows yearly.

It appears from these observations that the public has a means of safeguarding itself from the peril of depopulation; and this means consists in relieving the charge which a large family imposes on a father by a scale of compensation varying according to the results attained. Thus the whole community corrects that dangerous tendency which is created by individual forethought.

The whole community may here usefully intervene by facilitating the transport of individuals from regions where they are in excess to regions which lack labor, and in fact, each national group is directly interested in putting to the best possible uses all the natural resources of its territory, this full exploitation being the true criterion of a sufficient population. As regards the political aspects of the problem, these interest the nation naturally in a supreme degree. Of what avail are treaties for the material disarmament of peoples if the moral disarmament (which is to a great degree regulated by the pressure of population) cannot be realised?

From time immemorial, when a population could no longer maintain itself at that standard of life which it had attained, its excess numbers have overflowed more or less regularly to regions where an insufficient population invited invasion.

Thus it is easy to see how the resources at the disposal of the community could be used in such a manner as to produce the optimum result. And will not this result be of the highest quality if the mass of each generation is brought up to habits of work and sobriety such as those found in rural conditions, particularly if the social strata is renewed from below?

The community may, on the other hand, foresee better than can individuals the future trend of economic conditions. If economic conditions at any given moment permit families to bear certain costs or, on the other hand, cause them to avoid these costs, it is only in fifteen years or so that the excess or insufficiency of the population will be perceived. The chances of expansion abroad have an importance which usually is unperceived by individuals, particularly when countries with insufficiently developed territories shut their doors for fear of competition. Does not enlightened intervention of the community, in encouraging but not restricting natality (presumably tending of itself to become more widespread) in some measure tend to conform to the formula of Wells, "Materiunity is a social

function" ? If the artificial costs of maternity are removed, at least for the greater number, as William Morris dreamed, although this formula apparently fails to recognize the depth and importance of family feelings, we may note nevertheless that evolution has been tending generally in this direction in a number of countries within the last thirty years.

It must be well understood that the community may refuse its help to individuals marred by bad habits, who are an evident danger. However, we should not be able to move very far in this direction in our present state of knowledge, and we must not forget that Nature takes care of the elimination of defect. Those who contest this are reduced to cite frequently one and the same family as example.

We have yet to examine the possibility of international agreements analogous to those which we foresee in a more or less distant future on questions of less difficulty, those concerning the distribution of the natural resources of the globe, the exchange of products, that is, material disarmament. Possibly from this present Conference there may appear a practical outcome in this direction. At any rate, we may hope that, in those treaties destined to consolidate universal peace, not only will the population problem not be neglected so as to keep in view its needs, but also that full regard may be had for the total increase of population as related to the increase of wealth. Besides the material factors of power, defensive or aggressive, of nations, the human factor has always played an important part, and this rôle will not decrease in importance.

Finally, the problem of population should be studied from the international point of view, as well as from the national and humane point of view. Limitation of births seems the more legitimate in that the fall in mortality makes possible the same population with a lower birth rate. But the four means of this limitation, murder, abortion, sterilization (temporary or permanent) and moral restraint conform in very different fashion to the ideal which makes the strength of civilization. And further, the control of this limitation should never be taken out of the hands of the political and spiritual authorities whose duty it is to prevent excess or insufficiency apart from any aggressive intentions towards the outside world.

DIFFERENTIAL BIRTH RATE IN GERMANY

by

Professor A. GROTJAHN.

During the 19th Century, those countries which subsequently formed the German Empire had an average of live births of thirty-seven to forty per 1,000, and even after the formation of the Empire, this high birth rate was maintained up to the year 1885. From this time on, it fell steadily. In 1890 it was 35.7, 1900 35.6, 1905 33.0, 1910 29.8, 1914 26.8, 1920 25.7, 1925 20.5.

Great differences are to be seen in different parts of the country, depending on whether an urban or rural population dominates. High mortality is no longer the cause which prevents the urban population from growing by family increase, but rather this must be assigned to the spread of methods of birth prevention. These at the present moment are particularly widespread in the large cities. Thus, the forty-six greatest cities of the German Empire had: live births, only 14.2 and in particular Hamburg, thirteen as against ten in the four-million city of Berlin.

In certain areas of Germany, very great differences may be noted, corresponding to the preponderance of an urban or rural population. According to the Statistical Year Book of the German State (1923), the births per 1,000 inhabitants in 1921 were :

Province of East Prussia	29.6
Berlin	14.0
Province of Brandenburg	23.0
" " Pomerania	27.6
" " Posen - West Prussia	27.1
" " Lower Silesia	28.3
" " Upper Silesia	34.6
" " Saxony	27.1
" " Schleswig-Holstein	22.7
" " Hanover	24.0
" " Westphalia	28.6
" " Hessen-Nassau	23.0
" " Rhine	25.5
Hohenzollern	23.6

Bavaria	27.0
Bavarian Pfalz	26.5
Prussia	25.5
Bavaria	27.0
Saxony	23.4
Württemberg	23.6
Baden	26.0
Thüringia	26.6
Hesse	23.4
Hamburg	18.3
Mecklenburg-Schwerin	27.5
Oldenburg	26.8
Brunswick	23.2
Anhalt	25.9
Bremen	22.3
Lippe	23.7
Lubeck	21.3
Mecklenburg-Strelitz	27.5
Waldeck	20.7
Schaumburg-Lippe	21.2

We may further gather from these statistics that the Catholic population is increasing more rapidly at the moment than the Protestant, but it is questionable whether this condition may be regarded as permanent or whether the difference is only one of time in an irrevocable development. For the number of children is falling even amongst the Catholics, namely, in the urban well-to-do strata of the population.

According to Krose¹, the legitimate births, after marriage, were as follows:

	1891-1895	1913
Wholly Catholic marriages	5.2	4.7
„ Protestant marriages	4.2	2.9
„ Jewish marriages	3.3	2.2

This demonstrates the higher fertility of the Catholics.

In the later figures collected by F. Lenz², who divides the number of births by the marriages of the previous year, this is already changing. He finds that, in Bavaria, this same order recurred:

	1913	1920
Wholly Catholic marriages	4.0	2.0
„ Protestant marriages	3.0	1.6
„ Jewish marriages	1.8	1.0

¹ H. KROSE, "Geburtenrückgang und Konfession." Aus *Des deutschen Volkes Wille zum Leben*, herausg. von Fassbender, 1916. Freiburg, 1917.

² F. LENZ, *Menschliche Auslese und Rassenhygiene*. München, 1923. p. 117.

These figures show clearly that the fall in the birth rate is not stopping at the Catholics. It only falls somewhat later, and not as rapidly as in the Protestant and Jewish population.

The influence of the loss of faith of the fathers, on the number of children, is manifested especially amongst the emancipated Western Jews, whose birth rate has dropped in striking contrast with the fertility of the devout Eastern Jews. Nevertheless, the birth rate of the Prussian Jews dropped — according to F. Theilhaber¹ — from 5.2 per marriage, in 1820-30, to 2.4 in the years 1906-08, and while in the year 1875, the births per 1,000 Jews were still thirty-two, they had sunk in 1920 to seventeen, thus being reduced by almost half in a few years.

We are accustomed to compare the quantitative reproduction of different strata of the population, thus: We say that one stratum increases more than another. This mode of expression is confusing. We should say, one decreases its number per family less than another. For our criterion can only be the natural fertility. This might be eight or ten children per marriage. If, however, we analyze the average number of children per family of which certain strata of population are composed, we find much lower values. Thus, we have not to establish by how much one stratum increases beyond another, but rather *where it has fallen more or less with the general diminution of births*. This is true of those countries which, as in the area of Western European civilization, have adopted the limitation of families by preventive methods. Here we have in Germany most decided evidence that the upper strata have less children than the lower, intellectual professions less than others, well-to-do classes less than the poor, the urban less than the rural. A well-known phenomenon is the disappearance of the aristocracy. According to H. Kleine², in the year 1870, for 2,062 married Counts there were not less than 704 who remained single up to thirty-six years of age, and the genealogist Kekule von Stradonitz estimates the number of the knightly houses of Germany in the year 1200 at about 20,000, of which only about 800 now remain, but this is not only a phenomenon of the aristocracy, but indeed of every part of the population which rises above the general level, up to the superior or leading classes. We have no exact figures for the number of descendants of married officers, but even without these it may safely be stated that in the German Empire alone in the pre-war time, about 40,000 men, selected for fine physical development, showed underfertility, that is, their marriages did not reach an average of three children.

¹ F. THEILHABER, *Der Untergang der deutschen Juden*. 2. Aufl. Berlin. 1921.

² H. KLEINE, *Der Verfall der Adelsgeschlechter*. 3. Aufl. Leipzig. 1882.

The class of officials can be numerically studied more clearly than that of officers, and here again we have a group of the population in which countless particularly robust individuals grow up to end as single or childless men. In 1913, out of 22,264 of the higher State officials of Prussia, not less than seventy per cent were underfertile, that is, had less than three children per marriage. There were 4,778, that is, 21.5 per cent single, 2,994 childless, 3,258 only had one child, 4,694 only two children.

Ninety-two thousand teachers of Prussia had, in the year 1911, all told, only 159,000 children. According to a calculation of the German Postal officials in 1912, amongst the higher grades 19.3 were single, 19.1 childless, 27 per cent had one child, 29.7 per cent two children. Amongst the higher grades who had attained the ages of fifty-five to sixty there was an average of only 2.2 children.

The data regarding the families of the Bavarian officials in 1916 showed for the higher officials 1.9 children, and for each official who attained the years sixty to sixty-four, two to three children. But this want of numerical strength is not limited to officialdom, it exists also amongst the middle officials. From the above-mentioned investigation we learn further that in 1912, of the middle ranks of Post Office officials 17.7 per cent were childless, 28 per cent had one child only, 27.4 per cent only two children, while, taking the ages fifty-five to sixty, those in rank of middle posts had only an average number of children of 2.6 per marriage. Also, amongst the Bavarian officials of middle rank, the figures for the year 1917 gave only two children for each married official, and for each married official of sixty to sixty-four years, 2.7 children. Even the large group of employees whose position is similar to that of an official shares with these ranks of officials this character of childlessness. Before the war, in calculating insurance of these employees, only 354,000 children under eighteen years of age were found amongst 430,000 holding salaried positions.

According to the Bavarian family statistics¹ for officials, July 1st, 1916, from a total of 76,055 officials there were:

	Single	Childless	With children			
			1	2	3	4 and more
Lower officials	8.8	10.3	16.5	18.6	14.8	31.0
Middle officials	13.4	15.1	22.8	22.3	13.2	13.2
Higher officials	19.9	15.9	19.5	22.1	12.3	10.3
Total	11.1	11.9	18.1	19.7	14.2	25.0

¹ Veröffentlicht in Heft 88 der "Beiträge zur Statistik Bayerns", München, 1918. Statistisches Jahrbuch für das Deutsche Reich 1926.

Thus there was on the average for each official 2.4 children, amongst the lower 2.7, the middle group 1.7, and the highest 1.5.

In an estimate made for the Government in 1926, there was found an average of only 1.17 children to each official, that is, amongst the lower 1.2, amongst the higher 1.15, and the highest 1.02.

A register of births according to professions or social status is only undertaken in a few States in Germany. The best and most recent of these censuses was arranged recently in Bremen¹.

	1901		1925	
	Number of inhabitants	Births per 100 inhabitants	Number of inhabitants	Births per 100 inhabitants
Wealthy districts .	8,952	1.27	17,584	1.47
Middle class districts .	24,303	2.89	36,526	1.42
Artizan zone	12,386	4.37	23,507	1.95
Mainly laboring population	11,636	4.62	9,779	1.89

• An occupational census, for Bremen¹, grouped professional people, independent merchants, artisans and business people, chief officials, physicians, and so on: this showed per 100 individuals 2.59 births in the year 1901, 1.58 in the year 1925. Amongst the officials 2.47 in 1901, 1.49 in the year 1925, and amongst the laborers 3.98 in 1901, 1.81 in 1925.

A trade census undertaken in 1926 showed, amongst the textile and woodworkers in Gera, for all marriages, only 2.3 living children. The woodworkers in Dresden showed 2.1, metalworkers in Dresden only came up to two.

These numbers demonstrate clearly, first, the general steep decline of the birth rate and then the remarkable fact that even the laboring classes, who were called the proletariat because of their productivity, in towns have now just as few children

¹ W. RÖHMERT, 100 Jahre Geburtsstatistik in Bremen. Mitteilungen des statistischen Landesamtes Bremen im Jahre 1926. No. 3.

as the upper strata, because the custom of contraception has spread here also. This fall in the birth rate, even in the proletariat, is a new thing in the history of the world. For in future the upper ranks will no longer be able to recruit their number from the lower grades as heretofore.

The present low mortality tends to the misleading assumption that the numbers of the German nation are still increasing, as there is a difference between births and deaths which, in the year 1924 (with a birth rate of 20.4 live births and a mortality of 12.9 per 1,000 of the population) reaches the figure of 7.5. But this fluctuating population balance is mainly due to paradoxical mortality, not to any satisfactory level of births, of which the downward tendency has not yet become stationary.

It is necessary, in order to get a clear view of the great significance of these figures, to realize what a live birth rate of twenty means for a population. In Germany the average expectation of life was about fifty years in the pre-war years: there would then in an imaginary static population of normal ages be twenty deaths per 1,000 population, which therefore requires for replacement twenty live births. In other words, a birth rate of twenty signifies neither more nor less than the number below which a population of normal age groups may not sink without decreasing. It is important to remember this lest a mortality below twenty should deceive us into neglecting the danger to the stability of the population.

Thus we have already reached in Germany this figure of twenty, which is the lowest for numerical stability. It is, however, more than likely that the drop in the birth rate will not stop at this point; for the population of the large cities has already reached a lower figure, and it is the urban group that leads. Sooner or later the same condition will be reached, at least approximately reached, by the whole nation. It may be a matter of dispute whether the growth of the population is desirable or not. We shall, at least, reach unanimity on the point that it must not shrink. Low population in any country is always a serious condition, particularly because the quality of a population is wont to suffer by fall in quantity. Now, we must beware and, in spite of the tremendous burdens which the war has laid upon us, make possible to every married couple by means of economic insurance of parenthood that they shall fulfil their reproductive duties.

Such material assistance can be obtained by measures both partial and national. Amongst the former may be included taking the number of children into account in the many social and commercial welfare systems. Amongst the more important and really effective methods is that of consideration of family status in the calculation of salaries for employees of all regularly

salaries professions, that is, amongst the officials, managers, and workpeople in positions comparable to that of officials. The official's salary is wont to begin low and only to rise gradually as years go on, so that the official only reaches a satisfactory income at the age when reproductive impulse is no longer an urge. The widely extended officialdom of Germany in its present far-reaching regulation of appointments and pay represents a distinctly dysgenic institution, as it prevents from sufficient reproduction just those persons, male and female, who, by medical examination and standardized tests, have been carefully selected. If one imagines this process to go on working for some hundreds of years, it is quite obvious that it cannot but have disastrous effects on the quality of the total population. Wise insight and goodwill, with full recognition of these factors, could, without great difficulty, so rearrange the stipends that marriage and the birth of each child brought a financial advance which would be withheld from those in the same rank and the same period of service who were single or childless. This need entail no further financial burden for, from the same sum expended on wages, those with many children would draw more at the expense of the single and the childless.

The stratum of day laborers is, however, much greater than that of the salary earners. Here parenthood insurance or child endowment insurance is to be recommended. The cost for this should not be drawn from taxation, but from contributions from the single and the childless. It would be quite easy, technically, to carry out this insurance of parenthood as it is far less complicated than, for instance, sickness and accident insurance. Every single person should pay the full insurance, the childless married men should pay three-quarters, the father of one child a-half, and those with two children one-quarter of the contributions. From the third child onwards, no contribution would be payable, and after the fourth the family man would receive a contribution towards the maintenance of his child from the parenthood insurance. Such a parenthood insurance system, taking its place as a legal link connecting other types of insurance, can make it possible for us, without further trouble, to combine medical and hygienic services with wealth-earning capacity, as is now regularly done in the German Sickness, Accident and Disablement Insurance. A small *pro rata* sum would suffice, for example, for the establishment of special institutes, in particular a careful eugenic consultation bureau in which all difficulties of sex and of the reproductive side of married life could be dealt with. The payment of salaries on a family basis for the salaried groups and obligatory parenthood insurance for the rest of the community are, in fact, the most important means for the economic encouragement of

parenthood now to hand or upholding a eugenic population policy and diminishing the dysgenic action in human reproduction, of economic modes of thought founded on private capital. It would, in fact, reverse this.

Not only Germany, but all peoples comprehended in the ambit of Western European culture, including North America and Australia, must take account of the conception that they have entered upon the transition period from the intensive to the rational type of reproduction. The important point will be to secure that this transition period does not end in a decrease of births, but in a regulation of births. Such a regulation must aim not only at the elimination of the unfit, but in the conservation of the hale and competent, resulting in an increasing reproductivity of these latter. Regulation requires, however, a rule of its own; for this reason the author of this paper promulgated one already some years ago. This may be here given without alteration, since, so far as he is aware, neither criticism nor experiment has yet been brought forward which would induce him to alter it. This rule introduces the economic encouragement of those parents who rise above the lowest levels; for it is not the minimum requirements, but the superior performance of numerous healthy parents which now requires moral and material recognition on the part of society.¹

A general regard for this rule would certainly afford the necessary birth increase and make possible the lifting of parenthood on to a rational basis and general eugenic practice.

It is as follows:

1. Every married couple is in duty bound to bring up a minimum of three children above the fifth year.
2. This minimum must be aimed at wherever the situation of the parents gives expectation of descendants not falling below an irreducible minimum standard. In this case, however, the minimum must not be exceeded.
3. Every married couple characterized by particular virility should have the right to double the minimum, and should receive for every child in excess material contributions which would be exacted from the single and those couples which for any reason whatsoever remain behind the lowest number.

If by this or any similar rule the numerical stability of the population has been safeguarded and the general quality raised, rational use of preventive measures may then follow undisturbed, and manifest its wide-reaching beneficent action in different

¹ A. GROTHJAHN. *Soziale Pathologie*, Berlin, 1912, 1. Aufl., p. 674.

ways¹. Thus, at last, a reasonable period between births would become customary. Then we should bring to an end the stupid fertility in those strata which have least means, room, or time, for the upbringing of their offspring. Physicians will then be able for eugenic reasons to forbid further pregnancy as readily for eugenic as for any therapeutic reason, and then at last will be realized that complete separation of intercourse with desire for procreation from intercourse in and for itself, which alone will bring complete cleansing sanity of sexual life.

¹ A. GROTHJAHN, *Hygiene der menschlichen Fortpflanzung, Versuch einer praktischen Eugenik*. Berlin, 1926, pp. 3. Lede.

SOME ITALIAN ENQUIRIES INTO DIFFERENTIAL REPRODUCTIVITY

by

Professor C. GINI.

The question of differential fertility, or rather, reproductivity, has been, for about the last twenty years, the subject of many enquiries in Italy, especially by the author of this paper, the results of which have appeared in a number of publications¹. It may therefore be of interest to the Conference to have them summarized here.

First of all, I wish to state that by differential reproductivity I mean that there are several groups of the existing population which contribute in varying degree to the population of the future generation.

Differences in reproductivity may depend on differences in the death rate, the marriage rate, or in the fertility of

¹ A list of publications is given in the bibliography, to which the reader is referred in the text of this paper by a reference to the respective number.

the population, so that it seems to me preferable to use the expression "differential reproductivity" rather than "differential fertility", which is more appropriately used to designate one of the component elements of differential reproductivity.

Of course, differences in reproductivity will show very different results according to the methods used in forming the population groups between which comparisons are drawn.

It is therefore important to determine first of all the maximum which may be attained by differential reproductivity, or, in other words, the differential reproductivity which results when the several groups are classified according to the degree in which each contributes to the following generation.

An examination of the statistics of the several countries shows, in this connexion, that, of the persons who die, from two-fifths to two-thirds, according to the period and the country, were unmarried; of the married, from one-third to one-seventh die without leaving descendants, so that the following generation is not the product of the whole of the present generation but only of a fraction thereof, varying, roughly speaking, from one-half to two-ninths. The components of this fraction in their turn contribute in very varying degrees to the production of the next generation. Allowing for slight variations from country to country, it may be said that one-half of the next generation is derived from approximately thirty per cent of the married people who leave children, and that three-quarters of the next generation are derived from sixty per cent of the said married people. We may therefore conclude that one-half of the next generation descends from a very small fraction, varying from one-seventh to one-fifteenth of the present generation, and that a large majority, *i.e.*, three-fourths of the next generation descend from a fraction, also relatively small, varying between one-third and one-eighth of the present generation. (Cf. 4, 5, 8.)

Another fundamental point in this matter is that, through the effects of heredity, the components of the next generation, inasmuch as a majority of them descend from members of the preceding generation endowed with reproductive power above the average, ought to possess average reproductive power superior to that of the preceding generation. And this average reproductive power ought to be intensified from generation to generation, tending to attain that degree of reproductive power which represented the maximum for the generation first considered. (Cf. 3.)

If we grant that individual reproductive power can be transmitted and if we indicate by x the intensity of that power, and by $\frac{F}{x}$ the number of persons possessing an x reproductive power,

the average reproductive power of the n th generation would be represented by the expression

$$\frac{\sum Fx x^n}{\sum Fx x^{n-1}}$$

Now the above expression is nothing more than a well-known general formula of the average, and it is also known that its value increases with the growth of n , and has for its limit the maximum value of x .

The fact that reproductive power is not fully transmitted only implies that the tendency to increase will be less rapid; but if it is transmitted in some degree the tendency to an increase will inevitably exist.

What is said in general of the power of reproduction, resulting from survival, from the marriage rate, and from married fertility, could be repeated in the same terms for each of these components, and more especially therefore for married fertility.

In other words, as a result of heredity, there should be a tendency for the number of children per marriage to increase steadily with time. But as nothing of the sort has ever been observed, we must come to the conclusion that the above tendency due to heredity is offset by some factor acting in a contrary sense. It is difficult to admit, in view of the universal character of the phenomenon, that this factor can be one of environment, and it would seem more natural to consider it as a factor of an internal character.

These observations have a general bearing inasmuch as they are applicable, not only to the human family, but also to all other animal and vegetable species, and they confer verisimilitude to the idea that the numerical equilibrium of living species is the result of two forces or groups of forces acting in opposite directions, one of which, resulting from heredity, would drive reproductive power to increase indefinitely, while the other exercises an influence in the opposite direction.

This conclusion is important inasmuch as it runs counter to the widespread idea that, if the reproductivity of peoples shows variations in time, these must be ascribed essentially to environmental conditions, while the internal factors would tend to maintain the reproductive power constant. It would, on the contrary, indicate that variations in reproductive power may very well depend on the prevalence of one internal factor or group of factors over another.

Turning from these general considerations to the special consideration of the several human races at the present time, let us see which are the groups of population in which we meet with a systematic differentiation of reproductivity.

One of the first distinctions to which the attention of students has been called is that of the classification of population into groups distinguished as urban or rural. It is well known that the ratio between the birth and the death rate in cities does not afford an accurate idea of the reproductive power of town populations, as immigration leads to an age composition particularly favorable to natural increase, as such urban groups are rich in adult members who give a larger contribution to the birth than to the death rate. (Cf. 2.) This difficulty can be eliminated to some extent by the method of "standard population", which enables us to determine what the general birth and death rates would be for a population if the special birth and death rates for the several age groups remained what we see them to be, but if the composition of the population as regards age was that of the population taken as "standard".

This method applied to the Italian cities of Rome, Palermo, Naples, Milan, Genoa, and Turin has given the following results: while the natural increase of the population resulting from the difference between observed birth and death rate amounted respectively in 1926 to 10.2; 8.5; 5.8; 1.5; 0.0; -2.5 per cent, if the population of these cities were composed of age groups similar to those existing for the Kingdom as a whole, the difference would be as follows: 9.1; 8.0; 10.1; -3.0; -1.8; -7.3. As these figures show, the results are very different and, with the exception of Naples, when the disturbing age factor is eliminated, the growth of population is always smaller and in two cases (Milan and Genoa) it is converted from zero or a positive quantity into a negative quantity.

This method is, however, subject to the drawback that the coefficients of death and birth rates for the several age groups of population are established for the whole population of the cities. Now, this population comes in part from the country and its demographic characteristics may differ from those of persons born in towns. (Cf. 2.)

The same objection holds good for the method which tends to determine the growth or decline of city populations by basing its calculations on tables of mortality, nuptiality, and natality, as these, in practice, can only be drawn up for the total inhabitants of a city. In Italy, such a calculation was made for Milan, and it led to the conclusion that, if the population were not fed by immigration, the death rate would exceed the birth rate by about one-fifth (cf. 18), a conclusion which agrees with that arrived at for the same city by using the method of standard population (birth rate 13.8 per cent, death rate 16.8 per cent).

Another classification of the population frequently used when examining differential reproductivity is that by social classes;

indeed, it is of preeminent interest as discussion on differential reproductivity refers essentially to the differential reproductivity of the several social classes.

The studies made in Italy in this field confirm the lower reproductivity of the upper classes.

The classification of the population into lower and upper classes is made on the basis of various circumstances, the chief of which are birth, wealth, culture. The influence of each of these has been studied separately.

As regards birth, Prof. Savorgnan has ascertained the number of births resulting from marriages in the royal families of Europe and in the princely and ducal families of Germany, France and Belgium, England, Scotland and Ireland, obtaining averages which can be said to be always lower than those for the population as a whole. (Cf. 14, 15, 16, 17.)

Numerous and important studies have been made on differential reproductivity according to wealth (cf. 2, 5, 7), leading to the following conclusions:

In France, Belgium, Italy, and Finland, persons dying without direct heirs are, on the average, richer than those who leave them.

In Italy, Belgium, and Finland (this is not evident for Holland), the percentage of inheritances and the value of property transmitted in the direct line declines as the value of the property increases.

In France, it is, on the average, the less wealthy property owners who leave the larger families.

In Italy and in France, figures show that married property owners have smaller families than the married population taken as a whole.

If the property-owning population were not increased by additions from the non-property-owning, its ratio to the population as a whole would decline in Italy, and it would decline, even absolutely, in France.

In Austria, the percentage of inheritances transmitted within the family group is lower in the richer provinces.

In France, the fertility of married property-owners declines and their numerical reduction rises as the average *per capita* wealth of the Department increases.

In Budapest, the birth rate for the landowning class falls almost one-third below the death rate.

In Italy, data show that the wealthier districts are those in which the natural rate of increase is lowest.

In Prussia, Denmark, and Norway, the number of children per married person falls, and the percentage of childless marriages

increases, from a certain income upwards. The income with which this decline starts may be described as low, and it would of course be still lower if the age factor were eliminated, as in many cases the fact that persons with small incomes have a small number of children must be attributed to their youth.

Danish statistics also show that the number of children is affected not only by wealth but also by social position, in the sense that in those professions in which the degree of culture is generally higher and which call for a greater exercise of the intellectual faculties, the number of children is smaller, even when the property owned is much less. (*Cf.* 7.)

This leads us to speak of the differential reproductivity of population groups classified according to professions. The smaller rate of natural increase of the intellectual classes as compared with manual workers is shown in all countries for which data exist (Hungary, Croatia and Slovenia, Saxe-Meiningen, France, New South Wales), but the differences vary greatly from one country to another. (*Cf.* 2, 5, 6, 7.)

The number of children and the rate of natural increase are particularly low in the higher liberal professions (Prussia, Sweden, Hungary, Croatia, and Slavonia) and they fall to a minimum in the case of illustrious men. (*Cf.* 2, 5.)

But in all these cases it is evident that several causes are at work; for instance, the influence of urbanism is coupled with that of social position, inasmuch as the wealthy, intellectual, and noble classes live more frequently in cities than in the country.

Therefore special interest attaches to the comparison (not exempt, however, from disturbing factors) between the rate of natural increase in different districts of a town classified according to their economic status.

Enquiries made in Vienna, Berlin, Hamburg, Munich, Dresden, Budapest, London, Paris, Madrid, Lausanne, Magdeburg (*cf.* 2), Florence (*cf.* 20 and 21), and Trieste all agree in showing a regular decline in the natural rate of increase with the growth of wealth.

Many of the enquiries above mentioned refer to different times (*cf.* 7).

Thanks to them, we see that in France, Belgium and Italy the percentage of inheritances transmitted within the family circle, apart from the influence exercised by legislation, declines progressively.

In Italy, indications have been found which make us think that as time goes by the difference in the frequency with which property is transmitted in the direct line in the case of the wealthier and the less wealthy is increasing.

In Denmark likewise, the difference between the average number of children for the several professional classes is increasing.

The intensification of these differences may plausibly be attributed in part to the growth of urbanism. But in some countries at least, as for instance in Denmark, the phenomenon seems to occur both in the cities and in the country. (*Cf.* 7.)

In most of the cities above mentioned, for which enquiries were made into the natural increase of the population in the several districts, it has not been possible to detect a clear tendency of the differences between the several districts to increase or decrease with time (*cf.* 2). But it may be that this depends on the fact that the differences between the conditions of life in the several districts have gradually decreased in the course of time as a result, for instance, of the clearing-up of slums which has been undertaken in many cities.

Moreover, it seems natural, and the available statistical data confirm it, that the differential reproductivity of the several social classes becomes more noticeable as the differentiation between the said classes becomes more marked, either as regards wealth or culture (*cf.* 5, 8, 10). Even if the differences between the several social classes were to remain stationary and if the differences in reproductivity which occur among them did not vary, the fact that the percentage of the population belonging to the upper classes increases is a circumstance which enlarges the bearing of differential reproductivity.

Another classification of the population for the purpose of studying differential reproductivity is that by individual characteristics. Mistaken methods of calculation had led to the opinion that some classes of physical, mental, or moral defectives (consumptives, criminals, the insane) had a distinctly higher average number of children than the normal (*cf.* 5 and 6). Enquiries made on the basis of ample data drawn from official statistics of New South Wales have made it possible to ascertain that in the case of consumptives, suicides, and the insane (individuals, therefore, physically, intellectually, or morally weak and degenerate) the average number of children born and of children surviving their parents is distinctly below that for the total number of deceased married people. On the other hand, persons dying of cancer or heart disease — who have outlived the dangers which threaten the lives of young persons and those in early mature life, and whose length of life has been indeed above the average — leave behind them a number of children above the average. (*Cf.* 6.)

Another circumstance which is found to exercise a distinct influence on reproductivity is the age at which the woman

marries. The younger a woman marries the longer is the average duration of life after marriage. Nevertheless, the percentage of children who predecease their mother both in New South Wales and in Budapest increases as the age of the mother at the time of the marriage increases. And the difference is seen to be still more regular and marked if, as it was possible to do for Budapest, the influence of the age of the father at the time of marriage is eliminated. The fact is probably due, not to the direct influence exercised by the age of the woman at the time of marriage, but to the indirect influence which this exercises on the period of highest reproductivity. Indeed, it would seem that the children of very young mothers generally present less favorable physical characteristics than those born of women from twenty to thirty years of age; but it is precisely in this period, most favorable to the lease of life of the child, that women who have married very young generate most of their children, whereas women who marry between the ages of twenty and thirty will more often become mothers at an age in which the physiological decadence of their organism is already marked. (*Cf.* 6.)

Notable differences in reproductivity occur in the several races, and for some of them it is possible to follow the effects over a period of centuries.

It is calculated that, at the beginning of 300 A.D., the ratio of Latins to Germans was as 2 to 1, and to Slavs as 3 to 1. After seven or eight generations, towards the middle of the 16th Century, the ratio of Latins to Germans was as 3 to 2 and to Slavs as 2 to 1. When a like number of generations had succeeded each other, at the beginning of the 19th Century, 60 million Latins were still slightly in excess of 54 million Germans, who in their turn still kept ahead of 50 million Slavs. At the beginning of this century, the scale had already been reversed, as it was estimated that there were 127 to 130 million Slavs as compared with 124-126 million Germans and 106-114 million Latins, and since then the difference has probably become still more marked. (*Cf.* 8.) And it should be noted that in all times there has been assimilation, more especially of Germans by Latins and of Slavs by Germans and Latins, which has certainly contributed to attenuate the effects of differential reproductivity.

But this phenomenon certainly dates further back than 300 A.D. and is not limited to the three races we have mentioned.

Notable differences in reproductive aptitude also exist within each of the three groups: Latins, Germans and Slavs (*cf.* 5, 8, 10).

The studies which the Institute of Statistics and Political Economy of the Rome University is making on so-called primitive populations reveal the fact that many of them are decadent populations from the point of view of reproductivity, who have

gradually had to give way before populations endowed with a higher natural rate of increase. Undoubtedly contact and conflicts with European populations have in many cases hastened or determined the reduction and disappearance of such populations, but for many of them it is now clearly established that demographic decadence was already manifest before they came into contact with the whites. (*Cf.* 10 and 12.)

The consequences of the diverse reproductivity of the several populations and classes of population are of incalculable importance. They lead to a constant substitution of racial and social elements in the course of generations, so that, apart from all external influences of environment and selection, the population of the world, and that of particular nations, may gradually undergo a radical change in their physical, intellectual and moral characteristics (*cf.* 1, 2, 4, 5, 7, 8, 10, 13). But it is no less important to have ascertained the fact that, within the several populations, the intensity of differential reproductivity, and of the social changes to which it gives rise, varies systematically with the several stages in the life of the nation, which they in part determine, while in part they are themselves influenced thereby, thus constituting one of the most important factors of the evolution of nations (*cf.* 4, 5, 8, 10).

Differential reproductivity is generally ascribed to environmental factors, such as wealth, intellectual development, the comforts of life, the growing rationalization of human conduct, and we cannot deny the influence of these factors. Undoubtedly the conveniences of life and intellectual activities detract from the importance of genetic instincts, affording other pleasures than those of the satisfaction of such instincts, and probably also weakening them (*cf.* 1). It is also certain that the limitation of families is still more important as a means to improving their material conditions and therefore has greater hold on parents as their wealth increases (*cf.* 10 and 11). But it is very uncertain whether these factors should be considered as the most important, and it cannot be excluded that the fact that they assume importance depends on a weakening of the genetic instinct, the first symptom of a weakening of the reproductive power (*cf.* 1, 6, 12).

The universality of the phenomenon, which seems to occur in all ages, runs counter to the environment explanation. If indeed at certain periods, such as the first half of the 19th Century in England, differential reproductivity seems to have been very slight, that may be plausibly explained by exceptional conditions, such as, in the case of England, by the growth of big industry which made conditions unusually favorable to the reproductivity of the middle classes and at the same time very

unfavorable, owing to the high death-rate, to that of the working classes (*cf.* 1, 8, 10, 13).

The low fertility of reigning families is, moreover, in marked contrast with the attempt to explain the phenomenon by the voluntary limitation of families, while many other phenomena such as the more frequent sterility of the upper classes, the not lower frequency of still-births among them, and that in spite of better hygienic conditions and more rapid and skilful obstetrical assistance, the frequent inability of the mothers to nurse their babies, the widespread phenomenon of acute suffering in child-birth, the greater frequency of sexual perversions, are all facts which seem to point to the biological substratum of the differential fertility of the several social classes (*cf.* 1, 6, 10, 12).

If we turn our attention from the consideration of social classes to that of races, the attempt to ascribe differential reproductivity, as many do, to voluntary factors determined by environmental conditions, is in marked contrast with the demographic decadence of primitive populations on whom such circumstances could certainly have no hold.

Moreover, the idea that the different degrees of reproductivity depend on internal factors is much less difficult to accept when we reflect that, as we mentioned at the start, the numerical equilibrium of populations can only be explained as the result of certain internal forces which tend to increase it and of certain other internal forces which tend to lower it. For it then seems quite natural that at one period one category of forces may prevail and another category in another period, as happens in the growth of an organism. That the forces which tend to lower the population consist in a gradual loss of reproductive power will not seem strange to those who reflect that the gradual loss of reproductive power is a general characteristic of somatic cells, the original formation of which is not different from that of the germinal cells. It would therefore seem natural that they also should follow a similar curve, even though at a much slower rate, due to their being much less exposed to the differential action of the environment. The theory that the quantitative evolution of species and of populations is brought about essentially by internal forces is quite consonant with the theories, to which few biologists would now deny some foundation, that internal forces direct the qualitative evolution of the species (*cf.* 6, 9, 10, 12) and it affords a general explanation of the well-known phenomenon, brought to light by paleontology, of the disappearance of species and groups which were widespread and often predominant during a given geological period (*cf.* 10 and 12).

In addition to the internal factors, there are certainly selective factors consequent on one-sided matrimonial selection, prevailing among many peoples, based on the personal attractions of the woman (*cf.* 9), or even on a positive counter-selection from the point of view of reproductive aptitude, in the case of those peoples with whom it is customary to give a dowry to the daughters, which dowry becomes a leading factor in influencing a man in the selection of a wife (*cf.* 13).

Those who ascribe the differences in the reproductivity of the several social classes and of the several races and nations essentially to internal biological factors are led to see their effects in a quite different light from that in which they appear to those who recognize in these differences only the result of environmental factors.

The numerical reduction of the upper classes and of the nations of oldest civilization is seen to afford a provident natural mechanism by which certain racial and social elements, after contributing to national and world progress, gradually disappear from the scene of history before manifesting those symptoms of decadence which would have been inevitable in the future. In a similar way, Nature has wisely provided that the old shall disappear after accomplishing their task, instead of prolonging indefinitely a life which, whatever the past merits and gifts may have been, could not help becoming in the long run a burden on society. Indeed, the studies made on the evolution of characteristics of reigning and noble families show that, however high may have been the level attained by their founders, as a rule — unless new blood is infused — they gradually degenerate and disappear at last, often in vice or crime. Similar studies made for middle-class and peasant families incline us to the belief that in their case also development follows a similar parabola. (*cf.* 6, 9, 10, 12 and 19.)

An attempt to revive the reproductivity of the upper classes or of the nations of an older civilization in view of the aptitudes which in the past led to their elevated position in society and in the world, to the detriment of the lower classes and of the less evolved nations which are preparing to take their place, would be a program as deleterious for the progress of civilization and humanity as that of prolonging the life of the aged, thereby preventing the generations which are growing up from taking their place (*cf.* 6, 9, 10).

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RESULTS OF DIFFERENTIAL BIRTH RATE IN THE NETHERLANDS

by

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Among the questions which arise, when one studies the problem of population, there is certainly one which seems to have a very special interest, namely, this one — Is it possible for a nation at any moment to adopt a policy which promotes either a more rapid increase or a greater decrease of its birth-rate? In other words, is man capable of exercising a direct influence on these phenomena, or do these phenomena depend mainly upon the social, economic, religious and hygienic conditions under which a population lives?

Whereas we are undoubtedly able, be it to a limited extent, to help to improve our social, moral and mental relations, it is not to be denied that these, in their turn, are closely related to the stage reached by evolution at any given moment. This evolution, however, is the result of a mental development which extends over thousands and thousands of years and continues with a primeval force which we can hardly gauge and in which during a lifetime we can scarcely bring about any change.

For this reason it seems to me that a study in each country of its social, economic, religious, cultural and hygienic conditions and of the changes occurring in the demographic phenomena is of great importance, in order that we may derive from them the stage of the evolution, as well as the likely trend of the death and birth curves in the near future. Some countries find themselves in this respect in a curious transition.

Let us, by way of illustration of this opinion, take a bird's-eye view of the birth and death curves¹ for a number of years in Holland and some other countries.

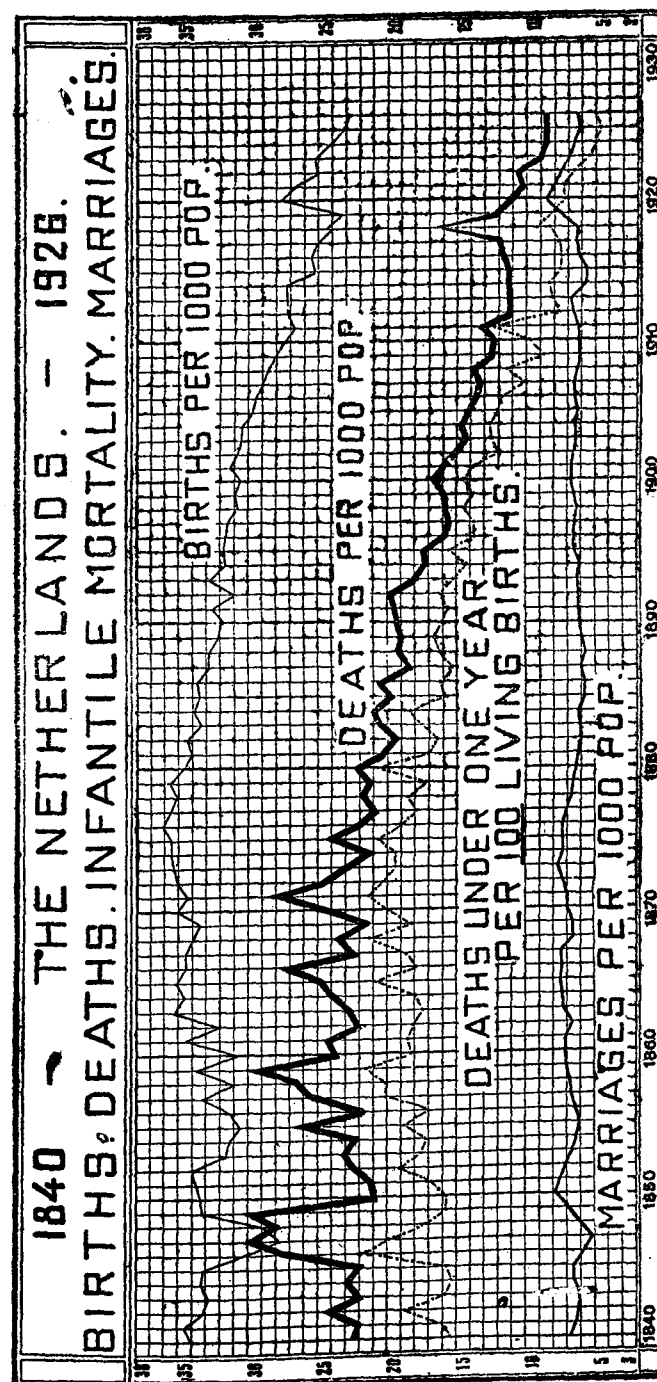
Holland.

In Holland the death rate varied greatly in the years 1840-70, as elsewhere, showing in some years high peaks owing to deaths caused by cholera, measles, smallpox, and influenza. After 1870, i.e., after the introduction of measures for the prevention of infectious diseases (Act of December 4th, 1872), these high peaks have disappeared altogether, and we only notice a rather considerable increase in the year 1918 on account of the then prevalent influenza. After that the decrease continues regularly till it shows less than ten deaths per 1,000 inhabitants in 1926. The birth curve, on the other hand, rises first till 1876, but falls rather rapidly till 1919. After a rise in 1920, probably caused by the return of the mobilized troops to their homes, the fall continues regularly.

If changes in the birth and death rates of various countries are examined, we will generally find the following facts.

As long as no particular events cause any disturbing influence, the relative birth rate shows in every country a tendency to increase till a certain maximum is reached, generally not higher than about forty births per year and per 1,000 inhabitants. Then we notice that the relative death rate is not, as a rule, higher than thirty per year and per 1,000 inhabitants. But after that, thanks to the successful struggle of man against all that threatens

¹ See diagram, page 171.



his earthly life, the relative death rate begins to fall, often before the birth rate does. As soon as modern ideas of hygiene, of the care of the newly-born child, of bringing-up, and, in connexion with these, an increasing sense of responsibility with regard to oneself and others, dawn on the various social circles, which is only possible when a certain degree of ease and education exists, the death rate falls, but for the same reasons the birth rate falls too. Whenever these expressions of cultural evolution respond more quickly to the death rate than to the birth rate, this former rate sometimes falls more rapidly than the latter, which may for the time being cause an alarmingly high birth excess.

This birth excess (difference between the number of births and the number of deaths per 1,000 of the population) has been examined for fifty-five countries, as much as possible for the same period, in most cases for the years 1919-23. Certain countries, such as Guatemala, Russia, Bulgaria, Mexico, Ukraine, the South African Union (white population) and Salvador have a birth surplus of sixteen and more per 1,000 inhabitants, whereas other large countries, such as India and France, are to be found at the bottom of the list, with a surplus of about three per 1,000 inhabitants, while Holland occupies the eighth position with a birth surplus of sixteen. The birth excess has not in all countries been greatest in the same years. In Holland it was greatest in the years 1920 and 1921, when it was 16.3 per 1,000.

In a table of birth rates, Holland occupies the thirtieth position with a rate of 26.4, while (51 Governments) Russia is first on the list with a birth rate of 42.6 and Switzerland, Ireland and Estonia are at the bottom of the list with birth rates of less than twenty.

Let us now confine ourselves to Holland: we will, in the first place, see that the relative birth rate has gone down in the years 1840-47 from 35.1 to 28.6 per 1,000 inhabitants. In this latter year, owing to various infectious diseases, and the shortage of food on account of a diseased potato crop, the death rate was higher than the birth rate (31.1 and 28.6 respectively). Then the birth rate goes up again with great fluctuations, till in 1876 it attains its maximum of 37.1, followed by a regular, gradual decline till 1919, when it is 24.6. After that, the birth rate goes up rather suddenly for ten months, as the result of the Armistice (November 1918), only to be followed by a regular decline to 23.8 in 1926. This is the lowest relative birth rate ever attained in Holland.

• *Annual birth rates per 1,000 inhabitants.*

1840	35.1	1869	34.3	1898	31.9
1841	35.5	1870	36.1	1899	32.0
1842	34.2	1871	35.4	1900	31.5
1843	33.8	1872	36.0	1901	32.3
1844	34.4	1873	36.2	1902	31.8
1845	34.2	1874	36.4	1903	31.6
1846	31.4	1875	36.5	1904	31.4
1847	28.6	1876	37.1	1905	30.8
1848	30.1	1877	36.5	1906	30.4
1849	34.2	1878	36.1	1907	30.0
1850	34.4	1879	36.6	1908	29.7
1851	34.7	1880	35.5	1909	29.1
1852	35.0	1881	35.0	1910	28.6
1853	32.7	1882	35.3	1911	27.9
1854	32.4	1883	34.3	1912	28.1
1855	31.6	1884	34.9	1913	28.3
1856	32.3	1885	34.4	1914	28.3
1857	34.2	1886	34.6	1915	26.3
1858	32.0	1887	33.7	1916	26.6
1859	34.7	1888	33.7	1917	26.2
1860	31.9	1889	33.2	1918	25.3 ¹
1861	35.4	1890	32.9	1919	24.6
1862	33.2	1891	33.7	1920	28.6
1863	36.3	1892	32.0	1921	27.7
1864	35.6	1893	33.8	1922	26.1
1865	36.1	1894	32.7	1923	26.2
1866	35.4	1895	32.8	1924	25.1
1867	35.4	1896	32.7	1925	24.2
1868	34.9	1897	32.5	1926	23.8

A similar decline of the birth rate is to be seen, when we compare the number of births and the number of married women under the age of fifty years, or when we put the number of births per 1,000 inhabitants side by side with the annual number of marriages concluded per 1,000 inhabitants.

The questions to be put concerning any country, the population of which we wish to deal with, are the following:

1. When and where did the decline first begin, and for what reasons?

2. Was this decline the result of determined propaganda, or rather an advancement of the standard of living, or the stage reached by evolution?

3. Is it only a temporary decrease, or is it inclined to continue?

¹ Previous to 1918 registered as being alive. Since 1918 born alive.

4. Is the increase of population likely to continue, or will it stop of its own accord as evolution progresses?

There are two series of figures which help us to study the evolution of the principal demographic phenomena. The first of these is the increase of the total population from one census to another; the other is the changes in the birth and death rates per 1,000 inhabitants, in connexion with the changes in the figures of emigration and immigration.

What has the increase of population been like in Holland since her separation from Belgium?

In 1830, after this separation, the population of Holland amounted to 2,613,000; eighty years later, when the census of December 31st, 1909, was taken, the population amounted to 5,858,000. Supposing the population in 1830 to have been 100, then it must have been 224 in 1909, which means well over double the number in eighty years.

If we divide this period of eighty years into two periods of forty years each, 1830-70 and 1870-1910, we shall see that the increase in the first forty years amounted to thirty-seven per cent, and that in the second forty years to sixty-three per cent. It has been said that, if this increase of 100 to 224 were to take place in each period of eighty years, the population of Holland would in 1990 amount to some 13,000,000 inhabitants, and in 2070 to over 29,000,000.

Other far-reaching calculations have been made. Examining the increase, not for periods of eighty years, but from one census to another, we will find the following figures:

1859-1869.	8.17 %	1889-1899.	13.13 %
1869-1879.	12.03 %	1899-1909.	14.17 %
1879-1889.	12.50 %	1909-1920.	17.19 %

Seeing that this increase has grown more considerable since 1870 and now amounts to about 1.4 per year, it has been said that, with a view to the increase of the last few years, we might admit a definite moment when it would continue with a similar rapidity of 1.4 per cent, and that the result would be for Holland a population of 27.5 millions in a hundred years' time, and of 110 millions in two hundred years' time.

This argument is not acceptable for Holland, if we consider the curves of the relative birth and death rates. In erecting such a horoscope, we should not ask exclusively how the increase of population has been from one census to another. Prudence is above all necessary for a period in which, since 1870, each decade shows a rapidly growing increase. Fifty years hence, when we shall probably have seen that the increase of each decade goes down as rapidly (or perhaps more rapidly still), these figures will perhaps teach us a little more in casting a horoscope.

Much more reliable, however, is the study of the changes of those factors which have led to the increase of population. In studying this particular subject, we shall never obtain estimates as mentioned above.

Increase of population can only take place as the result of an immigration which is greater than emigration, or of a number of births larger than that of deaths. In a country, such as Holland, where on the whole, emigration is greater than immigration, although to such a slight degree that the number of people leaving the country has hardly any modifying influence on the increase of population resulting from our birth rate, the increase of population is naturally for the greater part dependent on the number by which the births per 1,000 inhabitants surpass the deaths per 1,000 inhabitants.

If we are to try to answer the question as to how the demographic phenomena in Holland will probably develop, it is in the first place these two series of figures, showing the changes of the birth and death rates per 1,000 inhabitants, which can shed light on the problem. (See diagram, page 171.) The figure of marriages, which is important with a view to the birth rate closely connected with it, attained in 1924, after some fluctuations, the same height as in 1840.

The question to be put now is; Will the birth rate in Holland continue to go down? In order to be able to answer this question, we shall have to find out the causes of this decline.

Is it true that any population, on condition that material conditions are favorable, is apt to double after each period of some determined duration (the estimate of the number of years not being detrimental to the value of the thesis)?

Can Malthus' thesis that "Population always increases where the means of subsistence increase" be accepted under all circumstances? It is easily understood that in a period, in which Malthus wrote his alarming work entitled — "Essay on Population" (1798), people should argue thus. Nobody saw anything but an ever increasing birth rate, together with much unemployment, poverty, and a rather high death rate resulting from lack of hygienic measures.

But where did the decline of the birth rate begin? Amongst the poorest of the poor, through lack of food? By no means. The number of births decreased among the wealthiest and the most intellectual people. Researches in the latter part of the preceding century as regards degree of ease, births and infantile mortality, show plainly that the birth rate was lowest in the wealthiest classes and that it increased gradually with the various poor classes. These results have been confirmed by researches made in other countries. This proves that, for reasons other than lack of food, people abstain from procreation.

This is in the first place for reasons which are felt strongly by the more intellectual and well-to-do people. It goes without saying that the spreading and more general opportunities for obtaining means for preventing conception influence the decline of the birth rate, but the principal reason for the decline of this figure in Holland is certainly not to be found in propaganda for the application of these means. As in other countries, the birth rate in Holland began to go down in the period of 1870-80, whereas only in 1890 the New-Malthusian League started a vigorous campaign, the results of which are not to be traced in the decline of the birth curve.

What, then, are the causes?

On the whole, the motives which have led to the decline of the birth rate may be distinguished as follows:

1. Modification of the religious and moral principles of people, leading them to more independent and personal judgment. Whereas at each census the number of those who declare not to subscribe to any definite creed increases, this is even more the case with the number of those who practically feel themselves to be under no ecclesiastical authority. We also see that, by the side of orthodox beliefs, new religious and spiritual currents are born, which are, as far as principles are concerned, less averse from modern ideas on this point.

2. Selfish motives, the desire to preserve material conditions for oneself and for one's posterity, together with a craving for amusement, which may now more easily be gratified.

One of these selfish motives is the following. In former days it was an advantage to have children. At an early age children were occupied in agriculture and industry; sometimes they were partly their parents' breadwinners. Now that instruction is compulsory, and that labor done by young persons under a certain age is prohibited, this advantage in early age is lost or changed into material disadvantage.

3. A very powerful factor is to be found in the stronger sense of responsibility which both parents feel as regards the bringing-up of their children, and in that felt by the husband as regards the life of his wife. As the result of education, sports, limited alcoholism, sounder ideas as regards the application of hygienic measures — in short, as the result of higher ideas — there has gradually grown a refinement of the human mind which opposes itself to the former idea that the cemetery should help to make the education of the remaining children possible.

The more the idea penetrates that hygiene has its claims as regards the care to be taken of both infants and older children the more will procreation become an action which is not altogether dependent on accident.

Many of the reasons enumerated with regard to the decline of the birth rate influence first the wealthier and more intellectual classes of society, from where these ideas gradually spread to other circles.

Now there must be countries, and in each of these countries circles, where the selfish motives mentioned (*sub 2*) will make themselves more intensely felt, which naturally do not exercise a favorable influence on the energy of the population. Every possible effort will have to be made, lest love of ease and pleasure-seeking should be the causes of birth restriction. Not the efforts against this restriction, but the endeavors to uplift, can do good work in this case.

Much stronger, however, are the influences mentioned (*sub 1* and 3); much stronger and resistless. It is different views, and different opinions about what is morally allowed, and what is not—views totally different from the ideas prevalent some fifty years ago, under different circumstances. People have other notions of moral obligation, of responsibility towards infants, towards the mother and wife; more advanced knowledge and principles of hygiene, causing prophylactic both as principle that "prevention is better than cure" and the possibility of applying it, to penetrate everywhere. There are, however, always cultural influences which cannot be determined or modified at will, superindividual powers which go on working, independent of efforts either to accelerate or to prevent. The deeper sense of responsibility resulting therefrom is to be appreciated. Hence it may be safely prophesied that all these causes will lead to a further decline of the birth rate.

Let us now consider the changes in the Dutch death rate. Especially after 1870 it decreased to such an extent that, out of the fifty-five countries for which this figure is known, only four, viz., the South African Union (white population), Canada (without Quebec), Australia and New Zealand, all countries which, on account of their immigration, have a very different division of population according to age, show a lower death rate than the Netherlands.

The question whether our death rate can still further go down, remain as it has been these last three years (1924, 1925, 1926 = 9.8 per 1,000) or gradually go up to 16 per 1,000, as some people seem to think, depends on two factors which act simultaneously, but in opposite directions.

The one factor is the improvement of the chance of death in any age group; the other one is a modification of the occupation of the age groups, caused by the moving of surviving individuals from lower into higher age groups.

Let us stop a moment to consider the factor which tends to make the death rate go down still further, and let us put the

question whether the chances of death in the separate age groups are susceptible of further diminution.

It is undoubtedly possible to lower the infantile death rate which is favorable in Holland (1925: 5.8 per 100 live births). In a few countries, of which New Zealand is one, it is more favorable. The newly born babies in the Dutch towns have, since 1900, been better off than those in the country, because in the towns there is better advice to be had as regards the most natural treatment, such as breast-feeding and careful nursing. In the country the care taken of infants in the first month often leaves much to be desired. I am proud to be able to tell you that, among the four larger towns in Holland, the place where I live, viz., The Hague, thanks to the excellent organization of the protection of baby life, has reduced its infantile mortality to 4.1 per 100 live births per annum.

Researches which were started there in 1908 and were continued for five years with my collaboration, and which dealt with feeding, social conditions and death rate among all the 7,000 babies born in that year, make me hope that it may be possible to improve those figures in the course of time, and attain a rate of three deaths per 100 live births. On the other hand there are two provinces in the south of the country (Limburg and Noord-Brabant), where the infantile death rate is over eight per cent and three others (Gelderland, Overijssel and Drente), where it is over six. But although it may be possible to improve these figures, our infantile mortality does not include more than one-sixth of the total mortality. For this reason a permanent decline of the death rate of the entire population, if it is to be perceptible, will have to take place in other age groups as well. Whether this is possible will depend, on the one hand, on the question whether the general power of resistance of the population may be increased by judicious nourishment, a sensible amount of sports, and by a decreased consumption of alcohol; on the other hand, on the question whether it will be possible to take measures for reducing the mortality rate resulting from the chief categories of causes of death, such as influenza, diseases of the respiratory organs, tuberculosis and cancer, which together cause over one-third of the total mortality. Owing to a certain lack of satisfactory medical aid in the country, the influenza showed a tendency to choose its victims there; cancer mortality showed remarkable territorial differences, the cause of which has not been found yet; consumption was, especially during the war, more destructive in the towns than in the country, but after 1920, mortality from tuberculosis has decreased so much more in the towns than in the country that, since 1924, mortality from tuberculosis in towns of fewer than 20,000 inhabitants has been greater than that in towns of over 20,000 inhabitants.

If we continue in this direction with a successful fight against microbes as indicated by Pasteur, with hygienic advice as regards prophylaxy in its largest sense, which has proved to be efficient and more economical than the efforts to cure existing diseases or accidents, then mortality among those older than one year may surely go down a little further in most of the age groups. But this improvement does in reality only put off death for a little while, i.e., a gradual shifting of those in the lower groups to the higher ones. For this reason the mutual relations of the age groups will undergo a change, causing the highest group to have a denser population. This is a phenomenon which we perceive in Holland, as well as in other countries, and which will probably be even more pronounced in the future.

The population in any country may be compared to a crowd on a moving staircase. New births are continually added to these numbers, and once landed on the moving staircase they slide on, unless they drop off on the way, till they reach the top, or let us say the uninterrupted lifetime of 100 years. Hygiene can do a great deal. It may promote the sliding-on as long as possible of a human creature, but in the end its only effect is a moving-on of the individual from a lower into a higher age group. These individuals, once having reached the highest age group, belong inexorably to the group of the "morituri". Thus it may happen, in the case of a decreasing birth rate, that the death rate, as a perfectly logical result of the plain fact that all that is born must die, is going to exceed the birth rate, without the hygienic or economic conditions having in the slightest measure decreased, nay, rather as the consequence of death having been put off for years through the application of hygiene.

The temporary decline of the death rate as the result of hygiene causes the increase of population; the sense of responsibility promoted by hygiene causes the birth rate to go down. After having gone down to a certain minimum, the death curve goes up again. Thus the two curves of birth and death are, as it were, predestined to approach each other again, in accordance with a most regular evolution, and the population problem is solved. But this demographic evolution is only possible in case of a steadily developing hygiene, and those who have to perform the glorious task of serving hygiene naturally help to promote a normal solution of the population problem.

This is the comfort given to those who are interested in this problem. We need only persist in working at the task of civilization which has been put on our shoulders, always endeavoring to enhance the standard of welfare of the entire population, avoiding all that may do harm to the soul of the

population and all that hinders an economic evolution, organizing national and international cooperation. If we do that, we may confidently meet the future, although there may be moments when the sight of the incomprehensible events which sometimes take place on this earth makes us tremble with anxiety.

Providence has after all provided in the course of events the solution of this very important population problem which, whenever there is an economic depression, naturally claims our attention more than at other times.

APPENDIX

(Some information about the living births in the various provinces, in the towns, and in the country: about legitimate births by creeds; about infant mortality, still-births and marriages in the various provinces; about the results of the measurement and medical examination of conscripts and about expectation of life.)

* * *

Table I shows the number of live births by provinces. The birth rate in the whole Kingdom of the Netherlands has dropped rapidly since 1876 and went down in 1926 to 23.76, the lowest figure ever attained; it has gone down most especially in the last twenty-five years, in the Province of Zuid-Holland (influence of the towns of Rotterdam and The Hague), and in Noord-Holland (influence: (1) of Amsterdam, the largest town in the Kingdom inhabited by one-tenth of the entire population of the Kingdom, and (2) of the northeastern part of this Province, sometimes called "West-Friesland"). This part corresponds in this respect to the Province of Friesland which has always been characterized by a low birth rate. The two provinces which in the last twenty-five years have succeeded in maintaining comparatively high birth rates are those of Noord-Brabant and Limburg, where the population consists mainly of Roman Catholics. Still, the birth rate has dropped there too since 1910, i.e., in Noord-Brabant from 33.07 to 29.84 in 1926 and in Limburg from 33.54 to 29.26 per 1,000 of the population.

Formerly, the Province of Zeeland (non-Roman Catholic) which is equally situated in the south of the Kingdom, and west of Noord-Brabant, used to have a high birth rate, but this has rapidly gone down in the last few decades, and in 1926 it was 20.78 per 1,000 of the population. This figure is almost as low as that of Noord-Holland, the lowest of all the provinces (20.50) which is even lower by more than three per 1,000 inhabitants than the birth rate for the whole Kingdom, which is 23.76. The decline of the birth rate in Zeeland went together with a decline of the infant death rate which was greater there than in any of the other provinces.

The changes in the birth rates in the various provinces are influenced among other things by three remarkable phenomena:

- (1) By the fact that, in the last twenty-five years, the birth rate has increasingly dropped lower in the towns than in the country.
- (2) By the fact that in Holland there are always more births among the Roman Catholics than among the Protestants and the Jews; of the latter there are great numbers in Amsterdam, in comparison with other towns.
- (3) By the fact that both the general and the infant death rates have in the last twenty-five years dropped owing to advanced hygiene; as far as infant mortality is concerned, particularly as the result of very energetic efforts to protect infants.

Ad 1. It is not until after 1900 that the birth rate appears to be lower in the larger towns than in the country. How great the difference is at present may be derived from the birth figures of the various groups of communities for which it has been indicated what part of the total population is embraced by each group:

Communities of more than 100,000 inhabitants	Living births per 1,000 inhabitants, 1926	Part of the total population, 1926 (percentage)
Over 100,000 inhabitants	19.50	24.55
50,000-100,000 inhabitants	21.04	7.82
20,000-50,000 "	24.05	13.98
5,000-20,000 "	25.77	28.80
Under 5,000 inhabitants	26.32	24.85
• Birth rate for the Kingdom	23.76	100

The fact that a comparatively large proportion of the population still lives in places of under 20,000 inhabitants may also account for the rather high birth rate in the Kingdom.

Ad 2. The information given in Table II shows clearly that in Holland the number of legitimate births per 1,000 married women under fifty years of age is largest by far among the Roman Catholics, viz., 287. Next come the Protestants with 219, then the Jewesses with 157.

The following figures for 1909 and 1920 show the general proportions of births among Protestants, Roman Catholics and Jews and the groups of "No religion" and "Other religions".

	1919	1920
Protestants	56.95	53.29
Roman Catholics	35.02	35.61
Jews	1.81	1.68
No religion	4.97	7.77
Other religions	1.25	1.63
Unknown	0.0035	0.02
	100	100

It is certainly characteristic that, in all Provinces the proportional figures are higher among Roman Catholics than among Protestants, and the Jews especially show a lower figure than the Protestants. The other categories both show on the whole even lower figures, but we should not forget that the absolute figures are comparatively small here, which, however, is the case with the Jews just as well.

Ad 3. The low infant death rate in a country has often been considered as the standard attained by the application of hygienic measures. On the whole I think this judgment is not far wrong, any more than the assertion of some people that a regular decline of the infant death rate precedes a decline of the birth rate: Table III shows to a certain extent the confirmation of this assertion through the fact that, in the Province of Zeeland the infant death rate decreased most from 1910 to 1926, but that at the same time the birth rate dropped lower there than in any other of the Provinces with a mainly rural population. The Provinces of Noord-Holland and Friesland showed the lowest figures in 1926.

Still-births. — The number of still-births could only be shown with exactitude in Table IV from 1918 on, as, previous to that date, all children who died before being registered were included in still-births. These figures do not show great differences between any two Provinces.

Marriages. — The number of marriages per 1,000 of the population (Table V) has remained about stable in Holland since 1840. The figures for the various Provinces do not show great differences. After the war there was an increase owing to a number of marriages having had to be put off; after that there has been a return to the former proportional figure.

Results of the measurement and the medical examination of conscripts. — Table VI proves that the human race gradually gets taller. There is not much difference to be found in the various provinces, although it may be stated that, in the Province of Friesland, there is the largest number of conscripts of over 1.70 m. Then follow the other two Provinces in the north of the country: Noord-Holland and Groningen. On the other hand, the Provinces situated in the south of the country, viz., Noord-Brabant, Zeeland and Limburg, have the smallest number of conscripts of over 1.70 m.

The results of the medical examination of conscripts show, so far as the number of conscripts refused on account of illness or infirmity is concerned, so many variations in the different Provinces from one year to another that it is impossible to draw any conclusion or even deduce any indication.

Expectation of life. — The mortality tables (Table VII), which are prepared whenever a census is taken, show that in the case of both men and women the average lifetime has thus far increased, even among the oldest people. These figures have not been computed for the Provinces.

TABLE I.

NUMBER OF LIVING BIRTHS ¹ PER 1,000 OF THE MEAN POPULATION IN THE NETHERLANDS AND IN EACH OF THE PROVINCES.

Provinces	Years																
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
Noord-Brabant	33.07	31.81	32.66	32.53	32.68	30.96	30.79	30.56	29.50	29.32	33.17	33.85	32.02	32.61	30.87	30.24	29.84
Gelderland	28.65	27.93	28.26	27.88	27.94	26.24	26.12	25.84	25.25	24.65	28.76	28.00	26.82	26.94	25.41	24.64	24.34
Zuid-Holland	29.17	28.46	28.46	28.82	28.46	26.33	26.66	25.68	23.92	22.87	27.15	26.29	24.70	24.58	23.58	22.68	22.04
Noord-Holland	24.81	23.80	24.51	24.66	25.05	22.94	23.84	23.26	22.56	21.30	24.99	23.70	22.16	22.13	21.66	20.79	20.50
Zeeland	27.79	27.61	26.28	26.15	25.58	23.90	24.83	23.81	24.10	22.77	26.92	25.20	22.79	23.54	21.59	21.15	20.78
Utrecht	28.39	27.16	27.53	27.92	27.55	26.63	25.80	25.76	25.44	24.74	27.48	27.10	26.08	25.96	24.68	23.55	23.04
Friesland	25.28	24.97	25.25	24.36	24.85	22.71	23.82	23.64	23.25	22.91	26.97	25.45	24.11	24.64	23.66	23.16	22.59
Overijssel	28.61	28.30	28.10	28.07	28.22	25.51	26.47	25.69	24.83	25.00	28.67	27.81	26.80	27.48	25.80	25.18	24.94
Groningen	28.37	26.62	26.86	26.94	27.23	25.50	24.95	25.24	24.43	24.06	27.89	27.30	25.61	25.29	24.51	23.08	22.77
Drente	32.55	32.14	31.96	32.90	32.42	30.57	31.69	32.04	31.57	31.42	36.17	34.11	32.58	32.38	30.33	28.81	27.48
Limburg	33.54	33.05	32.76	33.43	33.47	30.66	30.02	30.01	29.27	29.05	34.01	34.40	32.49	32.16	31.56	30.21	29.26
THE NETHERLANDS . . .	28.62	27.83	28.06	28.16	28.18	26.18	26.48	26.02	25.10	24.40	28.41	27.66	26.13	26.23	25.12	24.24	23.76

¹ Since 1918, the live births have been shown; this is the number of children declared alive at the moment of registration, plus the number of children born alive but dead before registration, and declared for this reason as such.

* Whenever it was stated that the embryo was less than six months old, these births, even those that lived for a short time, are not included.

TABLE II.

TOTAL NUMBER OF LEGITIMATE BIRTHS IN THE YEARS 1909 AND 1910 BY THE RELIGION PROFESSED BY THE MOTHER
PER 1,000 MARRIED WOMEN UNDER 50 YEARS OF AGE, ON DECEMBER 31ST, 1909.

Provinces	Religion of the mother				Total
	Protestant	Roman Catholic	Jewish	No creed	
Noord-Brabant	229.79	322.27	128.44	80.81	309.58
Gelderland	233.16	297.20	171.53	90.60	249.83
Zuid-Holland	230.90	251.52	160.30	60.43	227.85
Noord-Holland	175.52	240.83	156.90	88.81	182.64
Zeeland	227.39	254.42	107.14	94.30	221.13
Utrecht	217.02	295.19	171.43	87.67	235.85
Friesland	203.86	240.48	126.58	122.59	194.96
Overijssel	223.48	292.76	131.18	92.33	232.57
Groningen	232.99	251.35	172.93	102.80	222.32
Drente	260.45	307.76	188.76	106.96	257.18
Limburg	226.19	320.79	110.17	130.44	316.96
THE NETHERLANDS . . .	219.37	286.91	157.13	88.19	231.49

TABLE III.
INFANT MORTALITY (INFANTS UNDER ONE YEAR OF AGE) PER 100 LIVING BIRTHS¹.

Provinces	Years															
	1910		1911		1912		1913		1914		1915		1916		1917	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Noord-Brabant	15.47	22.59	12.10	8.73	7.62	7.62	6.88	6.88	6.85	6.85	6.37	6.16	6.52	6.52	6.52	6.52
Gelderland	10.74	13.78	8.73	7.62	7.62	7.62	6.88	6.88	6.85	6.85	6.37	6.16	6.52	6.52	6.52	6.52
Zuid-Holland	9.69	11.20	7.62	7.62	7.62	7.62	6.88	6.88	6.85	6.85	6.37	6.16	6.52	6.52	6.52	6.52
Noord-Holland	8.14	10.22	6.95	6.95	6.95	6.95	6.88	6.88	6.85	6.85	6.37	6.16	6.52	6.52	6.52	6.52
Zeeland	11.57	18.27	9.74	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03
Utrecht	10.46	12.86	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38	8.38
Friesland	6.91	7.49	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98	5.98
Overijssel	11.38	12.56	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18	9.18
Groningen	8.84	12.87	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57	7.57
Drenthe	10.01	12.69	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86	7.86
Limburg	17.05	20.44	13.27	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30	14.30
THE NETHERLANDS	10.79	13.72	8.50	9.14	9.49	9.49	8.68	8.45	8.71	9.3	10.3	8.4	9.3	7.3	8.3	7.7

¹ Before 1918, death rate under one year of age (exclusive of those declared dead, but alive before registration) per 100 children declared alive. For years later than 1918 this death rate has been indicated sub *a*, whereas sub *b* is shown the death rate including those declared as dead, but alive before registration, per 100 living births. Since 1924 as stated sub *b*.

Whenever it was stated that the embryo was less than six months old, these births, even those that lived for a short time, are not included.

² Provisional figures.

TABLE IV.
NUMBER OF STILL-BIRTHS¹ PER 1,000 BIRTHS.

Provinces	Years															
	1910		1911		1912		1913		1914		1915		1916		1917	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Noord-Brabant	44.84	44.43	44.19	42.09	42.93	43.00	43.00	43.87	25.71	24.09	24.87	22.75	25.93	25.90	25.70	23.53
Gelderland	43.72	45.07	42.27	41.39	42.72	43.32	43.32	44.04	25.21	24.06	25.92	26.59	28.27	30.49	28.89	27.76
Zuid-Holland	35.42	35.21	34.91	34.29	34.50	34.11	34.74	35.86	25.21	24.06	25.92	26.59	28.27	30.49	28.89	27.76
Noord-Holland	34.67	36.14	35.56	32.82	35.87	36.31	36.28	36.44	23.73	23.57	26.65	26.50	27.66	27.08	25.62	24.08
Zeeland	35.98	29.67	33.41	37.46	30.35	34.23	35.95	32.21	27.46	25.10	25.12	24.12	23.25	23.21	23.96	28.39
Utrecht	37.71	32.40	37.49	37.77	35.50	37.81	42.34	34.13	18.06	17.28	24.98	24.09	25.97	27.01	26.06	24.95
Friesland	37.46	34.99	32.51	34.32	34.62	40.71	35.52	34.09	28.36	25.32	24.93	28.28	27.31	27.36	24.99	25.37
Overijssel	45.65	46.52	40.00	45.99	44.96	44.55	45.85	36.63	28.60	24.38	27.07	30.65	28.33	28.64	26.84	28.19
Groningen	33.98	33.76	33.51	33.90	34.94	32.58	28.58	32.85	30.17	22.48	26.54	26.57	25.76	25.97	26.18	23.88
Drenthe	47.74	42.19	41.64	44.25	38.27	40.99	43.76	39.96	34.76	29.05	29.05	31.05	27.00	31.19	31.48	26.83
Limburg	40.44	38.19	36.78	35.86	36.53	35.93	36.05	37.81	22.03	21.36	21.37	22.57	21.11	22.93	21.60	22.17
THE NETHERLANDS	38.96	38.33	37.53	37.26	37.55	38.95	38.44	37.73	25.73	23.94	26.10	26.27	26.89	27.67	26.03	25.44

¹ Since 1918 still-births have been shown; this is the number of children declared as dead minus the number of children born alive but dead before registration, and declared as such.

Whenever it was stated that the embryo was less than six months old, these births are not included.

TABLE V.
NUMBER OF PERSONS MARRIED PER 1,000 OF THE MEAN POPULATION.

Provinces	Years																
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926 ¹
Noord-Brabant . . .	12.94	13.25	13.13	13.77	11.33	11.31	12.88	13.86	13.81	16.16	17.75	16.89	15.53	14.38	13.78	13.51	12.99
Gelderland	13.79	13.25	13.88	14.24	12.80	11.77	12.86	13.63	13.61	15.92	18.23	17.52	16.11	14.18	14.19	14.20	14.32
Zuid-Holland . . .	14.82	14.73	15.86	16.27	13.98	14.64	15.14	15.04	14.87	17.06	19.16	19.28	18.51	16.74	16.22	15.48	15.76
Noord-Holland . .	15.21	15.53	16.72	17.56	14.88	15.40	16.15	16.18	15.71	18.35	20.11	19.22	19.35	17.81	17.29	16.03	16.16
Zeeland	13.99	14.38	14.29	14.64	12.77	11.41	14.22	14.59	15.07	18.67	19.02	16.02	15.07	14.52	15.12	14.86	14.54
Utrecht	14.22	14.25	14.90	14.98	12.97	13.56	14.17	14.96	15.04	16.67	18.15	18.71	17.98	15.60	15.13	14.25	14.01
Friesland	14.96	14.71	15.11	15.38	12.97	11.83	13.28	14.73	14.26	16.13	18.35	16.97	15.48	15.53	14.93	13.51	14.41
Overijssel	14.17	14.22	14.29	14.74	12.58	11.84	13.33	13.61	13.89	16.35	18.66	17.73	16.53	15.54	14.67	15.12	14.60
Groningen	14.29	14.38	14.83	15.66	14.11	13.15	14.53	14.95	14.55	16.77	20.22	18.60	16.07	16.09	15.49	15.04	14.83
Drenthe	14.69	14.64	15.64	16.26	14.94	13.58	15.04	15.85	15.34	18.78	20.90	17.35	15.83	15.06	14.56	13.67	13.98
Limburg	12.59	12.25	13.25	13.21	11.25	10.29	12.19	13.04	13.47	15.90	18.37	17.08	15.49	13.68	13.26	12.37	12.81
THE NETHERLANDS. ²	14.33	14.30	15.05	15.54	13.42	13.23	14.32	14.74	14.56	16.99	19.02	18.22	17.25	15.85	15.39	14.73	14.80

¹ Provisional figures.

TABLE VI.
RESULTS OF THE MEASUREMENT OF CONSCRIPTS.

Provinces	Period 1896-1900				Period 1906-1910				1920				1926							
	Number of persons measured		Per 100 persons measured		Number of persons measured	Per 100 persons measured				Number of persons measured	Per 100 persons measured									
	under 1.55 M.	from 1.55 M. to 1.59 M.	from 1.60 M. to 1.69 M.	1.70 M. and more	under 1.55 M.	from 1.55 M. to 1.59 M.	from 1.60 M. to 1.69 M.	1.70 M. and more	under 1.55 M.	from 1.55 M. to 1.59 M.	from 1.60 M. to 1.69 M.	1.70 M. and more	under 1.55 M.	from 1.55 M. to 1.59 M.	from 1.60 M. to 1.69 M.	1.70 M. and more				
Noord-Brabant	4,383	4,445	11,448	56,88	27,19	4,711	3,31	9,06	55,30	32,33	4,802	2,37	7,58	52,00	38,05	7,115	2,09	6,54	49,36	42,01
Gelderland	4,615	3,47	7,59	51,11	37,83	5,028	1,97	5,15	45,97	46,91	4,882	2,50	4,71	39,96	52,83	7,322	1,19	3,66	37,48	57,68
Zuid-Holland	7,921	2,26	7,03	50,38	40,33	10,648	1,49	5,53	46,47	46,51	10,845	1,96	4,90	40,28	52,86	15,725	1,04	3,62	37,37	57,95
Noord-Holland	7,056	2,81	7,41	49,21	40,57	8,925	1,74	4,84	42,14	51,28	7,906	1,92	3,96	35,73	58,39	11,784	0,86	3,01	33,08	63,05
Zeeland	1,825	3,12	10,01	55,80	31,07	1,997	2,00	7,66	53,94	36,40	1,638	1,71	5,80	48,23	44,26	2,155	1,25	3,90	44,18	50,97
Utrecht	1,800	1,11	6,22	49,88	42,79	2,935	0,88	4,77	43,18	51,17	2,107	1,76	4,32	37,59	56,33	3,329	0,75	2,43	33,88	62,93
Friesland	2,818	2,88	6,43	46,98	43,71	2,939	1,49	3,88	40,38	54,54	2,474	1,57	4,23	34,16	61,84	3,231	0,65	2,48	29,71	67,16
Overijssel	2,647	4,42	8,54	51,16	35,88	3,100	2,58	6,03	46,39	45,00	3,010	1,40	4,25	37,97	56,38	4,646	1,10	3,21	34,50	61,39
Groningen	2,509	2,67	6,45	47,39	43,49	2,687	1,60	4,50	43,10	50,80	2,526	1,62	3,64	36,12	58,63	3,697	0,78	3,11	33,95	62,16
Drenthe	1,160	6,55	9,48	51,99	31,98	1,337	3,74	7,41	48,39	40,46	1,453	2,06	5,02	41,71	51,21	2,032	1,43	3,89	39,27	55,41
Limburg	2,404	3,16	9,20	56,16	31,48	2,595	2,61	8,55	54,11	34,53	2,571	2,99	8,56	52,98	35,47	4,151	2,62	7,03	49,53	41,97
THE NETHERLANDS	39,138	3,13	7,99	51,24	37,64	46,232	1,98	5,87	46,54	45,61	44,214	2,02	4,97	40,92	52,09	64,187	1,20	3,89	38,02	56,89

TABLE VII.
THE NETHERLANDS.

Age	Expectation of life									
	Males					Females				
	1870/79	1880/89	1890/99	1900/09	1910/20	1870/79	1880/89	1890/99	1900/09	1910/20
0	38.4	42.5	46.2	51.0	55.1	40.7	45.0	49.0	53.4	57.1
5	50.9	53.8	55.5	58.3	59.5	51.6	54.8	56.8	59.4	60.2
10	48.0	50.4	51.7	54.3	55.4	48.7	51.5	53.0	55.4	56.0
15	44.0	46.2	47.5	49.8	50.9	44.9	47.4	48.9	51.0	51.7
20	40.3	42.3	43.4	45.7	46.7	41.2	43.5	44.8	46.9	47.5
25	37.1	38.8	39.7	41.8	42.8	37.7	39.7	40.9	42.8	43.5
30	33.7	35.1	35.9	37.8	38.8	34.3	36.1	37.1	38.8	39.5
35	30.1	31.3	32.0	33.6	34.6	31.1	32.6	33.3	34.8	35.4
40	26.5	27.6	28.1	29.5	30.5	27.9	29.2	29.7	30.8	31.4
45	23.0	24.0	24.3	25.6	26.4	24.5	25.7	26.0	26.8	27.4
50	19.6	20.5	20.7	21.8	22.4	21.0	21.9	22.2	22.9	23.4
55	16.4	17.1	17.3	18.1	18.6	17.4	18.3	18.5	19.1	19.4
60	13.3	13.9	14.0	14.7	15.1	14.1	14.8	15.0	15.5	15.9
65	10.6	11.1	11.1	11.6	11.9	11.0	11.7	11.8	12.3	12.5
70	8.2	8.5	8.6	8.9	9.1	8.4	9.0	9.0	9.4	9.6
75	6.1	6.4	6.4	6.7	6.8	6.3	6.7	6.8	7.0	7.2
80	4.6	4.7	4.7	4.9	5.0	4.7	4.9	5.0	5.2	5.3
85	3.3	3.5	3.4	3.5	3.5	3.4	3.5	3.6	3.7	3.8

DISCUSSION.

The Chairman (Professor Julian Huxley): We are met here to-day to discuss a subject which brings in the difficult problem of the quality of population as well as mere quantity. It is a familiar fact that different sections of human population — races, nations, classes, religions, and so forth — are multiplying at different rates, and of course this difference, if it remains thus unchecked, is cumulative.

The main subject will be the differential fertility of different classes within a single nation or within a single part of a nation. This is one of the most interesting phenomena which have been investigated by students of population. It appears that the present differential fertility was unknown a hundred years ago. On the other hand, it appears now that the differences in fertility between different classes are rapidly diminishing. We live in a period of rapid transition and it is very difficult to prophesy where it will lead us.

There seems no doubt that conscious deliberate limitation has played a part in bringing about some of the problems which we have to discuss, so that we face the whole difficult subject of the conscious control of population.

From our point of view as scientists, one fact will emerge very clearly, and that is the lamentable insufficiency of the data we have on which to base any conclusions. Different countries have different methods of collecting statistics. Even in those countries which collect the most elaborate statistics, the data are not really adequate for the full discussion of these problems. One of the main things that this Conference should stress is the necessity and the desirability from every point of view of getting a more uniform and a more adequate collection of vital statistics undertaken by the nations of the world.

Dr. David Heron (Great Britain): Professor Carr-Saunders, in his able summary of conditions in England and Wales, has reached the conclusion that "existing data, incomplete as they are, afford strong evidence of the unfavorable effect of differential fertility in respect of at least one important quality, namely, intelligence". I should be prepared to go somewhat further than he has done, but, in view of the fact that the eugenic importance of the differential birth rate has recently been challenged,¹ it

¹ "Differential Fertility" by Raymond PEARL. *Quarterly Review of Biology*. Vol. II, No. 1 (March 1927), pp. 102-118.

seems more desirable to deal here with some aspects of that criticism.

Professor Pearl takes the view that the differential birth rate "is to be regarded as a biologically normal feature of the social and economic structure of large human groups and is not necessarily a sound ground for eugenic alarm". He argues that we need to have laborers reproduce faster than the professional, clerical and trade groups in order to take up the greater human wastage in the laboring classes and to permit continued industrial growth and expansion. I could not accept this argument even if the differences between the birth rates of the various occupational groups remained constant, but it seems wholly incompatible with the fact that there is a considerable body of evidence in favor of the view that these differences have markedly increased since the middle of the last century.

If, as Professor Pearl suggests, a stable and economically sound society demands an excess production of laborers, it is difficult to believe that the organization of industrial processes, inventions and scientific discoveries which have made possible the growth of industry to which he has referred requires a continual increase in that excess production of laborers. More laborers? In the sense in which Professor Pearl uses the term, certainly not. We need, not fewer medical men, but more and more highly skilled, not fewer teachers but more and more highly qualified, while the vast increase in the use of machinery in industry demands, on the whole, labor of a considerably higher type than in the past. I venture to suggest that Professor Pearl has been tempted into an unsound generalization by the special and perhaps temporary difficulties of the United States.

As regards the evidence that such excess is increasing, Professor Carr-Saunders has quoted the views of Dr. Stevenson, who found that, in comparing occupational groups, differences in fertility were "very much less for marriages dating from 1851 to 1861 than for those of 1881 to 1891" and suggested that, "if the comparison could have been carried twenty years further back, a period of substantial equality between all classes might possibly have been met with".

These views are confirmed from an entirely different angle in a study of the birth rates of London districts where, working under the direction of Professor Karl Pearson, I found that there was a very close relationship between undesirable social status and a high birth rate¹. "In districts where there is over-

¹ "On the Relation of Fertility in Man to Social Status and on the Changes in this Relation that have taken place during the last Fifty Years", by David Heron. *The Drapers' Company Research Memoirs. — Studies in National Deterioration*, I (1906).

crowding, where there is a superabundance of the lowest type of labor, where it is needful to employ many young children in order to earn daily bread for the family, where infantile mortality is highest, there the wives of reproductive ages have most children. Where there is more culture and education as shown by a higher proportion of professional men, where there is more leisure and comfort as shown by a higher percentage of domestic servants, where the traders who appeal to the improvident and thriftless are fewer in number, there the birth rate is least. Again, where there is more general pauperism, where signs of bad environment like phthisis are prevalent, where pauper lunatics are most plentiful, there the birth rate is highest. Cancer alone of the undesirable physical conditions dealt with so far seems more prevalent in the prosperous and cultured districts and to be associated with a lower birth rate."

That was the position in London in 1901, but when I went back to 1851 I found that, although there were the same general relationships between undesirable social status and a high birth rate, the intensity of this relationship was approximately half that found for 1901.

With the other main argument used by Professor Pearl in the paper cited I am equally at variance. He says: "Finally, regarding these specific results set forth in this paper, I frankly do not see the usually alleged cause for eugenic alarm, for the reason that history demonstrates, I believe, that the superior people of the world have always been recruited from the masses, intellectually speaking, in far greater numbers than they have been reproduced by the classes." Professor Karl Pearson called attention to this point many years ago¹. Like Professor Pearl, he ascribed the principal role to inheritance in assuming that exceptional children are far more likely to come from exceptional than from commonplace parents, but he pointed out that, as commonplace pairs are far more numerous than exceptional pairs, the small chance of an exceptional child being born of commonplace parents made up for the greater number of such pairs, and it is obvious that even a small reduction in the rate of reproduction of the exceptional as compared with that of the commonplace will adversely affect the following generations. It is true that occasionally and rarely exceptional progeny will come from very unpromising parentage, but it would be altogether wrong, I think, to base a rule of conduct on what is unusual and rare rather than on what is usual and to be expected.

The only other point in Professor Carr-Saunders' paper to which I desire to refer is the reference to the Catholic birth

¹ "The Groundwork of Eugenics", by Karl Pearson. *Eugenics Laboratory Lecture Series*, II (1909).

rate. Professor Carr-Saunders deals only with the year 1924, but as similar figures for 1922, 1923 and 1925 are available, it seems desirable to amplify the data given in the paper. Unfortunately the data before 1922 are incomplete and cannot be used.

The figures are:

	From the Catholic Directory			From the Registrar-General's Returns		
	Baptisms	Marriages	Ratio of baptisms to marriages	Births	Marriages	Ratio of births to marriages
1922	70,349	20,159	3.49	780,124	299,524	2.60
1923	68,445	20,210	3.39	758,131	292,408	2.59
1924	67,565	20,394	3.31	729,933	296,416	2.46
1925	65,411	20,635	3.17	710,979	295,166	2.41

I doubt whether these figures can be used to obtain a ratio between the Catholic and general birth rate, but the fact that the ratio between the two is practically constant suggests that the Catholic population is not immune from those influences which are affecting the birth rate of the general population.

Dr. Karl Edin (Sweden): If you wish a new Malthusian propaganda, your first step must be to make a rational statistical investigation of the differential fertility and the child mortality of the great social classes, particularly of the working and non-working classes for the time after the great war. I do not know that any such investigation has been made. I believe it would be one of the most pressing tasks for this Conference and the Committee of Experts to stimulate representative statistical investigations of that matter for any progressive middle-sized cities for the whole economic unit. (See page 205).

* **Professor M. Boldrini (Italy):** I shall give a summary of a report, prepared by Professor Livi of Rome who is absent, on the result of studies made in Italy by him and other specialists, among whom may be mentioned Professor Gini.

The studies which have been made refer in general to the differential natality of the population of the great cities. This was made possible by the fact that there is a differentiation of quarters according to the wealth of the respective inhabitants. This study is not easy to carry out in Italy because the diffe-

rences between the social classes are not very distinct. The study could only be made for Trieste.

If we take into account the economic condition of the population, we find that the birth rate increases steadily as we pass from the richer to the poorer quarters. Thus in the new city, the rich part of the town, the birth rate per 1,000 is 17.4 and in the San Giacomo, the poorest quarter, the rate is 32.1. In these studies of the population of large cities, however, the influence of certain conditions cannot be ignored. For example, limitation of marriage is a necessary condition of some professions, and others impose celibacy. It would therefore be more interesting to study the question of differential natality for a country as a whole. In Italy we tried to do something of this kind. The districts were graded according to the incomes by profession, for example, the liberal professions. This income is considered as an index of the wealth of the district. It thus appears that the birth rate is higher in the regions in which the average income is low than in those where the average income is higher. For example, in the regions where the average income for the liberal professions is up to 2,000 lire the birth rate is 34.11 per 1,000 births, and in the regions where the incomes are above 5,000 lire the birth rate is 26.10 per 1,000.

One advantage, therefore, of these studies is that they have been carried out for the whole population. The influence of the proportionate density of population in the different regions should not however be forgotten. If we choose a small group of districts in which the density of population varies between seventy per cent and ninety per cent, we find ourselves dealing with a group which is more homogeneous and we can proceed from this to the same classification as that which I indicated at the beginning. In each group we can study the birth rate, the death rate, the natural increase of the population. The rule is always the same.

At the present time studies are being carried on by the Central Institute of Statistics. It is not the object of the report I have just given to study the causes of the phenomenon. As I told you at the beginning of my report, one should select professional groups, and study the birth rate in each on the basis of the average income of each group.

Mr. J. B. S. Haldane (Great Britain): There has been a good deal of difference of opinion as to the probable effects on the population of a differential fertility. The majority of eugenicists have considered that the results are likely to be rather serious. Others, such as Professor Pearl, have taken quite a different point of view. According to Professor Carr-Saunders' data, the striking feature of the situation in England and Wales is the low effective

fertility of a small class which is believed to transmit desirable qualities.

In a series of papers which I have published during the last eight years, I have tried to investigate mathematically the effect of selection on the composition of a population in which various characters were inherited in a number of different ways, and the striking thing which came out was that the effect was utterly different according to the type of inheritance. If we apply the results to the case of a population in which a small class has a low effective fertility, we find that, if the character transmitted by that class is transmitted as a Mendelian dominant, the effect of small fertility will be immediate and serious. But it is a notorious fact that, as far as one can see, intellectual traits are not, in general, inherited in that simple manner. You very often get children a great deal more intelligent than either of their parents, that is, from a Mendelian point of view, the type of inheritance must be something more complicated.

If you consider characters either inherited as recessives, or as the result of the coming together of two or three or more dominants, or of a number of recessive characters, you then find that the effect of differential fertility on such a character is relatively quite small. Whereas, for example, if you have a small proportion, say one per cent of the population carrying this desirable character and with an effective fertility of about fifty per cent, if the character is inherited as a single dominant, the numbers in the next generation will be reduced by something like fifty per cent; but if it is inherited as a recessive, the reduction is considerably less than ten per cent, and, if the inheritance is of a still more complicated character, the reduction will be less again, and that is true even if there is a very considerable degree of assortative mating with regard to the characters considered.

Before one comes to any very definite conclusions as to the probable results of such differential fertility, it is of the utmost importance to determine, so far as possible, how the desirable characters in question are inherited. Until we do that, we shall be very much in the dark as to the probable results of differential fertility, but we can say that in all probability its tendency will be to cut down certain kinds of desirable characters, and would have very little effect indeed, except in the course of many centuries, upon others. It will not only alter the proportion of the population showing desirable intellectual qualities, but the type of intellectual qualities shown.

With regard to the means of dealing with such a differential fertility, it appears that the most obvious method would be in the first place, as has often been pointed out, an equalization, either upwards or downwards, of the opportunities for family limitation between different classes; secondly, an equalization, so far as is

possible, of their economic status, and in particular, a uniform compulsory system of education which would tend to remove the incentive to family limitation among those who at present limit the numbers of their children in order to secure them a good education.

† **Dr. Hans Harmsen** (Germany): The science of population, which deals with the psychological and sociological life of nations, cannot be treated merely as a field bordering on medicine, national economy and sociology; it must develop its own laws and methods to a greater degree than has been done hitherto. We hope that this Conference will give a great impetus in this direction.

In Germany it is no longer a problem of surplus population that we have to deal with, but a problem of disappearing population. The central problem is that of underpopulation. As a matter of fact, in Germany there is an increasing duration of life, but at the same time a rapid fall of the birth rate, while the figures for marriage remain practically at a standstill. The result of this fact is excess of age, more old age. These two phenomena constitute the first stage towards definitely retrogressive population figures, a tendency which is now showing itself quite clearly in the upward trend of the death rate.

The high excess of births which Germany shares with the other Central European States is partly a phenomenon which has a time limitation. Perhaps Belgium and Holland are still suffering from a certain overpopulation, but close to these countries you find France, where the problem of underpopulation is a clear and apparent one.

The most important fact for population policy is the extensive assimilation of the level of birth rates in the lower and in the upper classes of the nation. The figure for conjugal fertility is to-day about half what it was at the beginning of the century. At that time there was about one birth to every three marriages in which the woman was of a childbearing age, and now the figure is one to six or seven. The clearest way of noting the marked retrograde movement of births is by classifying the succession of births in a family. Individual statistical investigation for the period 1901 to 1925 gives the following results: reduction of about one-quarter in the case of the firstborn child, of about two-fifths in the case of the second child, of about three-fifths in the case of the third child, and three-quarters in the case of the fourth child. There are practically no higher figures for births.

In Bremen it was seen that conjugal fertility amongst younger women (under twenty-five years of age) had fallen off one-third; in the case of married women (twenty-five and thirty) it had fallen

by about one-half; and two-thirds in the cases of women over thirty-five years of age.

Where classification was according to social position, it was seen that wealthy classes, who were in the vanguard of birth control, have now much the same figures to show as twenty-five years ago, in the middle classes the births have gone back fifty per cent, while the working classes, which about 1900 showed a birth rate three or four times as high as that of the wealthy classes, have now only a slightly higher rate than these. The masses have followed the example set by the middle and upper classes, and, as far as figures are concerned, it is they who turn the scale.

The average figure for births is not even sufficient to ensure the continuance of the nation. In any case the fears of the Neo-Malthusians no longer pertain to Germany, but there is no getting round the rationalization of births. It is a necessity; but we are doubly responsible for preserving the valuable classes of the nation, and we must pay quite special attention to this part of our duty of education. Our problem is merely this: how can we preserve the essential and important constituent parts of our nation?

We need the science of population statistics as an auxiliary science. We hope the Conference will join us in requesting all countries to pass from purely individual statistics to family statistics, so that we may at least have a clear general view of the construction of our population from the point of view of the family.

From pure national statistics we must pass on to statistics of racial groups, because it is no use obtaining, for example, averages for a State of which more than half represents foreign groups.

Finally, I am of opinion that the questions of present-day population policy are not, when all is said and done, economic questions, but intellectual ones. They are problems of education, not only of men but still more of women, questions of morality and religion.

Dr. Mabel Buer (Great Britain): With regard to the question of differential fertility of different classes, I quite agree that probably about 1830 there was not this differential contribution; indeed, possibly the upper and middle classes were contributing more owing to a level birth rate throughout the classes and a lower death rate among the higher classes. But we are much too apt in all these population questions to take the middle of the 19th Century as being normal, whereas as a matter of fact it was a very abnormal period, a period of very startling growth. If we go back before 1750, we find of course only a very moderate

growth which had existed probably from the time of the setback of the Black Death. This moderate growth was due in particular to the very high infantile death rate.

Before 1750, it is probable that the middle and upper classes contributed less to the population proportionately than the other classes. The birth rate among these classes was probably slightly lower; it is also probable that their death rate was higher. In the days of very small armies, the upper classes suffered more from war, including civil war. They undoubtedly suffered from the results of over-indulgence of all kinds, and there is considerable evidence that the children suffered from over-pampering of a foolish character.

If the merchants and the few professionals are included in the middle classes, and the handicraftsmen included in the lower, then, since the merchants and professionals were necessarily town dwellers, their death rate must have been appallingly high. Many handicraftsmen also lived in the towns, but there were many scattered throughout the country. It seems probable that these and the peasants were the most successful in rearing children, and thus, though for different reasons, a differential survival rate may have existed which was not dissimilar to that existing at present.

The most startling fact of the 19th Century was the increase of the European races which was due to a diminution of the death rate. At the present time the inhabitants of Asia and Africa are increasing less quickly than those of Europe; but it is important to notice that the slowness of their increase is due to the same cause as was the slow increase of pre-18th-Century Europe: that is to say, a high death rate and in particular a high infantile mortality, and elementary hygiene and elementary agriculture. There is every sign that these conditions will be altered in a few years, and are beginning to be altered already in India. It seems probable that we shall then have a period in which the Asiatic and African races may increase at the rate which the European races increased during the 19th Century. If that is so, there will be very great world problems arising. There is the beginning of better hygiene and of better agriculture in these countries, which means a decreased death rate which will not necessarily be immediately accompanied by a decreased birth rate.

Dr. M. Ginsberg (Great Britain): I should like to stress the point that the results of intelligence tests are not entirely independent of differing experiences on the part of members of different classes. We can by no means at present feel certain that the differences in intelligence revealed by the investigations are really differences in innate faculty.

Anyone who reads the history of intelligence tests in European

countries and in America will see that there is now practically hardly anybody connected with this matter who takes the view that the intelligence tests are independent of experience. In the beginning they were very confident, but now I think that confidence has gone. It is seen that the lower classes do worst first in those kinds of tests in which experience counts, which points to the fact that the different achievements are at any rate partly determined by different environmental conditions. Again, some investigations show that the differences among girls of different social classes are not so great as the differences among the boys, which, I think, again points to the fact that environmental factors may be concerned.

In the second place, the difference between the social classes in respect of intelligence decreases with age. This may be explained in different ways, but is at any rate consistent with the explanation that the common environment of the school reduces the differences which are at first determined by differing home conditions.

In the third place, it has long been known that there are differences in regard to physical growth among different classes. There are differences in respect of physiological retardation. Some recent investigations made in America and other countries suggest that the results of intelligence tests are determined to some extent also by the rate of physiological maturity. It is quite possible, therefore, that the differences in intelligence are correlated with differences in physiological growth. As to the differences themselves, it is extremely difficult to decide whether they are based upon innate factors or whether, again, they are determined by nutrition and other environmental causes.

* **Professor Jos de Boer (Holland):** Dr. Methorst has taken pains to adopt a point of view which is strictly objective and scientific. The amount of information that he has brought together to support his thesis is a proof of this. Nevertheless, in his examination of the causes of the decline of the Dutch population, he has allowed himself to make a few rather subjective statements.

According to Dr. Methorst, this decline of the population is due: (1) To a great modification of the religious and moral principles of people. In this everyone agrees with him. I would simply remark in this connexion that France offers a more instructive example of this than Holland. At the present time, in fact, the situation of France is dangerous. (2) To the selfish motives of parents. That may be quite true, provided that, up to a certain point, this cause is considered as being independent of the weakening of religious and moral principles.

It is the third cause of which I should like to question the objective reality. It is a fact that, while the first two causes can be measured, the third, described by Dr. Methorst as a greater sense of responsibility on the part of parents towards their offspring, or of a husband towards his wife, cannot be tested, and therefore has no place in scientific discussion.

* **Professor Severino Aznar (Spain):** In population studies all the countries of the world are mentioned, even the smallest ones, but always with the exception of Spain. Spain, however, is a European country, with Western civilization. It has a population of twenty-two million inhabitants and four million resident abroad. It may therefore be of interest to the Conference to see the way in which population problems present themselves in Spain, and what is the differential birth rate in the country, always bearing in mind the extreme fertility of the Spanish family. I will confine myself to simply reading the conclusions of the studies I have made on this subject.

Mr. Carr-Saunders' work is excellent, but my study was made with different objects in view. His observations are based on a study of the fathers, mine on a study of the mothers. He works on the rate of growth, I on the averages. The information he uses refers to men and women who have not attained the ages of forty-five in the case of women and fifty-five in the case of men. I have separated the men, and have divided the women, both married and widowed, into two groups, one group including mothers and the other only those women who are past child-bearing. He has classified, in the first place, according to social and economic situation and, secondly, according to place of residence and sociological characteristics. My classification is in the first place by district and then by economic position and profession. So far as sociological characteristics are concerned, I do not think that there is sufficient information available in my country. I am asking two professors of psychology to establish tests in schools to measure the psychological qualities of different social classes as indicated by me, but I do not know if the experiment will be a success.

I am sure that Mr. Carr-Saunders' information is exact and well chosen, but, all the same, in my country his classification would be very difficult to carry out and his conclusions could not be established. He combines the upper and middle classes in his classification. We should not dare to do this without previous research, for I think that in Spain the averages of births for these classes are different. He does not distinguish between the middle commercial classes and between the middle professional classes, but the factors influencing them are so diverse that the birth rates are quite different. Between the

first and the third groups and between the third and the fifth groups, he introduces another class which he calls intermediate. I do not know why this should be one group only, since it covers more than one grade.

From the working classes he distinguishes three occupations — textile workers, miners and agricultural laborers. I think that others could be distinguished on the same grounds, such as metalworkers, sailors, and above all, those occupations which are known to be unhealthy. Effective natality depends largely on mortality, and this is not the same in a healthy occupation as in others which are not healthy. We could not accept, without previous consideration, the high birth rate of miners, since this industry in Spain is noted for its unhealthiness. In our old age insurance system, miners ask the right to withdraw their pension five years before the other people because their average length of life is so short. As for agricultural workers, while the birth rate and death rate in England is low, the birth rate and death rate for this class in Spain is high. The provinces where the birth rate is highest are very largely agricultural.

The speaker seemed to take it for granted that greatest intelligence is found in the smallest families.

It would be a sad thing for the peace of the world if experimental psychology should show one day that the standard of intelligence falls as one descends the social scale. It would be a pessimistic and depressing revelation. But I do not think that there is enough information available and, on the contrary, from the facts that are available, it seems that this is doubtful.

The four cleverest men, in my opinion, that Spain has had during this century have come from very simple families. Here at Geneva each year there is an International Labor Conference. It is attended by employers and workers. Mr. Thomas could perhaps tell us if he finds that there is any difference between the intelligence of these two classes. Biologically it would seem that the sons of non-intellectual classes would receive from their parents fresher, stronger, healthier brains. In the case of the school-children of Northumberland who were studied, it is perhaps the differences of culture and social conditions which account for the early or late development of the intellect.

I should like to suggest one idea to Mr. Carr-Saunders. As long as we have only the results of national enquiries at our disposal, we cannot achieve a scientific result. A law which is applicable in the north is not perhaps the same for the south, the east or the west. What is a fact in England is not a fact in Spain. Enquiries must be carried out in all parts of the

world, and they must be comparable. For this reason I suggest that the office that you are going to create should lay down guiding and unifying principles.

• **Dr. B. Dunlop (Great Britain):** Dr. Grotjahn says that in Germany the average expectation of life was about fifty years in the pre-war years, and he concludes from this that a birth rate of twenty per 1,000 will consequently mean a stationary population. I should like to ask why the average duration of life in Germany is not to rise higher than fifty years. The average duration of life is rising in all the leading countries. In England, for instance, it is well over fifty now, and it is anticipated that it will certainly rise to an average of sixty years.

Those of us who have studied this population question for many years have quite confidently come to the conclusion that there is some connexion, as Malthus pointed out, between high birth rates and pressure of population on the means of subsistence. It is remarkable to me to find that there are fellow students of the population question who do not seem to feel any anxiety about that at all and are greatly concerned to urge and to encourage large families. From whatever point of view one regards these questions of differential fertility, humanitarian considerations, the standard of living and of comfort, we should all be agreed upon this, that at all events the people of the poorest classes should not be asked to have large families.

Professor A. M. Carr-Saunders (in reply): I said at the beginning that there was the question of the facts, then there was the question of the causes, and then there was the question of the consequences. Might I summarize briefly, under those three heads, the more important points that seem to me to have come out of the discussion?

First, as to the facts, it is obvious that we still depend very largely upon private enquiries, whereas, in order to ascertain what the position is, we must hope for enquiries undertaken by Governments through censuses, normal or special censuses as the case may be, and I hope that the necessity for these will be pressed upon the Governments of all civilized countries. We have a number of extremely interesting observations. In Stockholm, according to Dr. Edin, there is differential fertility which is in favor of the higher economic classes. Apparently in Holland and in Germany the position is nearly equal as between the different economic classes, if I rightly understood the interpretation of the figures of Dr. Methorst and Dr. Grotjahn. The position in Italy seems to be very much more like that in England, where the differences are very great.

When we come to the causes, there is a wide difference of opinion. Professor Gini, Dr. Methorst and Professor Pearl, as is

already well known, do not hold that social causes account wholly for the decline of the birth rate.

They call in biological causes. Personally, I do not feel convinced that it is necessary to call in biological causes. Dr. Methorst said propaganda in Holland began after the decline, but he gave the decade 1880-90 as the decade when the decline began, and it is well known that propaganda was set on foot in the previous decade in England, for better or for worse, and translated in almost every European country. Professor Pearl relies on the Algerian figures, where he says there is no deliberate family limitation, yet there is a general decline in the birth rate. I do not myself feel convinced that this requires a biological explanation. If time permitted, I would try to show that the decline in the Pacific Islands, which has caused so much anxiety lately, is a social and not a biological phenomenon. I think the explanation which holds good in that part of the world may also be applied to Algeria.

Coming to results, I would stress the great importance of Mr. Haldane's contribution. You first have to establish that there are biological differences and then that they are inherited in a fashion which will cause a difference to future generations. I believe the existence of biological differences is established, in spite of what Dr. Ginsberg and Professor March have said.

On the question of intelligence tests, the objections raised do not convince me. If, with all our social mechanism and our attempt to get the abler people into the more responsible posts we have not succeeded, all civilized countries must be most amazingly inefficient. Those people who do not believe in intelligence tests must think that the civilized nations have made the most enormous mess of their attempt to organize themselves.

Having established that there are differences, it is next necessary to find out whether they are of such a nature, or rather whether their inheritance is of such a nature, that the differential fertility existing will cause biological differences in the next generation. Upon that subject we have exceedingly little knowledge, and it is mainly because of that that I hesitate to draw any inference as to results.

FERTILITY IN MARRIAGE AND INFANTILE MORTALITY IN THE DIFFERENT SOCIAL CLASSES IN STOCKHOLM FROM 1919-1922

by

Dr. KARL ARVID EDIN.

The careful study of fertility, especially of fertility in marriage and of the death rate amongst very young children in different social strata, easy enough if they are grouped as far as possible according to income and occupation, should be considered as one of the most urgent and most complex enquiries in the statistical study of the population (demography) for the immediate future.

In examining the recent diminution of fertility, very marked in almost all industrial countries, we must ask whether it has affected, in the same degree, all professions and incomes, or whether there are differences in any direction. Also what is the ratio between fertility in marriage and the infantile death rate in the different classes, wage-earners, middle and upper classes. We know nothing with certainty. The statistics that might throw light on this important question have been, up to the present time, based entirely on the general census of the population, which gave the answer to questions concerning the occupation (professional or industrial), the age, date of marriage of the couple, the number of their children, born alive and living at the time the census was taken.

The weak points of this system, for our enquiry, are (1) births cannot be placed, in exact relation to the groups to which they belong, for example, the age of the mother at the birth of each child is a detail which is not given in any of these statistics, nor is the date of the death of the children who have died. (2) Occupations are not given with an accuracy which makes a correct grouping of classes possible.

One of the best works on this subject "Fertility in Marriage" (London, 1923), based on the 1911 census in England, seems to show that the fertility in marriage of the working class during the first years of the 20th Century was markedly greater than that of the upper classes, and also that this difference was still greater during the last years of the 19th Century. Other works of the same kind show a like result, and public opinion amongst educated people shows the same bias. The lower class, having, as a rule, the least desirable heredity, reproduce their kind

without limitation while, as the families rise in the social and biological scale, we find deliberate restriction. This is what has been happening, but since the war, and the revolutions and social evolutions it brought to pass, we see that the more thoughtful and progressive among the working class, in certain large towns, now come first in the restriction of births. It would be interesting to have a study, for the years after the war, of fertility in different social strata, in a large town, known as practising birth control.

I have made such a study for Stockholm. The study is founded on the figures of the general census for 1920 giving details as to the social position, profession and income (appearing in general results) and extracts of registers of births for 1919-22. From these results, I have prepared a series of detailed records, one for each couple domiciled in Stockholm on December 31st, 1920, the wife having been born in that town in 1881 or earlier, where the date of marriage and the dates and places of the birth of both husband and wife were known and where the couple were living together on December 31st, 1920. With these, I have put the certificates of birth of children born in 1919-22, the marriage having taken place at latest in 1920, and mention (if the case occurred) of the date and cause of death. These parents have also been followed up in the census papers. These results are, consequently, to be relied upon. I know of no similar enquiry in any other country. Sweden at the present time has the lowest birth rate, and the rate in Stockholm is only half that of the country districts.

The principal result of my examination, for groups standardized according to age, has been:

1. That fertility in marriage for these years was about twenty-five per cent lower amongst industrial workers than among the upper classes (considering only couples where the wife was under thirty in 1920, it was thirty-three per cent lower). At the same time the infantile death rate among children born during these years was twenty-six per cent higher; ●

2. That the fertility of the upper classes has increased with the income declared in the census: couples having an income of at least 10,000 Swedish crowns in 1920 had a birth rate fifty per cent above the rate for couples with an income less than 4,000 crowns, and yet even the last-mentioned group had a birth rate perceptibly higher than that of the working class, especially among young couples. At the same time we see that, as income increases, the infantile death rate decreases.

3. That the fertility of professional women is only one-third of the general rate.

4. That the fertility is greater amongst the couples born in Stockholm, though we must make an exception for professional women, relatively numerous, amongst natives of Stockholm.

Immigrants and less settled inhabitants are generally stronger, less subject to tuberculosis than the native-born. They marry earlier and in greater numbers, but as these more vigorous elements are also more completely guided by reason, they may make up for early marriage by a more rigorous birth control. The classes socially superior have, in Stockholm, adjusted their births with great nicety to their income, while the lowest group as well as the highest among the working classes have a low fertility, about the same for the two groups. Probably amongst skilled laborers it has been low for a long time, while amongst the unskilled laborers it seems that a communist propaganda in favour of preventive measures has been active. (In this group fertility outside marriage is frequent.)

In conclusion I must mention that according to the publications of the Statistical Bureau for Bremen (1925) the birth rate in this town between 1901 and 1925 has decreased in a much larger proportion in the working-class districts than in others, and the compiler adds:

"Since we need not assume that the birth rate of this class will fall below that of the well-off classes, we may conclude, with considerably probability, that the present birth rate in Bremen will, for a time, remain unchanged." This is an excellent illustration of the fixed belief in the permanency of the ratio in fertility hitherto observed in different social strata.

THE PSYCHOLOGY OF THE FALL IN THE BIRTH RATE

by

Dr. J. TANDLER.

Human reproduction rests primarily on instinct which like other phenomena originally have no connexion with rational reflexion. This purely emotional point of view doubtless gained its first intelligent direction when the leaders of any State became aware that the defence of the nation, its power and very existence was secured by a greater number of individuals. Thus with increasing human organization natality and mortality became a question of State and a political problem, and the attempt was made to ascertain the causes underlying natality and mortality from which to deduce a constructive national policy. States began to work out the causes of rising, and, above all, of falling birth rates in order to apply Governmental and social stimuli to raise or if necessary to lower natality. If we now attempt in what follows to speak of the psychological causes of the fall in the birth rate, we must cross the dividing line between individual and collective psychology.

The psychological basis of a population policy rests upon the need for power and the will to power. When Jehovah promised the Jews that they should multiply as the sands of the sea, this was nothing but a promise of world power which is reflected in the need for national force. This type of population policy, despite all assurances to the contrary, operates almost everywhere to-day. I have formerly spoken of it as the "imperialistic population policy". Its roots lie in the longing for Empire. But it is obvious that this could work but little or not at all on the childbearers and on the individual, for in childbearing and in the total of the birth rate this mental attitude really plays no part.

In the history of population policy another intention with a different psychological foundation has been observable. Thus, for example, the desire of the employer to procure for himself cheap labor by means of a large reserve is a manifestation of modern capitalism, and there arises the psychological basis of population policy which has been called commercial. Here

again the individual psychology of the childbearers is untouched. The fall in the birth rate is due to their direct observation of the miserable existence of their offspring, and to the lack of response of the masses to the problems enumerated above. The population politicians, both imperialistic and mercantile, desire a rise of the birth rate. The psychology of the masses, however, brings about its fall, and it is therefore of the greatest interest to go more closely into this mass psychology.

Economic factors are alleged to be the predominating ones responsible for a decreasing natality. At first poverty was blamed, but everyone knows now that it is exactly poor families which have most children. Wealth has also been accused, but that is incorrect, and is not the decisive factor, since the number of rich people is so small that their lack of children makes but little impression on the fall in the birth rate of the whole population. Several psychological factors have been adduced as causes, but they were based either on phenomena, which though widespread were sporadic, or on statistical data of limited application. Some have proved, as necessity required, that this or that point of view as regards world outlook, the bourgeois or socialistic, in its psychological effect on the individual was the determining factor in natality. This is failing to recognize the real basic factors.

The moment when the sense of responsibility for children enters the consciousness of the parent, pure instinct has reached its end and intelligence enters. Foresight in regard to economic conditions now becomes the controlling cause, not only in reproduction but in all other happenings or human society, and wholly instinctive reproduction remains only amongst the irresponsible, the anti-social and the degenerate. Economic conditions are manifestly the true driving force of human history. Not only do individuals react differently to economic causes, but masses also differ in their response, and thus we find a different reaction to the material surroundings in the psychology of particular strata, classes and peoples. Although as yet we have no clear idea of the relation between individual psychology and that of the mass, it is nevertheless evident that the more instinctive are the reactions, the less close is the tie between the individual and the mass response to this attitude. It is quite evident that the individual is least influenced by the will of the mass in his reproductive urge. One who desires to have no children does not think of the Malthusian law of reproduction and of the means of subsistence. If he thinks at all, it is of his own misery and the possible misery of his children, his position in the economic environment. His responsibility for the misery of his children is decisive, if his intelligence really influences his impulse. Imperialists may well rave about the greatness and

might of Empire, but few among them transform this collectivist ideal into the individualistic and bear children for the sake of the Empire. Everywhere where the imperialistic ideal is expressed by the top stratum, the individual for egoistic motives refuses to take his share in reproduction and demands that the ranks be filled from other strata, forgetting that the psychological premises of imperialistic thought are wholly wanting, while the psychological inhibitions to childbearing are present. The rise of the individual into a higher social stratum or class fulfills naturally a feeling of personal satisfaction. A large number of children is one of the first hindrances, and it is this sort of generative egoism which leads to small families, and one can hardly accuse with want of high ideals the man who thinks thus. This desire for a social rise is not altered by the ideals of Catholic humility or Protestant simplicity. It is not altered by the imperialistic or the socialistic outlook.

The imperialist desires to increase his power while the laborer desires to ensure security for his children. In this search for causes one learns early to differentiate between the two classes. In apportioning blame we find that the man who is not burdened with reproduction has been acquitted, while the woman who is heavily burdened by childbearing is condemned. This is mistaken judgment and not the first in history. It would take us much too far if I attempted to analyze also the psychological bases of the relative position of the two sexes in the ethical aspects of this question.

It is only too well known that, in the course of history, the position of the woman in regard to motherhood has altered just as much as her position in the economic, political and ethical spheres. Naturally greater stress has been laid on the importance of women in human reproduction and in bringing up the children of the next generation. The fall in natality is recognized and observed with anxiety in population political circles. Even here it is not possible to bring into the picture all the psychological factors of this short survey or to analyze them. As long as birth was regarded as due to chance and as an unalterable accompaniment of sexual intercourse, so long was woman not merely an object of desire but also a machine, ordained by fate to breed. At the moment in each cultural epoch or each cultural group, in which woman by one or another means reaches to self-determination, the effect is seen in natality. The whole complexity of psychological factors are enhanced by women's rights, and the mental problems which they raise. Women, deprived of rights, formerly bore, and bear still to-day, according to chance. A high natality is the consequence, and the difficulty of rearing drags in its train infant and maternal mortality.

Recognition of too frequent childbearing, when so many of those born necessarily disappear in the first years, brings in the awakened self-consciousness of women the power of rationalization which is doubtless due to the ethical motives. Women no longer desire childbirth for the sake of the graveyard. This advance is the right of self-determined women, and is one of the most important presuppositions for the culture of a nation. It is viewed by many population statesmen only from their own narrow horizon; and they condemn and oppose the "emancipation of women" (as they call it), regarding it as the greatest restriction on natality. And here be it noted, the economic or material conditions have on the average remained unaltered, while the psychology of women has changed. Mothers, daughters, wives, brides, who saw their young men go in millions to battlefields from which they never returned, have to a great extent lost their reproductive intention, and it is pure impertinence when those with political theories regarding population upbraid them for their lack of willingness to bear children. It is only where the reproductive process is at the same time both centered in the family and repeated in the family psychology, that we find maternal ambition linked up with the idea of the perpetuation of the family so closely as to become operative. This characteristic we find in the desire to continue their stock in ruling dynasties, aristocracies and plutocracies, though often the effect is diminished by inbreeding and degeneration. But in those cases where the family ideal of continuity is allied to a certain family egoism, there the rationalization declines. If it is regarded as an unendurable shame for parents to die childless, because the extinction of the family will not be tolerated by the tribe, then those families will reproduce themselves steadily and secure perpetuation by a higher birth rate.

When there is this great longing for family continuity, all other psychological and economic inhibitions disappear. Thus the continuance of the Jews, for example, by their endeavor to maintain their families, was secured as long as they remained immune from psychological inhibitions of the people in the midst of whom they lived. On the other hand, where the position of the family is sublimated by ancestor worship, and where family perpetuation is linked up with religious fervor of an ancestral cult, their natality remains very high in spite of all psychological difficulties, and in spite of all economic circumstances.

From what has here been said, it is clear, taking into consideration how much it may be broadened and intensified, that all the economic "doles", great and small, which are proposed by population politicians, will not suffice to raise the birth rate. It is also to be deduced that the mass psychology of the State, the nation and even of religion are not sufficient to alter the

point of view of the masses towards the problem of natality. The influence of these factors is rarely deep-rooted in the soul of the mass; they are not born with it and cannot really be influenced by it. The only way to encourage the reproductive intention of the mass here is through the psychology of the family. Of course it is true that we cannot influence a group by these means in those cultural circles in which ancestor worship does not exist, but we can through the sense of responsibility. We must add to that great inventory of ethical presuppositions that of personal rights and of human values; the sanctity of human life, the ethical responsibility of the next generation, and thus the generative impulses are reinforced when this potent psychological influence forces into the background all other ideas. We shall only be in a position (if this might be necessary), to influence natality, when we can convince one generation that its greatest task is the creation of the next, and it is this which will overcome all egoism, whether of individual or of family, or of the good of the whole extant generation, which will give way to the aim of creating a worthy human life for the future. It will be more possible to achieve this when the totality of a generation not only desires to create the next, but makes possible for it a better world for human existence. The whole meaning and object of life is its reproduction, so that in creating this generation, the individuals of the next follow. Without this background the whole of existence is nothing but a senseless hurry with an antagonism to the continuity of life.

FOURTH SESSION.

Chairman: Dr. C. C. LITTLE.

Paper presented to the Conference:

CONCERNING FERTILITY AND STERILITY IN RELATION
POPULATION, by Dr. F. A. E. CREW.

Supplementary Paper:

ANTHROPOGENETIC SELECTION, by Dr. Boleslav Rosinski.

CONCERNING FERTILITY AND STERILITY IN RELATION TO POPULATION

by

Dr. F. A. E. CREW.

In those forms of life in which diminished powers of repair are associated with architectural complexity, the inevitable end of every individual and of each generation is death. The species, however, does not thereby become extinct, for these forms exhibit the function of reproduction, the means by which the torch of life is handed on from generation to generation in an unending relay. Race preservation and perpetuation are ensured through the exercise of this function. In the case of such species which have not achieved a mastery over their environment, the life of the individual is precarious. It cannot command its food supply, it is preyed upon by other forms, and, associated with an appalling death rate, particularly during the earlier phases of the life history of the individual, there is an extravagance in reproduction. There would seem to be a correlation between the reproductive rate of a species on the one hand, and the sum of all the dangers which the individuals must encounter, the amount of potentially available food, and the numbers necessary for the efficient functioning of those selective agencies which in their action lead to the maintenance and improvement of the powers of adaptability of the species, on the other. It would seem that in a state of nature, if the species is to maintain its numerical strength and if there is to be no loss of "fitness" to flourish within a given environment, there must be reproductive prolificacy.

The great majority of living organisms are enchained in the service of the race. Race preservation is, among them, the first law of nature, being of paramount importance and being cared for by the strongest instincts. Reproduction is always expensive physiologically, indeed the act commonly involves

the death of the parent. It should not occasion surprise, therefore, to note that, even far down the scale of life, there are to be seen mechanisms and contraptions which, because they would seem to be the means whereby the individual may escape from the bondage of reproduction, can be regarded as evidence of an effort on the part of the rebellious individual to effect a compromise between individuation and genesis. Manifestly, if the conditions in which fertilization, being external and largely fortuitous, demands the elaboration of fabulous numbers of gametes, can be replaced by others in which every ovum is certain to be fertilized and in which the majority of young can be expected to reach maturity, then fewer gametes will be required and the individual can cease to be merely and continuously a factory of the future and can dedicate some of its activities to the further development of itself. For example, the sexual season can then become restricted to a certain part of the year and the young be born when conditions are favorable.

In the more simply organized forms, the products of the gonads are merely liberated at the body surface and the prospects of the fertilization of the ovum by the sperm would seem to be remote since it must be a matter of the chance meeting of dissimilar gametes. The development of the accessory sexual apparatus and external genitalia provide the means for the direct transference of spermatozoa to the genital passages of the female and so render fertilization far more certain. Highly elaborate sexual tropisms further increase the certainty of profitable sexual congress whilst amazingly perfect contraptions are utilized to bring the sexes together for this purpose. Care of the young is exhibited by those species in which the production of gametes, particularly by the female, is restricted, and in cases in which the offspring themselves possess but a limited supply of nutritive material. The replacement of oviparity by viviparity is associated with changes in the maternal organism, and amongst the viviparous forms it is possible to sense yet another effort at compromise. The pregnant mother, the slave of the offspring she bears, demands her physiological independence; it is to the advantage of the offspring that it should not be born until it has become capable of leading an independent life. A compromise is effected; the offspring is born before it is ready to fend for itself and the mother undertakes its post-natal care, this being not so complete a slavery as is pregnancy itself. In general, it may be said that the duration of pregnancy is related to the rate of the general or local development of the offspring, gestation taking place when the development of the foetus has proceeded to that stage which, being passed, would render live birth impossible without sacrifice of the mother.

It is possible everywhere to find suggestions of rebellion against the slavery of reproduction and in the case of the human, the greatest rebel of all, a considerable degree of freedom has been already gained; the reproductive activity of one generation which determines the strength and the constitution of the next is already controlled by many, thwarted and perverted by many more. The human, though the most successful, is by no means the only rebel. He shares with many other forms the mechanisms which in their functioning allow the individual to achieve a greater degree of self-development. Yet in the human, as in other forms, there are plentiful instances of phylogenetic legacies in the form of mechanisms which served the ancestral forms well, but which have not become modified to meet present-day needs.

The secondary sex-ratio of the human — the numerical proportion of the sexes among newborn infants — for example, is very near equality, being about 104 males per 100 females. From the point of view of the sex-physiologist, this equality is very unnecessary, for the male elaborates many millions of functional spermatozoa for each functional ovum made available for fertilization by the reproductive processes of the female. One male, in this matter of gamete production, is the equivalent of very many females. Moreover, the male is capable of providing functional sperm continuously throughout his sexual life and this itself is much more prolonged than is that of the female. If the propagation of the species were its chief function, then surely it were better that there should be a great excess of females in a population, that the secondary sex-ratio should be low, unless polygamy were the custom in a social organization, for then a tertiary sex-ratio of equality at the time of maturity might be advantageous, since under these conditions sexual selection might permit the really "fit" male to collect and control many females and so benefit the race. But polygamy is not customary and cannot be used as an explanation of a sex-ratio that is equality. To-day the female of the species exhibits a greatly reduced fecundity, a restricted sexual life, and a prolonged gestation period, whilst the sexual organization of the male has persisted relatively unchanged and so the secondary sex-ratio of equality has become an anomaly, a disharmony, an instance of the workings of a mechanism which has remained unmodified.

The reproductive rate of a mating and of a generation is determined by various agencies which affect fecundity, fertilization, pregnancy and parturition, and the post-natal viability of the offspring.

A. Fecundity, the power of producing functional gametes, is affected by various factors:

I. Those which determine the number of ova available at one and the same oestrous period.

It is possible that there are genetically monotocous and polytocous species in which single and multiple births respectively are specific characters and the difference between these forms is that, in the monotocous only one ovum is extruded from the ovary during a single oestrous cycle, whereas in the polytocous forms several ova are available for synchronous fertilization. Ovulation in both forms is conditioned by environmental agencies and, in the case of the polytocous, they determine the number of ova that are available at any one time, but any increase in fecundity, provoked by improvements in husbandry, does not proceed beyond the limits set by the genetical constitution of the individual. There is no evidence which shows that through husbandry the monotocous can become polytocous, and if under improved conditions fecundity is increased, then it may be assumed that the form concerned is polytocous. In the case of the human female, it is impossible to state definitely whether she is genetically mono- or polytocous. It is possible that both types exist, for in certain instances two ova within one follicle are common.

Twinning is most certainly a true breeding character. There are plentiful records of related women who have never had a single child at a birth in a series of pregnancies. Twinning occurs more often in large families than in small, and it is found that twins occur with nearly equal frequency in the pedigrees of fathers and mothers respectively of families in which twinning has occurred more than once. This observation is of importance in that it indicates that this tendency to twinning is not transmitted solely through the female but through the male as well. In a family in which there are two or more pairs of twins, it can be safely assumed that the hereditary influence of the father relating to twinning is approximately equal to that of the mother. About one in eighty births is a twin birth and in about one in 300 cases the twins are identical. Only in five to six per cent. of cases of multiple births does the human mother have more than one pair of twins. The production of identical twins depends upon a hereditary tendency on the part of the ovum to develop into two embryos instead of into one and upon the ability of the two zygotes thus formed to complete their development. The production of fraternal twins depends upon the extrusion of two ova from the ovary more or less synchronously. It is estimated that five to six per cent. of all

ovulations are multiple, being far more common than are multiple births; since, for reasons as yet unknown, only one egg is usually fertilized or one zygote survives. It would seem that one consequence of the fertilization of an ovum is that synchronous fertilization of others is rendered difficult or impossible and that twinning occurs only when, for genetic reasons, this barrier to multiple fertilization is weak. Such a hypothesis permits an explanation of the fact that the tendency to produce twins is transmitted through the male.

Faulty diet, especially such as takes the form of a deficiency of the reproductive vitamin, leads to imperfect fecundity or to complete infecundity. It is not yet established whether the fat infecund female is infecund because she is fat or fat because she is infecund. It is probable that in different cases either may be the cause of the other.

2. Those which determine the frequency of ovulation.

It is possible that there are genetically monœstrous and polyœstrous forms, and though husbandry can and does condition the frequency of œstrous, there is no evidence which shows that improvements in husbandry can transform the monœstrous into the polyœstrous. There is considerable evidence which points to the conclusion that in uncivilized races the breeding season is restricted and that male and female are reproductively active only during a limited period of the year. That civilized people do breed at all times during the year is not to be interpreted necessarily as a reflexion of a change in the nature of the human, but rather as an indication of the results of altered social conditions. In the case of domesticated stock, the frequency and intensity of œstrus is largely determined by food and housing, and so it may well be in the case of the human.

In this connexion, the phenomenon known as the interval pain or "Mittelschmerz" is of considerable interest. The fact that commonly there is a slighter but typical menstrual disturbance rhythmically intervening between two menses proper may possibly be an indication that the conditions of life in the community are permitting the expression of a greater fecundity, that new ova are made available for fertilization at shorter intervals.

Among the agencies which affect fecundity must be placed prolonged lactation, for it would appear to be the case that the return of menstruation is delayed thereby. Another is pre-pubertal sexual intercourse which would seem to affect in a deleterious manner the later elaboration of functional gametes, this being due most probably to the effect of such habits upon the general health of the individual and not to any particular effect upon the gametogenetic tissues.

3. Those which determine the length of life of the individual.

The time of onset of puberty in relation to the whole life and the length of life are genetic characters, though the expression of these characters is conditioned by environmental agencies. The sexual life bears a definite relation to the whole life, being that phase between puberty and senescence (the menopause in the female). It follows, then, that the total number of ovulations and the sum of the opportunities for fertilization and reproduction are influenced profoundly by the genetic factors affecting longevity and puberty. Death before senescence must necessarily reduce the number of opportunities for reproduction. The extension of the sexual life of the individual is a direct result of the improvements in feeding and housing that are associated with civilization, and thus it is that civilized peoples are more fecund than those who live in a state of nature.

Racial genetic characters relating to the onset of the sexual life of the individual are not profoundly affected by changes in environment and these, like all other genetic characters, must be considered in any discussion concerning migration, for, being genetic, they will become incorporated into the structure of the population and so the possibility will arise that man's organic evolution may conflict with his social to the hindrance of social progress.

4. Those which influence the functional ability of the gametes.

Certain forms of genetic sterility would seem to be due to peculiarities in the anatomy and physiology of the gametes themselves which render fertilization imperfect or impossible. In some cases the sperm is abnormal; in others, a form of self-sterility would seem to be responsible, for two individuals, mutually infertile, are found to be fertile in other matings. The cause of this infertility would seem to be an inability to fuse on the part of ovum and sperm, this inability being the expression of disharmonious genetic constitutions.

A study of the human sex-ratio provides evidence which seems to show that the two forms of sperm elaborated by the male are not equally functional, the male-determining spermatozoon being more efficient in the act of fertilization than the female-determining. More will be said of this later.

5. Those which lead to the establishment of abnormal states, general or local, which render gametogenesis imperfect.

Genetic or accidental disfunctioning of such endocrines as the pituitary and adrenal is associated, in certain instances, with imperfect gametogenesis. Cryptorchidism, a genetic character in many cases, involves some grade of infecundity, the cause of this being a matter of temperature. It has been

shown that the temperature within the inguinal canals and abdomen is significantly higher than that at which spermatogenesis proceeds normally. Gametogenesis is commonly imperfect in cases of *dementia praecox*. X-rays destroy the gametogenic tissues, leaving the interstitial untouched. Neoplasms, localised tuberculosis, syphilis, fibrosis following acute infections, such as gonorrhoea or mumps, destroy the gonad.

In general, it may be stated that social and religious habits and customs which do not disturb the general metabolism of the individual do not affect fecundity. When all allowances have been made for the effects of food and housing and of environment generally upon fecundity, the fact remains that this is a genetic character and therefore must be considered in all discussions concerning the constitution of a population. Since fecundity is a genetic character, its inheritance can be controlled.

B. *Fertilization, the fusion of egg and sperm to form the zygote, is affected by various factors:*

1. Those which affect the act of sexual congress.

Homosexuality, a grade of asexuality based in a disharmony or insufficiency of the hormones elaborated by the gonads, frigidity, the result of unfortunate experience, abnormality of the reproductive system (genetic or accidental in origin), disproportion in the size of the external genitalia of male and female, disharmony in the time relation of male and female organisms, due to faulty courtship, may be responsible for imperfect sexual congress.

Socio-religious influences in restricting sexual congress reduce the opportunities for coitus and thus for fertilization, or in restricting this in its relation to the time of ovulation render fertilization more or less probable. There is evidence which points to the conclusion that there has been an increase in the efficacy of the sex-hormone consequent upon civilization, for among civilized peoples the sex-equipment is relatively larger, sexual desire is more easily aroused and is more intense than among the uncivilized. Diseases of many kinds, general and local, render coitus undesired or impossible.

2. Those which affect the actual union of egg and sperm.

Self-sterility has already been mentioned, the inability to fuse being due to a genetic disharmony. The probability of fertilization varies with the number of sperm available, so that any condition which is associated with a diminution of the number of functional sperm in the ejaculate can be a cause of infertility. The over-young and the over-old are, probably for this reason;

less likely to effect fertilization than is the individual in the heyday of his sexual life.

It is not improbable that in certain instances fertilization is prevented by the death of the sperm, this being due to the action of spermatoxins elaborated in the blood of the female following absorption of the sperm from the vagina.

Occlusion of the oviduct or of the *vas deferens* necessarily prevents fertilization and such a condition may be the result of genetic action or of developmental accident as well as of disease.

Contraception has been practised by primitive agricultural and historical races and is practised extensively by modern communities for the prevention of the union of egg and sperm. It is to be regarded as an instance of the expression on the part of the individual of rebellion against the bondage of reproduction, evidences of which can be disclosed in many forms of animal life.

It is recognized that a differential fertility rate distinguishes the social grades. The average size of the family among the relatively socially unsuccessful is on the whole greater than that of the successful. Much of this difference is due to the fact that, among the higher social classes, there is less coitus and more contraception. Relative wealth gives to its possessor not merely a better environment but also far more avenues and opportunities for recreation, more varied intellectual interests and wider outlets for nervous energy. Relative poverty implies a poorer environment, restricted opportunities for recreation and narrow intellectual interests, and for the poor there are but two main outlets for the speedy and satisfactory relief of nervous tension, sexual intercourse and alcohol. Contraception is not practised by the lower social orders at all extensively because they do not always consider and accept the social responsibilities of parentage and because contraceptives cost money and require a certain self-interest in their use.

There is no critical evidence which shows that a difference in fecundity is a distinguishing character of the social classes. In all ranks of society there are abundant instances of relative infertility. Much of this is the sequel of an outraged physiology consequent upon extravagant living, too much and too violent exercise, manual or mental; much is due to general debility. It may be that some is due to such social agencies as pensions and insurances, for no longer is it necessary to safeguard old age by begetting numerous offspring who later will support their parents. But when all allowances have been made for reproductive disharmonies caused by abstinence, contraception,

disease, debility, and extravagance, there still remain differences in fertility among matings of the same social group which can only be explained on the assumption that, for inborn genetic or physiological reasons, certain matings are less fruitful than others. It has not yet been shown that there has been any concentration of such matings in any particular social group, however, and it must be concluded that social differences in fertility are not at all commonly due to genetic causes.

C. Pregnancy and Parturition:

The ante-natal nurture of the offspring and its birth are affected by various agencies:

1. Those which bring about the death of the offspring at some stage of its ante-natal development.

Important among these are lethal factors, genetic in nature. These in their action yield characterizations which render the further development of the embryo or foetus improbable or impossible. The recessive character *Ichthyosis congenita* is such a lethal, and in the great majority of cases the affected foetus is aborted. There is reason also to think that perhaps the haemophilic female dies in utero and that this is one reason why females exhibiting this sex-linked recessive character are rare. Achondroplasia, because of the resulting disproportion twixt foetus and maternal birth passages, is a cause of dystocia and of foetal death. Achondroplasia is genetic in nature and is thus a lethal characterization which directly, or indirectly through the commonly associated hydramnios, leads to foetal death.

There is reason to think that mutations in the germplasm yielding slight but deleterious modifications in the general characterization of the individual are the commonest of all genetic changes and that for the reason that these mutations are most commonly recessive and therefore not quickly brought to light, the population slowly but surely is becoming loaded with them and that it is but a matter of time, unless appropriate steps are taken, before their accumulation and spread lead to definite racial deterioration. This question has to be considered in any discussion relating to migration, for this mingling of peoples of different stocks implies the merging of different genetic constitutions and in this abundant opportunity for the expression of disharmonies is provided. Large foetal heads and small maternal pelvis is a gross example of such disharmonies that can be produced by mistaken matings.

A review of the human sex-ratios at different phases of pregnancy reveals the fact that ante-natal death is common

and sexually selective. The following table shows that still-births are common and that among them the sex-ratio is far removed from equality, being high in the records of every investigator taking the standard secondary sex-ratio of 104:100.

TABLE I.
Frequency and Sex-incidence of Still-births.

Authority	Locality and Date	Percentage	Sex-ratio
Auerbach (1912) Bertillon (1893) Bodio (1895)	1887-1895 Budapest	3.3	—
		4.5	—
	Italy	—	131.1
	France	—	142.2
	Germany	—	128.3
	Austria	—	132.1
	Hungary	—	130.0
	Switzerland	—	135.0
	Belgium	—	132.0
	Holland	—	127.1
	Sweden	—	135.0
	Norway	—	124.6
	Denmark	—	132.0
Bucura (1905)	Vienna	5.8	
Davis (1918, 1919 and 1920)	United States	5.56	137.1
Dawson (1921)		—	138.0
Düsing (1884)	Prussia	4.06	129.09
Heape (1909)	Cuba	—	144.45
Hirsch (1913)	Germany	—	127.9
King (1921)	America	4.36	131.06
Le Maire (1901)	Copenhagen	5.7	
Lewis (1906)	Europe	—	120-170
Nichols (1907)	All records	3.04	131.6
Quetelet (quoted by Bugnion, 1910)			133.5
Rauber (1900)	Germany	4.0	—
Terry (1917)	Massachusetts	3.2	—

It is seen that the sex-ratio of still-births is distinctly higher than is that of the newly born.

It has been commonly argued that a natal sexually selective mortality may be due to dystocia caused by the general and

local larger size of the male foetus or to the more advanced ossification of the male skeleton at the time of parturition. But Ladame (1904) has adduced figures which show that only 36.4 per cent. of still-births occur during parturition. Treichler (1895) and Prinzing (1907) found respectively that 19.6 per cent. and 32.6 per cent. of still-births were premature, so that since in these cases size and degree of ossification cannot complicate premature labor, still-births cannot be regarded as the result of dystocia caused by size disharmonies. It would appear, then, that still-births in most cases are dead before labor commences and are not caused by dystocia and that this sexually selective natal mortality is to be regarded as evidence of the existence of some definite mechanism, the working of which can be further revealed if the amount and sex-incidence of abortions are examined. It cannot be expected that figures showing the total amount of abortion should be available. Embryonic death during the earliest months of pregnancy will not result in recognizable abortion and must remain unrecorded. However, even those data which are available are significant and noteworthy.

TABLE II.
Amount of Abortion in Man.

Author	Amount of abortion (percentage of all pregnancies)
Ahlfield (1876)	20.0
Auerbach (1912)	24.0
Bertillon (1893, 1896)	6.8
Davies (1910)	15.6
Franz (1898)	15.4
Malins (1903)	19.2
Mall (1915)	20.0
Parkes (1924)	16.5
Pearson (1908)	28.5
Priestley (quoted by Routh)	23.0
Rauber (1900)	9.6
Routh (1914)	20.0
Schultz (1918)	22.0
Taussig (1910)	30.3
Whitehead (quoted by Routh)	14.0
Williams (1923)	16.2

It is seen that one in every five or six conceptions is destined to end in abortion. Moreover, as is seen from the following table, this abortion hits the sexes differentially.

TABLE III.
Sex-ratio of Abortions.

Authority	Age of abortion	Number	Sex-ratio
Lenhossek (1903)	3-6 months	156	160.0
Auerbach (1912)	4-7 months	4,067	156.4
Carvallo (1912)	Up to 4th month	—	250.0
Gunther (1925)	—	—	143.2
Korosy (1898)	—	3,781	152.4
Pinard & Magnan (1913)	—	1,229	101.1
Rust (1902)	First 6 months	454	101.8
Rauber (1900)	—	—	159.0
Schultz (1918)	3-10 months	647	118.7
Marmisse (1867)	—	2,881	144.7
Bertillon (1896)	—	—	121.5

This sex-incidence of pre-natal mortality varies during the course of gestation, as is seen in Parkes' (1926) presentation of the figures of several authorities.

TABLE IV.
Sex-ratio of Mortality according to Month of Gestation.

Month of Gestation	Sex-ratio according to					
	Auerbach (1912)	Schultz		Nichols (1907)	Marmisse (1867)	Bertillon (1896)
		(1918)	(1921)			
1	—	—	—	—	—	—
2	452	—	—	—	—	—
3	322	123.7	121.0	176	170.0	180.3
4	229	110.5	117.5	1	—	—
5	163	108.1	109.6	148	105.0	118.6
6	116	58.8	87.5	111	119.5	112.0
7	116	—	108.5	114	113.2	116.5
8	—	—	133.3	106	136.6	106.7
9	—	—	167.5	129	132.5	131.6

It is seen that the nearer the conception the higher is the sex-ratio. The inference is that, throughout the period of gestation, there is a continuous selective elimination of males and that the

primary sex-ratio must indeed be far higher than the secondary, the latter becoming equality owing to the operation of a sexually selective pre-natal mortality. It is possible to form an estimate of the primary sex-ratio by taking what is known concerning the sex-ratios at different times both after and before birth, and projecting what is known back towards the unknown. Indeed, it would seem that the primary sex-ratio cannot be much less than about 170 males per 100 females.

From these considerations there emerges the conclusion that far more males than females are conceived and that far more males than females perish during the period conception-parturition and that it is this selective elimination of the males which leads to the establishment of a secondary sex-ratio of equality. There is no real reason for assuming that the primary sex-ratio is equality and that those agencies which lead to foetal death bear most heavily upon the female zygotes during the first two months or so of pregnancy, and then during the later months upon the males. Undoubtedly, slight differences in the mode or rate of development and differentiation can be responsible for differences in the relative viability of the sexes, but there is no evidence in the case of the human which supports this explanation. One is forced to the conclusions that the male elaborates two forms of sperm in equal numbers in the majority of cases; that there may be a differential susceptibility on the part of the two sorts to adverse conditions; and that the sperm bimodality in the matter of head-length which has been shown to exist is perhaps an indication of a differential motility on the part of the two kinds or else of a differential ability to penetrate the egg. The result is that the male-determining spermatozoa are more efficient in the act of fertilization than are the female-determining spermatozoa and so more males are conceived.

One may assume that the elaboration of an ovum is physiologically more expensive than that of a sperm and that it is desirable from the point of view of the race that, for the process of fertilization, there should be available more spermatozoa than ova. A preponderance of spermatozoa is ensured if there are equal numbers of spermatocytes and oocytes and if polar body formation results in three abortive ova out of every four. It can be further ensured by the establishment of a high primary sex-ratio. Both safeguards are exhibited in the case of the human. It would appear that, for the production of a secondary sex-ratio of equality, a very high primary sex-ratio is necessary.

If the selective elimination of males pre-natally can be counteracted successfully by refinements in general medicine and in ante-natal care, then there must be a disturbance of sex-ratio at birth and thereafter. The successful activity of the Ante-natal

Clinics and of the Child Welfare Centres must result in an increase in the number of males born and reared beyond the 0-5 years age period.

2. Other factors affecting pregnancy are the sociological, which lead to criminal abortion, *e.g.*, illegitimacy, and the desire to limit the size of the family, and the pathological, which lead to the death of the foetus.

D. *The post-natal viability of the offspring:*

Factors affecting the post-natal viability of the offspring are genetic and environmental. Any difference between the tertiary (that which obtains at the time of maturity) and secondary sex-ratio must be due to a difference in the post-natal survival values of the sexes. It can readily be shown that there is a very considerable amount of post-natal mortality and that this varies according to the age groups.

Deaths are fewest between ten to fifteen years of age and thereafter increase steadily. The mortality during the period 0-5 years is extremely heavy, being about equal to that of the sixty to sixty-five years age group. If the mortality during this period 0-5 alone is unequally distributed among the sexes, then the sex-ratio would indeed be modified.

There is no doubt that the principal determinant of longevity is organic inheritance and that the age at which an individual dies is decided by the biological constitution of the individual. The death rate during the earlier age groups is selective, eliminating the biologically unworthy and leaving the biologically strong. Child welfare not only protects the strong but also salvages the weakly who may grow up and reproduce. More often, however, the application of medical skill merely postpones death for a little while; the infant who for genetic reasons was doomed to die in its first year is kept alive to die in its third. The mortality among children of the age group one to five years varies with the age at death of the parent. The longer-lived the parent is the lower the mortality among the children. Thus if the parents were such as live to eighty or more, the death rate of the children of one to five years is but one-third to a-half of that of the one to five years age group as a whole.

Next it can be shown that the sex-incidence of this mortality is unequal. For example, Prinzing (1907) has estimated that the sex-ratio of mortality in the first year of life for England is 121:100. Kroon (1917) states that the sex-ratio of mortality in the first two months of life in Holland is as high as 139:100, whilst the following table shows the Registrar-General's figures for England and Wales:

TABLE V.

*Mortality during First Year of Post-natal Life, by Age and Sex.
England and Wales, 1913.*

Age in months	Deaths per 100		Sex-ratio
	Males	Females	
0-3	67.47	51.79	131.5:100
3-6	21.64	17.82	121:100
6-9	16.81	14.04	120:100
9-12	14.22	12.59	113:100

These figures are in agreement with those of a great many investigators, and the general conclusion which emerges is that more boys than girls die during the first year of life, and that throughout this period the excess of male over female deaths steadily decreases as the end of the year is approached. There is, then, a sexually selective post-natal mortality during the first year of life which results in a selective elimination of males.

This inequality in the sex-incidence of post-natal mortality is not confined to the first year, however, as is shown in the following table:

TABLE VI.

*Mortality during Post-natal Life, by Age and Sex.
England and Wales, 1913.*

Age	Deaths per 1,000,000		Sex-ratio
	Males	Females	
0-5	35,022	29,449	113.4
5-10	3,068	3,047	100.7
10-15	1,823	1,968	93.3
15-20	2,816	2,688	104.9
20-25	3,523	3,058	115.3
25-30	4,174	3,552	117.5
30-35	5,207	4,356	119.6
35-40	6,957	5,783	120.1
40-45	9,117	7,146	127.5
45-50	12,522	9,646	132.5
50-55	17,250	13,064	132.0
55-60	24,784	18,886	131.1
60-65	36,405	27,465	132.8
65-70	51,140	40,018	128.0
70-75	83,568	68,846	121.0
75-80	125,487	102,830	121.0
80-85	175,703	152,209	114.0
85+	266,022	245,609	113.0

It is seen that in each age group, save that which includes the onset of puberty in the female (10-15), there is an excess of male deaths over female. It is reasonable to infer that the onset of menstruation is indirectly responsible for the low sex-ratio of the ten to fifteen group, and that in all groups there is a selective elimination of the male.

The amount and sex-incidence of post-natal mortality must necessarily affect the composition of a population. This is illustrated in the following table:

TABLE VII.

Population of England and Wales, 1913, by Age and Sex.

Age	Males	Females	Sex-ratio males per 100 females
0-1	404,705	396,124	102.0
1-2	383,286	377,804	101.5 101.0
2-5	1,195,270	1,191,534	100.3
5-10	1,891,801	1,894,602	99.9
10-15	1,788,908	1,894,602	94.2
15-20	1,693,711	1,721,461	98.5
20-25	1,538,431	1,712,214	89.7
25-35	2,899,804	3,198,584	81.4
35-45	2,391,988	2,568,336	89.7
45-55	1,732,989	1,875,472	92.2
55-65	1,109,286	1,240,145	89.3
65-75	615,852	774,011	79.4
75-85	187,815	275,815	68.0
85+	23,218	42,158	55.2

It is seen that the secondary sex-ratio of 104:100 becomes reduced by the end of the first year to 102, and thereafter undergoes further and steady reduction throughout the series. Only at the fifteen to twenty and the forty-five to fifty-five age groups is there discontinuity in this reduction, and these higher ratios are the reflection of the effects of menstruation and of menopause in the periods immediately preceding. The total reduction is remarkable, for a sex-ratio of 102:100 at the end of the first year is replaced by one of 55.2:100 in the 85+ age group.

Congenital malformations of the kind included under Title No. 150 of the Internal Classification of Causes of Death affect more males than females, as is seen in the following table taken

from Pearl (1903). The table shows the rate and manner in which unfavorable variations are eliminated:

TABLE VIII.

*Deaths from Congenital Malformations (Still-births excluded).
(U. S. A., 1899-1900, Twelfth Census.)*

Male		Female	
Age class	Frequency	Age class	Frequency
Under 1	1,455.6	Under 1	1,232.0
1-2	21.2	1-2	28.5
2-3	9.7	2-3	7.7
3-4	4.3	3-4	6.6
4-5	2.1	4-5	3.3
5-10	1.8	5-10	1.1
10-15	1.2	10-15	1.2
15-20	0.7	15-20	0.2
20-25	0.5	20-25	0.2
25-30	—	25-30	0.3
30-35	0.3	30-35	—
35-40	—	35-40	—
40-45	—	40-45	—
45-50	—	45-50	0.7
50-55	1.7	50-55	—
55-60	—	55-60	—
60-65	—	60-65	1.5
65-70	—	65-70	—
Total	1,499.1	Total	1,283.3

The sex-ratio is not static, but shows a definite swing from equality to relatively low throughout the age groups post-natally, this swing being a continuation of a process that has been operating natally and pre-natally also. It is difficult to ascribe this sex-difference to the presence and action of unbalanced lethal factors: all that can be said at the present time is that the female-determining sperm and the male zygote cannot compete successfully with their alternatives, being physiologically and, by implication, genetically less well equipped for their various functions. There are, however, certain genetic characters which, when in the homozygous condition, are known to be

sub-lethal, *i.e.*, they usually lead to the death of the individual during the earlier part of post-natal life. Such are brachydactyly, infantile amaurotic idiocy and xeroderma pigmentosum. Other factors affecting the post-natal viability of the offspring are the sociological, which lead to infanticide, environmental factors such as diet and general care, developmental abnormalities and pathogenic diseases.

A consideration of the different agencies which affect the reproductive rate of a population shows that in the main they are non-genetic, but pertain to the environment and to the social inheritance of a people. The pathological factors affecting fecundity, fertility, pregnancy, and infant life are such as can be removed when greater knowledge of the biology of the human and of the processes of disease has been secured. The sociologico-religious factors can be manipulated if and when it is decided to do so. Controlled fertility in any form — contraception, abortion, infanticide — is a sociological problem which has to be considered in relation to the future evolution of mankind which man is to direct. Medicine is concerned, not so much with the policy of controlled fertility, but with the means by which it is to be achieved if it is necessary or desirable. The genetic factors affecting the reproductive rate have to be considered in relation to the hereditary constitution of a people and care must be taken that a social development is not planned that shall conflict with the facts of human biology.

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DISCUSSION.

The Chairman (Dr. C. C. Little): There are certain questions which I wish to place before the Conference, not for an answer, but for thought and for research during the period to come. One of these is the interesting conclusion that decreased fecundity accompanies overcrowding. It is an interesting truth that, from the time of Darwin at least, it has been the belief that civilization has increased the fecundity of man. Therefore, is it a fair conclusion that at the present time mankind is not overcrowded because of this increased fecundity rather than because of the decreased fecundity which Dr. Pearl found in his experiments?

A second question is the decreased life-span which accompanies overcrowding. Dr. Pearl showed very clearly that his flies lived a shorter time when overcrowded. It is a rather interesting thing that all the medical and humanitarian efforts in the human race at present are in the direction of lengthening the life-span. What effect will lengthening of the life-span have upon saturation of population in any given area at any given time?

Mankind has created, by civilization and by the institution of marriage, an interesting discrepancy between an increased fecundity due to civilization and a limitation of opportunity to reproduce.

In connexion with this question of fertility and sterility, it is interesting to consider the efforts which individuals, wise and unwise, have made to control these factors; it is one of the greatly debated socio-biological questions of the present time. Is it not well to recognize that, in addition to the above-mentioned factors which control human population, there is another which has not yet been mentioned at this Conference. If I have, as I do, a constant-sized box for the breeding of mice, I find that I am unable to keep in a box of that size, even with a surplus of food, as many fertile male mice as I can fertile females, or sterilized males or females. There is in the attitude of the male mouse in full possession of his reproductive faculties a certain intolerance towards the addition to the population in his immediate neighbourhood. There is a psychological factor, in other words, even in mice, towards the addition of population beyond a certain point. The male mouse objects, with male pugnacity, resulting occasionally in murder, to the introduction of other male mice into his immediate neighborhood. I simply say that the mental factor, the attitude of a given population, or a given fraction of a population, towards the addition or subtraction of elements within that population may be the determining factor which,

overriding all these questions of standard of living or economic factors or any other, will finally shape a decision.

As long as mammals are in possession of full physiological facilities, they are inclined to have a reaction to additions to or subtractions from their immediate population. That is an interesting question, because it is wrapped up with fertility and sterility, for, if I remove the gonads of my male mice, they are entirely tolerant of the addition of other members to their society, and therefore show distinctly the interrelation between physiology and psychology in this matter.

Dr. C. P. Blacker (Great Britain): Dr. Crew suggests that a possible cause of sterility in human beings may be that the woman may on occasions absorb from the vagina spermatozoa and elaborate therefrom a spermatotoxin capable of destroying spermatozoa, thereby preventing conception. There are of course numerous processes which might also contribute to this end. I would like to mention three. The first is the question of the acidity of the vaginal secretions. It has been known for some time that certain concentrations of acid first immobilize and then destroy spermatozoa. It has also been known that relative concentrations of acid may be produced in the vagina. It is generally assumed by bacteriologists that this acid is the product of a local bacterial activity alone. It is possible, however, that this acid may be the expression of fluctuations in the acid values of the secretions of the local cells. It seems possible that such fluctuations may be produced by constitutional factors such as might be involved in variations in the national dietary. That is a question with regard to which little is known at the present moment and with regard to which I think research might yield valuable results.

The second question to which I wish to refer is the relation between blood acidity and sterility. Work is now being done in England suggesting that sterility may under certain circumstances be associated with certain degrees of acidity of the blood, which is measured in terms by the bicarbonate in the blood. In two cases such acidity was associated with chronic kidney disease and in one case it was not associated with any determinable disease. In all three cases, by giving the patient alkalis by the mouth, the blood alkali was restored to normal, the function of menstruation was restored and the women conceived. It is clear that further research on this question is required.

The third point which I wish to mention is the possible relationship between sterility and certain epidemic diseases. There are not lacking diseases which exert a selective action upon particular cells in the body. To quote a single instance, I may mention that the toxins produced in scarlet fever exert

a selective action on the kidneys. There is one constitutional disease which is known to have a selective action upon the germ cells, namely, mumps, which for many years has been recognized as a cause of sterility. It seems to me possible that certain other epidemic diseases (I am thinking particularly of influenza, which is known to take many different forms) may produce a selective action upon the germ cells which has passed entirely unrecognized up till now, by reason of the lack of inflammatory phenomena which particularly drew attention to that action in mumps. I have mentioned three of those particular processes, but there are of course many more.

I wish to reassert the proposition made by Dr. Crew that, of all the systems in the body, perhaps less is known with regard to the reproductive system than any other. The problem of human sterility is one of greater national importance than many other physiological questions which are extensively and generously dealt with in the text-books. It is therefore extremely important that research work be done on this all-important question, and I much hope that the symposium which is to sit here will take cognizance of this and will include in any program of research that it may contemplate some kind of scheme for research into the physiology of the reproductive system, with special reference to the problems of fertility and sterility.

* Professor L. Hersch (Geneva): I simply wish to ask Dr. Crew about his statement: "There is considerable evidence which points to the conclusion that in uncivilized races the breeding season is restricted and that male and female are reproductively active only during a limited period of the year." I should like to know whether statistics or other positive information exist by which this fact could be established with sufficient certitude.

Captain G. H. Pitt-Rivers (Great Britain): I should like to put forward a plea for a closer collaboration between biologists, anthropologists, demographers, and geneticists, who together, each from their own approach, have something to contribute, and whose data must be taken together in determining the causes of overpopulation and depopulation.

The work I have done has been devoted particularly to the problems of depopulation in the Pacific. I should like to suggest that an elucidation of the causes of depopulation reflects upon and is necessary in elucidating the causes of what we call overpopulation. The two processes, of course, must be taken together. I have approached this problem and consider that it must be viewed as a problem in adaptation, that is to say, in terms of the substitution of more adaptable for less adaptable

stock within the locus of given physical and cultural environmental conditions. This selective process operates within populations containing heterogeneous groups and elements where there is a differential survival of distinguishable groups.

• Demographers are inclined when they are discussing the tendencies of populations, to assume that the population in a given locus can be treated or illustrated by means of a single curve. Actually, when a sufficiently penetrating diagnosis of the factors and elements that make up that population is examined, we find that within the same area there are distinguishable groups, by which I refer not only to the ethnically distinguishable groups, but to groups that can be categorized either by reason of social grade or occupation and which show a different tendency to increase or to decrease.

In the United States of America, taking the three easily distinguishable ethnic groups — the red group, the negro group and the white group, living under more or less the same environmental conditions, the red group, or elements within the red group, may show in their curves a depression in the curve of population. In one group there may be underpopulation, whereas other groups — for instance, the black groups — may show symptoms of overpopulation.

• It is unnecessary, perhaps, to labor the point that it is demonstrable nonsense to say that a region, however demarcated or distinguished, cannot be overpopulated because it adjoins or has access to another region in which depopulation occurs. To illustrate that by a *reductio ad absurdum*, it is surely obviously absurd to suggest that Greater London shows no symptoms of overpopulation by reason of a proportion of its population being unemployed or suffering from insufficient nutrition whilst the Highlands of Scotland may be underpopulated.

When we seek for criteria of a tendency to increase or decrease in population, we can find, if we study the facts which I have been collecting for the last five years in the Pacific particularly, that there is a correlation between the tendency to increase or decrease and the sex-ratio. The sex-ratio to which I am going to call your attention is not the sex-ratio familiar to biologists. I am not dealing primarily with the sex-ratio of the total population, either with the primary or the secondary ratio, the sex-ratio at birth. The sex-ratio that I am going to suggest to you as significant is what I term the effective mating sex-ratio, that is to say, the ratio of reproductive females at the nuptial age to the ratio of reproductive males at the nuptial age.

The difference in these ratios may be illustrated by taking the white population of Australia. In 1921, the average age of bridegrooms was twenty-nine and a-half and the average age

of brides twenty-six. The census figures show 2,762,870 males and 2,672,864 females, which is an excess of 90,006 males. That represents a masculinity of 1.66. Now take the adult sex-ratio at the nuptial age of the male, that is, at twenty-nine. We get 46,179 males and 46,949 females, which is an excess of 770 females. That represents a masculinity of — 0.83. If, however, we compare the sex-ratio at the mean average nuptial age of the respective sexes, we get 46,179 males aged twenty-nine and 47,683 females aged twenty-five, which gives an excess of 1,506 females, representing a masculinity of — 1.60.

The fall and subsequent rise in the curve of the total enumerated Maori population are no indication of what is happening to the Maori stock, because actually a gradual substitution of population is taking place concomitantly with a progressive European blood infiltration. The full-blood element remains unadapted and continues to decline, and the better adapted miscegenated stock is replacing it. The sex-ratio is higher in the full-blood group than in the mixed-blood groups. Masculinity is decreasing only where the population is increasing.

One further illustration, drawn from two censuses of the New South Wales aborigines, may be given. This population decreased from 2,012 in 1911 to 1,501 in 1921, while the masculinity increased from 14.51 to 17.12. Another unfamiliar point is that, in decreasing populations, males appear to show a post-natal survival rate superior to that of females, reversing the more familiar tendency in stabilized populations where the male, as Dr. Crew reminds us, exhibits "an inherently inferior resistance to the stresses of the act of living".

Dr. F. J. McCann (Great Britain): I have come to the conclusion that those who seem to know most about this subject are the least decided in their opinion. I think it would do us all good if we made a solemn confession of our profound ignorance of the whole subject of reproductive power. We do not know the laws which govern it and we do not really know what it is. We do not know what governs its increase, its diminution or its total disappearance; but it is the factor which underlies the consideration of the whole subject of fertility and sterility.

I do not agree that the spermatozoa is the chief sex-determining agent, but believe that the ovum does play an important part.

The fertility of the female population gradually increases from the beginning of the child-bearing period of life until the age of thirty, when it gradually declines. A similar law would seem to be applicable to the majority of adults.

In comparing experiments on animals with conditions in human beings, it must be borne in mind that woman has not only

a limited fertility, but also a limited period of fertility. There are other factors which have an influence, such as changed conditions of life, and the study of these conditions and their influence on animals made by Darwin is one of the most splendid pieces of work ever done in zoology. He showed the extraordinary influence which captivity has on certain animals. The best-known example is that of the elephant. The elephant does not breed or rarely breeds in captivity, but when turned out into its native forests breeds at once.

Sexual incompatibility cannot be foreseen or prevented, but it is exceedingly common and is a very important factor in the fertility of a population. A great deal of work has been done, as you know, on the endocrine glands, and this work has a very important bearing on the question of sexual incompatibility. An individual is not sexually normal unless there is that even correlation between the endocrine glands, the sexual organs and the nervous system. It is an interesting observation that a definite period of sterility exists between marriage and the appearance of the first child. It is variously stated as from sixteen to eighteen months. In other cases it may extend to four years, when a woman is relatively sterile, or even longer, and this without any artificial prevention. During that time there is a gradual preparation for the great act of reproduction.

It is very difficult from the physical conformation of any individual to tell whether that individual has reproductive power. It is the same with animals. The finest animals may be deficient in reproductive power. Enormous sums are given for racehorses for reproductive purposes, yet they may fail when at stud. It is the same with the human being; we do not know what it is that endows anyone with reproductive power, and certainly physical conformation is no test whatever. It is a subject of considerable obscurity on which more information will doubtless be forthcoming.

* Professor Corrado Gini (Italy): It is much to be doubted whether the fall in the birth rate, observed during the last fifty years almost throughout the white race is due to voluntary causes, or whether it is also due to biological causes. A useful study for the solution of this question would be an examination of the interval between marriage and the birth of the first child. It is evident that it is especially after the birth of the first, and often after the second or third child, that reproduction is limited. The influence of voluntary limitation is much less in the interval between marriage and the birth of the first child.

Very few States give information on the interval elapsing between marriage and the first birth. There is always the possibility of special research on this subject, based on a comparison

of the date of birth certificates with that of marriage certificates. The official statistics of New Zealand, the Australian Commonwealth, and particularly Western Australia, New South Wales and also Saxony, and the towns of Dresden, Chemnitz, Amsterdam and Zurich give some information on this phenomenon. I have similar information, gained by special research, for Leningrad, for three Departments of France and for about forty Italian towns. From this information it clearly appears that for some time the interval between marriage and the birth of the first child has been much longer than formerly, and that the interval continues to lengthen.

It is understandable that if the fertility of women were at its maximum, all women would conceive immediately after their marriage, and the first child would always be born about nine months after the marriage. If, on the contrary, the fertility of women diminishes, the first births will occur at longer intervals, and there will be an increase in the percentage of firstborn who arrive after a longer period. Now it is found that these intervals are growing longer and longer and that this has become especially apparent during recent years. One may also estimate the proportion of births conceived soon after marriage to the number of marriages, eliminating those marriages where the first child is born before the marriage, or within less than nine months. This study was made for the former Kingdom of Saxony for a period of thirteen years, from 1911 to 1924. From these statistics it appears that conceptions occurring within the first three months of marriage have decreased by half. We can only explain this result by voluntary influences, that is, that half the newly married couples in 1924 succeeded in retarding the birth of their first born by contraceptive measures. This percentage appears very high, but when one considers that such practices do not always succeed, then the explanation appears unlikely.

There are countries in which the territorial differences are still more marked. The Direction Générale de Statistiques of France, having heard of the studies in which I have been engaged for several years, asked me to make a special analysis for the Departments of Haute-Garonne and Gers, where for a long time the birth rate has been very critical. An examination of the results of this enquiry reveals the fact that the probability of conception at the beginning of married life is, in the Department of Gers only two-fifths of what it is in the Department of the Côtes-du-Nord. If we follow the same line of reasoning, and explain the difference by voluntary influences, we come to the conclusion that three-fifths of the newly married couples in the Department of Gers employ contraceptive measures with success, that is, assuming that contraceptive measures are not employed in the Côtes-du-Nord. On the other hand, if it is allowed that

these measures are not always successful, one is forced to the conclusion that these differences cannot be explained only by voluntary influences. Similar results are obtained for the Department of Haute Garonne.

• A comparison of these results together with results obtained from studies in other countries, with the information available regarding the fall in the birth rate, shows that at first the fall in the birth rate seems to have no influence on the control of conception within the first months of marriage. But when the critical situation of the birth rate continues, this influence becomes evident. One cannot lay down any hard or fast rules as to how these things come about. One can only say that it seems as if the birth rate diminishes, first under the influence of external circumstances outweighing the volitional forces. Then a physiological factor appears, from which it may be supposed that the facility with which considerations leading to the limitation of birth are adopted is only one manifestation of the weakening of genetic instincts, which, in its turn, produces a weakening of the reproductive capacity.

Dr. C. B. Davenport (United States): Dr. Crew, in his valuable report, has called attention to the phenomena of intra-uterine deaths. Recent statistics have indicated that such deaths are far more frequent than we have hitherto known, even in cases where there is no possibility of disease causing the result. Thus, in mice, recent studies show that from thirty per cent in certain strains to sixty per cent in other strains of all of the mice starting development fail to be born alive. In pigs numerous counts have revealed a proportion of about thirty per cent. In the case of humans, the percentage is unknown, but is certainly large. For example, statistics indicate that about ten per cent of ovulations are double ovulations, whereas in only about one per cent of the cases are there twin births. Somewhere there occurs a heavy mortality. The fact of intra-uterine mortality is an important and significant fact.

Intra-uterine deaths, however, do not occur at random. There is evidence that embryos die because of a union of defective cells or gametes. An interesting example of this is found in the case of the yellow mice. Gametes of the yellow mice that contain the factor for the yellow coat colour, if united with similar gametes from the other parent, cause a zygote, which inevitably dies. In humans it sometimes occurs that these defective embryos succeed in being born alive, but die a few days after birth. The number of such congenital infantile defects is very great. The defect occurs in almost every organ of the body, as, for instance, in the skeleton, producing the achondroplastic dwarfs and the brittle-boned; in the blood, pro-

ducing the haemophiliacs; in the nervous system, producing the amaurotic family idiots, who generally die a few days after birth; and in the alimentary tract, producing some types of marasmic babies. Intra-uterine deaths, then, and early infantile deaths are highly selective.

We have been told that the earth is filling up fast, and one of our questions is what to do about it. Could we perhaps not draw a lesson from these causes of intra-uterine deaths, a lesson from the natural phenomena? Of good agriculturists, good artisans, good mechanics, good accountants, good tradesmen, good inventors, artists and professional workers, we cannot have too many, and we are not apt to have too many. It would seem to be a fair conclusion that we should encourage the reproduction of strains out of which such classes spring. But in families, and there are such, which produce prevalently feeble-minded or epileptic children, or children suffering from other types of insanity, and ne'er-do-weels, we may well discourage reproduction. If necessary, society may avail itself of the method of sterilization, properly controlled. The life of the commonwealth takes precedence over the right of reproduction of the individual. The program of the World Population Union will not be complete unless it takes into account, not quantity of population only, but quality also. Human efforts at control of reproduction should be selective.

Professor Roswell Johnson (United States): With the inevitable further spread of contraception, the sex impulse alone will prove quite inadequate to keep up the required birth rate. The extraordinary decrease in the birth rate raises the pertinent question, "Is there an adequate motivation for child-bearing?" Leta Stetter Hollingworth, some years ago, concluded there is not, that the present motivation needed supplementing. The situation is so tragic, if her fears are correct, that that is the problem I have chosen to consider in this contribution.

My method has been to request letters or obtain interviews, giving the factors motivating and inhibiting the birth of a fourth child outside the obvious one of economy and health, from a selection of fathers and mothers representing all sizes of families and nearly all degrees of activity and interest outside of the home. These letters listed all the motivations and inhibitions that I have independently been able to find. The reason of asking about a fourth child was because a motivation strong enough to produce only one, two or three children is inadequate in view of Dublin and Lotka's finding that 3.15 births per fertile couple are necessary to maintain the population of the United States. The list is as follows. First, parental instinct. This is recognized as one of the two most frequent motives. It is variably stated,

some apparently not recognizing it as an instinct. Some of the expressions are, "desire for a baby and small children as the others are growing up"; "likes the feel of a baby in her arms"; "love and longing for more babies and children"; "likes the idea of a baby in the house"; "desire to have youth around as one grows older". On the other hand, many reflective and analytic parents, after having had one, two, or three children, weighing the cost, consider this satisfaction and find it not strong enough to motivate another conception.

A second leading motivation is that of the inadequacy of a set of children, all of one sex, since it is widely desired that both the sexes should be represented in the children. Nearly all correspondents mention this. In fact, it seems highly probable that one of the commonest causes of the two-child family is that there was a child of each sex represented. When the first two children are of one sex, a third child is frequently desired. When all three are of one sex, we may have such a case as is referred to in "several of my friends have been almost obsessed in regard to having a boy, the So-and-So's, for instance, with three girls".

Thirdly, related to the foregoing, there is the desire to have a second child of each sex to provide a play companion of the same sex. This is much less common and less strongly felt and may be in some cases a rationalization of other motives.

Fourthly, the fear that death might reduce the family below the desired status.

Fifthly, "curiosity as to what the child would be like". It is probable that this is closely allied to the maternal instinct.

One of the conclusions was that we need a better-balanced attitude toward contraception. The mere legalization of knowledge of contraception will not suffice to get contraception well distributed among the parents who bear inferior children. We need a strong effort nationally and internationally to spread contraception in order that it may be more widely available to ignorant people. Unfortunately, much of the agitation to this desirable end goes much too far in that it fails to acknowledge and deplore the widespread abuse of contraception. Much of the argument ignores the very rapid spread of contraception regardless of proposed legal changes and propaganda and still mistakenly preaches more indiscriminate reduction of the birth rate for its own sake, a thing which is going on willy-nilly so widely that it will be overdone. The efforts should be concentrated on bringing about a better distribution of contraception, getting it more in use by the inferior and less in use by the superior.

Mr. J. B. S. Haldane (Great Britain): Possibly certain other dietary causes besides those mentioned by Dr. Crew play an important part in determining sterility. Those which I think he mentioned were a lack of the specific vitamin E, which apparently plays an important part in reproduction, and also diets, leading to great fatness, especially in females. In rats, at any rate, there is very definite evidence that you may get sterility from an excess of proteids in the diet. That to some extent can be compensated for by large amounts of one of the water soluble vitamins; but since the diet of the richer classes in Europe and North America invariably contains a good deal more protein than that of the poorer classes, it is conceivable — I say no more — that such an excess may have an influence in lowering the fertility of the well-to-do classes. I should like at once to say that the thing can go the other way. Rats, for example, put on a diet of the type adopted by human vegetarians, generally become quite sterile. Animal experiments strongly suggest that differences in diet may have something to do with the differences in fertility of different social classes.

Dr. Boleslav Rosinski (Poland): It seems to me that it would help the work of the Conference if I presented here some results of the studies which have been made by modern anthropology. These results throw light on questions of progeniture, fertility and sterility. They have been carried out in a population which, from the point of view of economic, social and ethnographic conditions, is of a particularly uniform character, that is, a population of peasants inhabiting the central region of Poland. (See Supplementary Paper, page 249.)

Dr. R. Engelsmann (Germany): It is very difficult to determine at the present time the fertility of the human race. The birth rate depends very largely on preventive methods. This factor is equally difficult to determine, and only estimates can be made. The figure for births depends very greatly on the figure for miscarriages and abortions. That figure can be determined where registration of miscarriages takes place, as, for instance, in Germany by the midwives. We need international regulation in this matter. Such regulation should tend towards giving us the possibility of studying the figures for miscarriage in the various countries. These figures are fluctuating, as we have seen during our investigation. They vary according to the economic situation and rise with the increasing number of conceptions. The birth rate falls where the number of members in a family is higher, and the number of abortions increases in such families.

The number of births of twins or more than one child at a time used to be thirty per cent of the children born for Kiel and Breslau; after 1919 this figure was only sixteen per cent; the figure for miscarriages in Kiel, and indeed for the whole of Germany, used to be about fifteen per cent of all births; to-day that figure is thirty-five to forty per cent and even higher. The figures for births would not have decreased if the miscarriages had not been chiefly responsible for the decrease in the birth rate. These investigations were undertaken in connexion with my work on the Federal Committee on Large Families in Germany.

Dr. Vincent Naser (Denmark): I cannot refrain from emphasizing the plea which has been made here for empirical research with due allowance for all causes both natural and artificial. I think we can all agree that the discussions which have taken place have shown the desirability of standardizing the statistics of sterility, of abortions, of differential birth rates, and of all the other conditions concerned; standardizing our methods internationally and agreeing on definitions.

*** Dr. Léon Bernard** (France): May a doctor be permitted to join in this debate?

We have heard here men of science belonging to very different orders. We have heard economists voicing the notion of the provision of foodstuffs remaining in the world, just as if one can tell what form nutrition will take a hundred years hence. Can we talk about the future food resources? It is as if someone a hundred years ago had tried to estimate the future provision of fuel by taking coal only into account. Do we know what will be food in a hundred years' time?

The founder of experimental medicine, Claude Bernard, established a fundamental principle that the results of experiments with animals could only be applied to man with very great prudence and in certain defined conditions. That is the more true when it is no longer a question of individual experiment, but of experiments bearing on the whole social group. Then the prudence exercised should be all the greater, for really no kind of comparison can be made between a society of flies (a society which is not even spontaneous, but observed experimentally under conditions laid down by the person making the experiment) and human society developing itself, with all its complexity of factors.

I think that the sciences of medicine and hygiene have not been given sufficient and rightful consideration in the problem of population. Medicine and hygiene enter into these three elements of this problem; natality, mortality, migration.

Let us take the first of these three elements, natality. Medicine has a capital part to play here. Do not believe that heredity, in any very general manner, plays a considerable role in the phenomena of human life or, at least, in the pathological phenomena. The capital role of heredity is in physiological phenomena, but it plays a very restricted part in pathological phenomena. I attribute to heredity the effects on the nervous system produced by syphilis and drug addiction. Outside this, pathological heredity is of little account; it does not prevent the persons subject to it from leading a full and fertile life, useful for human progress.

Allow me to speak for a minute of tuberculosis. I tell you that the offspring of persons afflicted with tuberculosis have the same vital value as the offspring of normal persons. All one has to do is to safeguard them from contagion.

Although I say that heredity has little influence on morbidity other than syphilis and nervous diseases, I certainly consider that it plays a very important part in these cases. Syphilis is a factor of sterility, it is a factor of still-births, it is a factor of infant mortality. But it is up to us to struggle against these factors by means of a good anti-syphilitic organization. This struggle would be enough to bring about a considerable revival of the birth rate.

As for mortality, there exist prophylactic measures against infectious diseases by which the dangers of infection are completely changed. The future of inoculation against specific diseases is more or less indefinite, and the amount of progress already realized in typhoid and diphtheria anti-toxins and in smallpox vaccination is only a beginning. Very soon, perhaps, thanks to Calmette, inoculation against tuberculosis will be possible. There is opening an immense future in the organization of public hygiene for inoculation against specific diseases, which will enormously reduce mortality.

Dr. C. C. Little: Dr. Pearl pointed out that he did not seek to force conclusions obtained in experimental work with insects upon humans. He merely desires, as I believe all true biologists desire, to serve, and the medical men would surely be far from honest if they failed to acknowledge their great debt, especially among the French themselves, to the great biologists who have used their findings for human welfare.

Dr. F. A. E. Crew (in reply): Dr. Blacker very rightly called attention to the possibility of local conditions in the female passages affecting fertility. I ought to have remembered that because, when working a year or so ago on the problem of the migration of the ovum in the rat, I was driven to the

conclusion that migration was rendered impossible because, in its passage from one side to the other of the uterus, the ovum must necessarily pass from one kind of chemical atmosphere to another.

Professor Hirsch quite rightly asks me for my authority. I have to confess that this, which I allowed to be presented as scientific orthodoxy, is at least second- or third-hand. I wish merely to hand on the responsibility for these figures to Carr-Saunders and Marshall in their work on population and the physiology of reproduction.

Captain Pitt-Rivers had something of profound importance to say on this question of sex-ratio, because he is engaged in a piece of work which must show in the clearest manner the effect of certain social and physiological conditions upon the delicacy of a mechanism. I was reminded as he spoke of the fact that such a phenomenon as crossing-over is affected by age. One may assume that the delicacy of a mechanism of a cell organ deteriorates with age and other unfavorable conditions. I should have liked to hear him speak longer and perhaps suggest that here was a race which was presenting certain signs which could be regarded according to various standards as a decline, in which not only were there social organizations undergoing a change, but indications of an impaired delicacy of operation on the part of cell organs.

I agree with Dr. McCann that one is not justified in dogmatizing about the role of the ovum in sex determination. I can merely state that, in my considered opinion, the evidence presented by the phenomenon of sex-linkage and non-conjunction allows me to assume that the most reasonable explanation of a sex-determining mechanism is that sex in the case of humans is mainly determined by dimorphism of the sperm, but I am only too willing to pause and to discuss in my ignorance the possibility that the varying physiological conditions of the ovum may override that sex-determining mechanism which usually operates.

I have never used, unfortunately for my own education, the human as experimental material, and I am not sure that I know much about my animals, but this much is certainly true, that I have great difficulty in my animals — and apparently also the difficulty exists in the case of humans — to ensure ready conception immediately after sexual maturity and opportunity. I have always tried to be simple in my explanations, and I regarded this as being due to clumsiness. It is interesting that the interval is not the same as that between subsequent conceptions, and there again one has a field of very interesting enquiry, in that a woman who has borne a child is not the same as she was before. That is about as far as one can get.

The obvious, the manifest fact that emerges is that we know so little that we all hold divergent opinions and that it really is time that we discussed these matters and, having discussed them, got to work in the way of critical experimentation.

SUPPLEMENTARY REMARKS.

Professor Raymond Pearl (U.S.A.): There are only two points which may possibly be developed a little further:

1. In Dr. Crew's paper is this statement (see page 220): "When all allowances have been made for the effects of food and housing and of environment generally upon fecundity, the fact remains that this is a genetic character and therefore must be considered in all discussions concerning the constitution of a population." While this is undoubtedly true, its form of statement may perhaps tend to obscure the fact that the observed fecundity of an animal may be profoundly modified by environmental circumstances, to such a degree indeed as to make impossible any just estimate of the true genetic degree of fecundity under those particular circumstances. Many years ago I showed that the fecundity (egg production) of genetically homogeneous groups of hens could be significantly altered by relatively small differences in density of population. The work of Dr. Arato Terao in my laboratory during the past year has demonstrated that the egg production (fecundity) of genetically homogeneous groups of *Drosophila* can be reduced almost to the vanishing point by increased density of population. There is statistical evidence that the fecundity of the human female is adversely affected by increasing density of population. These facts do not in the least invalidate the conclusion that fecundity is an inherited character. They merely show that it is a character whose expression is capable of profound modification by environmental conditions, a fact of which Dr. Crew is well aware, as is shown by the concluding paragraphs of his paper.

2. I should like to record my general agreement with Dr. Crew's remarks regarding differential fertility. The critical student of human biology recognizes that other environmental factors besides conscious and deliberate contraception play important roles in bringing about observed differences in the fertility of different social classes. I do not

find myself quite so certain as Dr. Crew seems to be that there are no genetic differences in fertility between the different classes. The forces which determine the social class to which a person belongs are, in a statistical sense, in some part biological, and may involve correlations with fertility. Thus the classes which exhibit statistically the highest fertility rates are also the classes which statistically have the best physiques. Is it not possible that we have here the expression of a real biological correlation, of which the basis is genetic? I raise the point not to disagree with Dr. Crew's conclusion, which may be right, but for the purpose merely of expressing the feeling that the evidence at present available does not quite justify a final positive conclusion. It is a matter that wants further investigation, I think.

ANTHROPOGENETIC SELECTION

by

Dr. B. ROSINSKI.

This study of anthropogenetic selection is based upon research undertaken in the Polish population of the district of Paltusk (Palat. Warsaw). The examination was made in the western part of this district and concerns more than 800 families, 633 of which are complete families.

I have thus been able to study the principal points concerning the anthropological analysis of the population, the morphological and physiological features of each type and matrimonial selection in special types.

In making the anthropological analysis, I have employed the method of resemblance¹ which is based on the principle that elements belonging to the same type have a positive coefficient of resemblance between them, while elements belonging to different types have a negative coefficient.

¹ JAN CZEKANOWSKI. *Zarys metod statystycznych*, Warsaw, 19, p. 163.

Our population shows the following types:

TABLE I.

Anthropological Types in the Polish Population of Paltusk.

Types / % in the series	nordic (α)	Pre-slave western race (β)	Sub-nordic (γ)	Alpine (ω)	Laponoidal (λ)	Mediterranean women also dinaric
Masculine . .	31.9	27.5	21.3	15.0	3.8	0.5
Feminine . .	23.2	26.1	24.4	16.3	9.5	0.5
Difference . .	+8.7	+1.4	-3.1	-0.7	-5.7	0

We see a difference of percentage in the figures for masculine and feminine. In the masculine series, the nordic type is most frequent; then comes pre-slave (β), sub-nordic (γ), alpine (ω), laponoidal (λ) and so on. Amongst the women, pre-slave (β) stands first, then sub-nordic (γ), nordic (α), alpine (ω), laponoidal (λ) and so on. Since emigration affects men more particularly, we may conclude that the women represent the older types, while the men represent the tendency towards change showing in the anthropological composition of our population. This tendency is due to the pressure of the nordic elements on all the other elements. The Polish population is completely different from that of Baden, described by O. Ammon, where the nordic elements leave the country for the town. But the Poles are not attracted by town-life.

The fundamental types of our population are nordic (α), pre-slave (β), sub-nordic (γ), alpine (ω). These types differ in length of life. The pre-slave type has the longer life, the alpine type the shortest. The nordic type matures slowly and lives long. In the feminine series, the types in length of life come in the order β, α, γ, ω. This is true for the majority. Also we see a difference in the families of the anthropological types. The sub-nordic type has more children than the other types.

The family increases up to a certain age (men 60, women 45), later it diminishes; though in the pre-slave type and with women also in the alpine, the family continues to increase still later. This is because, in the nordic and sub-nordic types, selection due to external factors (tuberculosis in the nordic type) begins

and ends earlier than in the pre-slave type. In matrimonial selection, there is a marked tendency for like types to marry. The coefficient of anthropological resemblances in marriage is $C = +0.3105$.

Marriages amongst sub-nordic types have the largest coefficient. These types are the most exclusive in matrimonial selection. Table III shows that the nordic (α) and sub-nordic (γ) types rarely cross with other anthropological types, especially avoiding the pre-slave. The other types (β ω λ) are not so exacting. We have not been able to discover whether a tendency to more numerous families occurs in marriages where both belong to the same types. We have not enough unions of special types to furnish an answer.

Table IV, after eliminating the differences of age, does not show us whether the union of like types tends to give a more numerous family.

TABLE II.

Matrimonial Selection amongst Anthropological Types.

♂ / ♀	α	β	γ	ω	λ	n
α	+ 68 (47.28)	31 (40.26)	19 (31.60)	+ 23 (22.24)	+ 6 (5.62)	14
β	42 (52.75)	+ 64 (44.92)	31 (35.25)	21 (24.81)	6 (6.27)	164
γ	47 (49.85)	30 (42.45)	+ 59 (33.32)	18 (23.45)	1 (5.92)	155
ω	28 (32.82)	+ 29 (27.94)	16 (21.93)	+ 22 (15.43)	+ 7 (3.90)	102
λ	17 (19.30)	+ 18 (16.43)	10 (12.90)	+ 11 (9.08)	+ 4 (2.29)	60
n	202	172	135	95	24	628

$$C = 0.310.$$

For special types the coefficients are different.

TABLE III.

The Coefficients of Matrimonial Selection amongst Anthropological Types.

$\delta \backslash \gamma$	γ	α	ω	λ	β
γ	+ 0.633	- 0.036	- 0.088	- 0.148	- 0.157
α	- 0.180	+ 0.403	+ 0.013	+ 0.012	- 0.105
ω	- 0.098	- 0.070	+ 0.124	+ 0.109	+ 0.002
λ	- 0.060	- 0.042	+ 0.046	+ 0.076	+ 0.030
β	- 0.556	- 0.118	- 0.060	- 0.008	+ 0.241

TABLE IV.

Proportion of Children from Marriages according to Anthropological Types (Differences in Age eliminated).

$\delta \backslash \gamma$	α	β	γ	ω	λ	n
α	6.61	6.32	7.08	5.48	3.98	6.29
β	6.83	6.38	6.05	5.86	8.15	6.40
γ	6.25	7.03	7.04	6.65	—	6.76
ω	6.32	6.76	6.60	5.50	6.35	6.27
λ	6.53	6.26	5.91	7.21	5.01	6.33
n	6.51	6.43	6.64	5.94	5.88	

It may be that social considerations, rather than the expectation of having children, decide matrimonial selection. Morphological features have more weight than the physiological, the possible family.

We see, however, that in marriages between men and women of nordic type, the unfertile marriages are ten per cent less than when a nordic man marries a woman of another type.

TABLE V.

Proportion of Sterile Marriages (Differences in Age eliminated).

$\delta \backslash \gamma$	α	β	γ	ω
α	3.6	5.6	3.1	3.1
β	4.0	4.5	0	4.2
γ	12.5	4.0	2.1	0
ω	14.5	5.6	0	0

FIFTH SESSION

Chairman: Professor E. MAHAIM.

Paper presented to the Conference:

INTERNATIONAL MIGRATION AND ITS CONTROL, by Mr. Albert
Thomas.

Supplementary Paper:

THE PRINCIPLES OF MIGRATION RESTRICTION, by J. W.
Gregory.

INTERNATIONAL MIGRATION AND ITS CONTROL

by

Mr. ALBERT THOMAS.

1. Migration and the population problem;
2. The present trend of migration;
3. The quest for solutions;
4. Conclusions.

I. MIGRATION AND THE POPULATION PROBLEM.

It would be as difficult to consider the population problem without touching on migration questions as it would be to deal with the latter without taking account of demographic factors. Migration is to a large extent the result of population conditions. At the same time, it constitutes one of the essential elements in the population question, along with such other factors as birth and death rates.

If, therefore, an attempt is to be made to lay the foundations of a rational population policy, the formulation of an emigration and immigration policy is no less essential than that of a policy in regard to the birth rate, public health, etc. It is true, of course, that measures taken for the regulation of migration movements would not of themselves suffice to solve all population questions, but if the possibility really exists of laying down a rational population policy, it is certainly no less possible to establish one in regard to migration.

Of all demographic phenomena, migration is the most susceptible to direct intervention and control. The rate of births and deaths is a factor on which it is impossible to exercise any profound influence at short notice. On the other hand, migration movements have throughout history been susceptible to external checks and stimuli. Thus, in past ages, considerable migration movements have been brought about by wars, invasions, religious and political persecutions, as well as by every important advance in colonization or industrialization. Similarly, in our own day, considerable migration movements have been caused by the world war and its political after-effects. Refugees from Eastern Europe and the Near East have been forced to move westwards; wholesale exchanges of population prescribed by treaty have taken place between Greece and Bulgaria, and between Turkey and Greece. More recently, important programs have been drawn up for the encouragement of migration and colonization within the British Empire, and the British Imperial Conference has expressed the opinion that by such means a better distribution of the white population of the Empire may be secured. Moreover, measures adopted by various Governments, especially during the war, have had far-reaching effects on emigration and immigration. Countries the inhabitants of which normally emigrate in large numbers, like Italy, put a stop to practically all emigration during the period of the war, whilst countries which normally receive immigrants, such as France, succeeded in creating a labor supply from sources which hitherto had been untapped. On the other hand, the recent "quota" legislation in the United States has barred the way to immigration from Europe.

The importance of such developments as these cannot be overlooked. They deserve careful study, in order that the various lessons to be learnt from past successes and failures may be brought to light. The more thorough our knowledge of the manner in which migration movements naturally and spontaneously develop if left to themselves the easier will it be to regulate and control them by systematic action. Such movements are not due solely to the volition of the emigrants themselves. In the majority of cases, indeed, they arise from or are determined by factors which completely override the will of the individual and which need thorough elucidation. The studies and reports which have been published in a number of countries, and the information of an international character which is now available, already make it possible to discern cyclical variations in the general development of migration movements, involving alternate acceleration and retardation. A thorough analysis of the causes of such fluctuations and the manner in which they operate, their rate of development and their comparative

relationship with other cycles (business cycles, seasonal movements, variations in the unemployment figures, etc.) is necessary. Such an analysis is, at the present day, essential to the study of the main economic and social problems with which mankind is faced.

2. THE PRESENT TREND OF MIGRATION.

At the present day, migration movements are undergoing a very thorough transformation. The more or less anarchic freedom with which, until recently, they proceeded is now decreasing, and the Governments are tending to subject them to increasingly strict control. The characteristic tendency of the present period consists in the supplementing and, in some cases, the replacement of the spontaneous movements on which migration has hitherto generally been based, by political intervention and conscious and methodical planning. The State no longer follows a "*laissez faire*" policy, but has in almost all countries made attempts to grapple with migration problems by means of detailed regulations based on a definite national policy.

Emigration and Immigration Policies.

The emigration or immigration policies pursued by the various States are based on their national interests. Some countries, such as Italy, endeavor to turn emigration into an asset to the community by extracting from it the maximum advantages with a minimum of loss, both for the country and for the individuals concerned. Emigration thus "disciplined" tends to develop into a means of national expansion, through which concrete economic and political advantages are expected to accrue to the nation as a whole — the return of savings to the mother-country, an increase in the country's influence abroad, the creation of markets for national exports. At the same time, the emigrants are formed into groups and subjected to supervision with a view to the preservation of their national character and civilization. Other countries, such as the U.S.A. and France (though in the latter case more timidly than in the former) are adopting a protectionist policy, comparable to that on which Customs tariffs for the protection of national industries are based. They subject the immigrants to a process of sifting and selection in their native countries, and only admit them subject to severe restrictions in regard to number and personal qualifications. These restrictions, which are

determined in accordance with the national interests of the immigration country as a whole (maintenance of the standard of living, protection of the labor market from violent fluctuations, etc.), are sometimes suddenly and unexpectedly modified. The aim in view is to absorb the immigrants into the community with the greatest possible rapidity or, if absorption and assimilation are impossible, to ensure their departure. The immigration of Asiatics is subjected to specially strict control, the normal restrictions in regard to immigrants in general being supplemented in their case by special restrictions, the aim of which is to avoid the effects which result from collisions and intermixture between races.

This evolution from practically complete liberty to increasingly strict regulation by collective and national action has had a very considerable effect on migration. Its extent and its character have both been profoundly modified. On the one hand, the total number of emigrants is falling in comparison with the period immediately preceding the world war, the fall being, generally speaking, mainly noticeable in the case of the migration of persons who intend to stay a long time abroad or who are going to distant countries, leading for the most part to permanent domicile. On the other hand, freedom of the emigrant to act as an individual, to move from place to place, to seek work or to settle abroad, is becoming increasingly subject to the consent of official bodies, which consider his case from the point of view, not merely of his own personal interest, but still more from that of the economic, hygienic, ethnical, moral, military and other interests of the nation. The measures of collective control which are taken are not always solely restrictive in character. In some cases, on the contrary, their object is, up to a certain point, to compensate for the more or less paralyzing effects of official regulation. A number of Governments or communities are making efforts either to find openings for portions of their population or labor supply or to supplement their population or labor supply from abroad. This has been the case particularly in the British Empire, the colonization program of which has already been referred to. Group migration, based especially on collective recruitment, is being carried to considerable lengths and is becoming a fairly general practice. In the case of a number of the migration movements which are taking place within the Continent of Europe (e.g., migration from Poland and Central Europe to France) this method is tending to assume greater importance than the spontaneous migration of individuals. It seems also to be making its appearance in the various currents of overseas migration, particularly in those proceeding from the various European countries to South America.

Conflicting National Policies.

As migration has assumed an increasingly national character, it has become a cause of disputes and collisions between different countries. Where such disputes arise they involve, not merely the individual migrants directly concerned, but, to a far greater extent than in the past, the Governments and public opinion of the respective countries. Not only do national interests conflict, but differences in regard to questions of principle arise, owing to the claims of national sovereignty and differences of opinion regarding national rights between the emigration and immigration countries.

Although hitherto such differences of opinion have not degenerated into open quarrels, serious international difficulties have nevertheless arisen in recent years in connexion with migration problems. Thus, the application of the latest American immigration law led to protests on the part of a number of countries and the policy of exclusion pursued in regard to Asiatics in the United States particularly, and also in certain other countries such as Australia, has given serious offence to Japan and inflamed opinion in that country to an alarming extent. Similarly, the adoption in France of a new law on nationality has been denounced in Italy as a menace to Italian emigration, whilst the emigration policy pursued by the Italian authorities has sometimes been regarded as incompatible with national sovereignty in France, Brazil and other immigration countries. Questions concerning the establishment of Germans in Poland and the immigration of Poles into Germany have been discussed at great length and have made relations between the two countries more difficult. The above examples suffice to indicate the increasing importance assumed by migration problems as a source of disagreement between nations.

International Agreements.

With a view to smoothing out such difficulties, negotiations between various States have taken place and have resulted in the conclusion of bilateral agreements (labor and emigration treaties). Since the end of the war, treaties or agreements of this kind have been concluded by France with Poland, Italy, Czechoslovakia, Belgium and Austria; and by Italy with France, Brazil, Luxemburg, the Serb-Croat-Slovene Kingdom and Albania. A number of countries have followed this example and have concluded other agreements.

Such conventions owe their origin primarily to a certain coincidence between the interests of countries suffering from surplus population or labor supply and others in which a deficit has made itself felt. Moreover, the conclusion of a number of them must be regarded as due at least in part to the establishment and activities of the International Labor Organization. It is fair to assert that the decisions which the International Labor Conference has taken for the general protection of emigrants have helped to facilitate the solution of a number of difficulties of secondary importance arising out of migration, e.g., between France and Poland (Protocols of February 20th, 1925, concerning emigration and labor questions) and between Germany and Poland (recent negotiations concerning the insurance of emigrants against industrial accidents).

3. THE QUEST FOR SOLUTIONS.

Nevertheless, serious latent conflicts of interest still exist which it is beyond the power of international social legislation to solve, or even, in many cases, to mitigate.

The International Problem of To-Day.

The conflicts referred to are primarily political in character, seeing that they involve differences of opinion in regard to national sovereignty and national interest. The principal claims in opposition may be stated as follows:

(a) The sovereign right of an immigration country to pursue its own population policy without outside interference, to admit only such persons or races as are considered capable of maintaining local traditions, customs and ideas of morality, and to fix limits to the numbers of immigrants who may be so admitted from the respective emigration countries;

(b) The right to exist of overpopulated communities less favorably situated or incapable of fully utilizing their own resources, and which desire in consequence to settle their surplus population in foreign countries, but are not prepared to see their emigrants lose their nationality too easily in consequence of their departure from the home country.

These two conflicting policies, based on the idea of national sovereignty, both appear somewhat extreme. They inevitably

provoke a query as to whether a people has a natural right to reproduction beyond the limits of its own economic resources and to overflow into foreign countries and whether, on the other hand, a people has a natural right to maintain a hold on territory which it does not exploit and from which it is incapable of extracting the maximum yield. The results of such extreme claims and the antagonisms to which they give rise are plainly visible; sparsely populated territories are to be found geographically adjacent to territories suffering from extreme overpopulation, and a surplus of persons belonging to a particular sex or age group in one country exists simultaneously with a deficit in others. The resulting instability and lack of balance may become aggravated if no remedy can be found.

In the face of such problems, it is natural to indulge in dreams of a world organized on rational lines and populated in accordance with local fertility and productive capacity, regardless of the practical difficulties which necessarily stand in the way of their realization. Such ideas do not appear as yet to have exercised a very serious influence on Governments. They have, however, inspired a number of recent statements by individuals, especially at the meeting of the International Migration Commission (Geneva, August 1921), at which the Brazilian delegate declared that it was urgently necessary to "discipline migration in the higher interests of mankind", and also at the International Labor Conference in 1921 and 1927. They also appear latent in a good deal of the discussions which took place at the International Economic Conference, where, although the Conference abstained from dealing with the problem as a whole, there was a very general consciousness of the fact that a number of the world's existing difficulties result from defective distribution of population. To similar ideas may also, to some extent, be attributed various steps of a practical kind, and so far of limited scope, to which reference has been made above, e.g., the assistance of refugees and the plan for a better distribution of the white inhabitants of the British Empire.

International Control.

Has the moment yet arrived for considering the possibility of establishing some sort of supreme supernational authority which would regulate the distribution of population on rational and impartial lines, by controlling and directing migration movements and deciding on the opening-up or closing of countries to particular streams of immigration? This would no doubt be the logical solution, but it will probably be thought premature or Utopian. Its realization under existing circum-

stances would meet with obstacles which seem insurmountable: It may be no more than an ideal, to be attained only at an indefinitely distant date. But if it be no more than an ideal, it is at least an ideal which can and should serve to direct our deliberations and our efforts.

Even at the present moment, it ought to be possible to formulate in very precise terms a certain number of general principles or policies which, after thorough discussion, would provide a means of settling migration questions in a rational and enduring manner. The following are suggested by way of example:

(a) Individuals should be entitled to leave their home country and settle abroad only under certain conditions, the idea of absolute freedom to proceed from place to place being no longer valid under modern conditions and therefore quite impracticable.

(b) Under certain fixed conditions, an international authority, whose intervention would previously have been agreed to by the parties of their own free will, should be entitled to lay down the conditions under which territory lying within the sovereignty of a given State and obviously unoccupied might be thrown open to certain classes of emigrants. There would be no question of any offence to national sovereignty, it being taken for granted that the countries concerned would have become permeated by the new international spirit and would have agreed in the general interest to collaborate in securing international justice.

(c) On the other hand, and subject to some supervision, every immigrant-receiving community would be entitled to exercise a right of selection, as the vital principles of the different States should certainly not be threatened by invading swarms of migrants.

(d) International rules concerning naturalization and assimilation accepted by common consent might, failing a policy of compulsory birth control, form a protection against excessive growth of certain sections of the world population where such growth may represent a danger for neighboring communities.

4. CONCLUSIONS.

The principles laid down above represent, of course, only the outline of an international program and would require considerable elaboration and thorough discussion. It is, however, considered that the following conclusions may already be adumbrated:

1. Migration problems and population problems are inseparably bound up with each other. Migration is not in itself a panacea for the world's population difficulties, but it is nevertheless one of the chief remedies to be considered.

2. An attempt should be made to tackle the migration problem, and this attempt should be made internationally. The question is one of peace or war. If no action is taken, fresh wars, perhaps even more terrible than those which the world has recently experienced, will break out at no distant date.

3. In dealing with the problem, there should be no tendency to generalize. To attempt to remodel the world on artificial lines would be absurd. Natural and traditional factors, existing movements and tendencies must be taken into account; migration problems are made up of particular cases.

4. These particular difficulties must be courageously handled as they arise. The assistance of outside bodies must be utilized to solve them in the interests of peace. Practical internationalism is still too weak and the theory underlying it has not yet been adequately thought out. An attempt must be made to establish this theory and to make it part of the common traditions of mankind.

5. The guiding principles can only be determined on the basis of an exact knowledge of the facts. An international scientific centre or institute must be established, the primary task of which would be to study and to elucidate migration problems in their national and international aspects. The partial and uncoordinated enquiries of the present must be extended and combined in order to throw adequate light on the complexities of the existing situation. A systematic attempt must forthwith be made to explore certain problems of great importance, particularly:

The part to be played by national and international regulation, the manner in which such regulation should be applied and the restrictions to which it should be subject;

The relationship between the supposed over- or under-population of a given country and the theoretically ideal density of population (necessitating research concerning the optimum density of population in a given country and its distribution in the world as a whole);

The effects of contact and intermixture between different races and civilizations;

The effects of the population situation in a particular group on its tendency to emigrate (and the possibility of prognostication in this respect);

The form, rate and recurrent fluctuations of migration movements: their historical progress, cyclic fluctuations (or crises) and seasonal variations;

The existing migration crisis, its causes and effects;

Effects of emigration and immigration on the state of the labor market.

6. A further task of a more delicate, but also of a still more important, character would devolve on such an international centre. So long as the establishment of a supreme migration tribunal responsible for giving opinions in cases of dispute between different communities remains out of the question, the international centre would have to make constant and untiring efforts to acquire the necessary authority to enable it to determine the requirements of peoples and to propose means by which they might be satisfied. For this purpose, international scientific enquiry is all the more necessary in that the susceptibilities and apprehensions which exist in regard to migration questions can only be appeased, and the way to a settlement of urgent difficulties can only be opened, by action of a general international character inspired by a spirit of the most complete impartiality.

DISCUSSION.

The Chairman (Professor Ernest Mahaim): Population questions cover a wide field. I do not think that I in any way cast aspersion on previous speakers if I say that, up to the present, the point of view which has dominated the debates is that of natural science. To-day we approach the question from another side, a side which is particularly human, particularly social. We have the honour and good fortune to have as a speaker Mr. Albert Thomas, and I have no need to sound his praises to you here or to remind you of his great activity. He will present a summary of his report. The question that we have to deal with to-day is one to which a population conference should pay great attention. Human migration is not only a natural phenomenon, or only a phenomenon of race, but is essentially a social phenomenon, which to-day involves problems of international politics on which the future depends, whether it be peace or war. It is the fundamental basis of a particularly

human problem that we have to study. The Conference will not attain its object if it is content with confining its attention to general problems, I would even say, to problems of pure science. We have another duty before us. We shall hear the concrete propositions which Mr. Albert Thomas has to make, that our work may not be simply of a temporary and passing nature, and I forthwith call on the eminent Director of the International Labor Office.

* Mr. Albert Thomas (Geneva) spoke as follows: I am speaking here as a free man, as a citizen of the world, if you will. I am not speaking as the Director of the International Labor Office.

The International Labor Office has a very definite task, that of protecting emigrants and immigrants, a task in which, on several occasions, it has been asked to limit its action. In truth, the facts show that this protection obliges the Office to consider a number of vaster problems, and often the problems of protection have been the means of solving wider problems of a political and social nature. The International Labor Conventions concerning emigration, the bilateral or multilateral treaties between States, extend to an infinitely wider field and sometimes offer solutions for these problems.

This Conference is of a purely scientific character, and I am not a man of science. How is it, then, that I am speaking here? Because in my own country, even before I was called upon to occupy an international post, I had an absorbing interest in the problem of population. I am French. France used to be the most populated country in Europe and consequently its policy was essentially international. Both in the reign of Louis XIV and at the time of Napoleon, France was superior to other countries in the size of its population. Since that time France has had a population problem. Before the war this was due to the state of affairs in Europe and the possibilities of military defence. Since the war, it has been due to questions of industry, of labor supply, of the fact that France possessed certain means of production which perhaps she had insufficient labor force to develop. Thus a Frenchman is led to look for some practical solution of the problem of population.

Is there an optimum population for a given standard of life? When people have a certain economic or idealistic mission, when they think they have a certain part to play in the world, should not the state of the population be such as will enable them to play this part? This is a question which should be put forward at times of general elections when the political conscience is active. I believe that emigration and immigration are more immediately effective in influencing the population situation of a country

than any other method, and the interest of the problem we have before us lies in this.

Migration problems have greatly changed since the middle, or rather, since the end of the 19th Century. Before the great movements of the 19th Century men had not the right to migrate. Men only obtained the right to emigrate by a great effort, a great struggle, for the colonial system in force prior to the 19th Century restricted freedom of movement.

But immediately that liberty of movement was established, migration increased in a remarkable manner, from 20,000 or 30,000 a year at the beginning or towards the middle of the century to an annual figure of two to three millions at the end of the century. That was a period of liberty, and this liberty had far-reaching results. It was guided by the intervention of a number of particular bodies, the steamship companies, the emigration agents, etc. But in a certain number of countries, from the idea of the protection of emigrants, there gradually emerged the idea of the control of emigration or immigration. I need not go into the whole history of this. The most characteristic example is that of Italy. The first step is an organization for the protection of individual emigrants; this is continued with the idea of increasing the value of Italian emigration to the Italian nation, of controlling emigration for this purpose; and we arrive at the idea put forward by Mr. Grandi in the Italian Parliament last March of keeping the emigrants within an Italian environment, an Italian circle, looking upon them still as part of the Italian nation, of replacing the Emigration Department by a Department for Italians Abroad, which no longer regulates the migration movement in the interests of the emigrant, but in the interest of the country.

With changes in the policy of emigration, the policy of immigration is also modified in the direction of organization and control. Some nations, of which the United States is the most striking example, close their doors to certain classes of immigrants. They attempt to solve their population problems by controlling and restricting the entrance of aliens. It is hoped by some that a similar policy will be followed by France, though more modestly. If many immigrants enter France, should they be distributed or will they be concentrated in certain regions? Should such-and-such concessions be made to the country of emigration? Should efforts be made to naturalize all the alien elements in the population or, on the contrary, should one allow the persistence of a number of alien groups within the country, among the French people?

Briefly, there is a policy of emigration on the one hand and a policy of immigration on the other. Around these two policies there consequently develops a series of special concep-

tions, purely national conceptions which may be antagonistic and from which, as the Chairman pointed out just now, there arises the possibility of conflict, or even war, among the nations. I need not speak of the uneasiness felt throughout the world on this point. It is a common subject in the daily papers and in books. Sometimes the idea emerges that conflicts may arise caused by Italian emigration. If no solution is found, then the explosion of which the head of the Italian nation spoke will one day be a possibility.

It is noticeable that, even if there is a possibility of conflict, nobody, that is, I mean nobody in a responsible position, will take the responsibility of speaking of it. It is because of this that I wish to speak in a free capacity to-day. In all the assemblies of the great States, of those States which would be threatened by a conflict, there is a systematic refusal to face the question. The problems of migration were excluded from the International Economic Conference. Problems of migration in this form did not form part of the program of the International Labor Office. Nevertheless, on several occasions, in 1921 and again in 1927, propositions have been made, and all the Governments rejected them with horror. Really, what is the use of having international institutions when each time that a serious problem comes up, the States draw back and refuse to discuss it?

It is easy to guess the consequences of such a policy. So long as no conflict becomes apparent, it seems as if peace were maintained. When conflict arises, opinions are so diverse that States, Parliaments, Governments have nothing to direct them. The great service that a conference like this can render is to face these problems with all the necessary scientific preparation, with all the independence of men who are not responsible to anyone or anything, so that Governments can obtain some idea as to what results are possible.

In the short report that we have prepared, we have indicated the most serious problems which should be systematically dealt with at the present time. The methods used and the scope of action are as much national as international.

If migration problems are ever to be dealt with in a rational and constructive manner, we must examine the seasonal rhythm of the movement, the nature of this rhythm, the reason why the movement increased in the course of the 19th Century, how and as a result of what circumstances it has been interrupted since the war. In the migration movements of the present day, a similar analysis is necessary, the rhythm of the migration cycles, their relation to economic crises, the seasonal rhythm.

There is, first of all, the sacred principle of the liberty of movement. I have just referred to the long historic struggle for the right of peoples and individuals to migrate. To-day

regulations and limitations are such that the liberty to migrate seems greatly restricted, and to proclaim this liberty is perhaps to return to a period already passed. At the present time, the emigrant should submit to a certain number of rules in the higher interests of the nation or of humanity.

There is another which has already been mentioned here, that of the right of overpopulated nations to occupy other lands. That is a very important problem, and we must doubtless proclaim the principle. It involves, however, a certain number of necessary modifications.

The right of overpopulated nations to occupy certain territories! Granted, but on the condition that these nations, before passing their national boundaries and causing international trouble, have first tried to solve for themselves the problem of their population. Before recourse is had to emigration, it should be seen how far a better organization of production, increased industry, credit operations, the distribution of the population, internal colonization, will make possible a solution of the problem.

At the present time, a certain number of nations are proceeding in this direction. But if there should be set up one day an international organization, a sort of Higher Migration Council with the power of deciding the right of overpopulated countries to populate other territory, they would be able to take into account all these considerations, together with others. Emigration and settlement may be legitimate, but it is also necessary to take into consideration that the action of those who wish to defend a certain standard of life and to ensure a certain degree of moral and social development for their population is also legitimate. In other words, is it possible to impose on a people the presence of national minorities, with all the inconveniences that such minorities imply?

There are therefore a number of principles to be taken into consideration, the restricted liberty of emigration, the right of a people to occupy other territory and the right of other national groups to forbid them.

But, between these different rights and these different principles, who can decide by what methods of action an international migration agreement may be achieved? There is a third question which must be considered, the question of method. How can an international organization be realized in such a way as to harmonize these conflicting principles and to bring about a distribution of population in the interest of humanity?

Since the end of the 18th Century, an evolution has taken place in ideas of economic organization. In the 18th Century, freedom of trade was fought for and obtained, and it flourished in many countries in the 19th Century. Then in opposition there developed a protectionist system. This has been followed in

Europe since the beginning of the 20th Century and in particular since the war. These two opposing systems, therefore, have been found in all countries, and at the present time we have come to the conclusion that neither free trade nor protection offers a final solution. Finally, there has come the idea of organization of cooperation among nations. For many years the members of the International Cooperative Alliance have maintained this idea, and it was recently expressed in the International Economic Conference.

Will not a similar evolution take place as regards migration? Besides this free movement of men and national policies of emigration and immigration, is there not a higher idea of organization under some form? Under what conditions will it be realized? Here, again, it is easy to formulate some very vague general principles, which serve as guides.

In 1921, at our International Emigration Commission, Mr. Oliveira, the representative of Brazil, spoke of the necessity for controlling and organizing all migration in the interests of humanity.

In 1921, also at the International Labor Conference, Mr. Zumeta showed that a balance should be established for protection throughout the world and a general distribution of the population.

Even at our last Conference, in the speech of Mr. de Michelis on the possibility of international distribution of work, the same idea of a higher international organization was developed.

You will tell me that this is chimerical, but we have an example, in a part of the world, which is composed of several nations and is itself a kind of league of nations. I refer to the British Empire. The British Empire, since the Empire Settlement Act of 1922, has, according to clearly defined principles, concluded a number of agreements which have been particularly successful. Is it impossible to do for the whole world what the British Empire has done for itself? Is it impossible to make a series of agreements according to some general principles which will enable us to find a solution to the problems of the present time?

At the other end of the world, several days ago, there took place the Honolulu Conference. That Conference has had exactly the same problem. Like us, no doubt, it has declared the importance of seeing if special machinery cannot be established for the solution of migration problems which are fraught with danger, and if there cannot be set up a sort of supreme institution to settle the different migration problems between nations. Thus, at the present time, the idea is gaining ground in the majority of countries. I do not think that one can advise the immediate institution of a Higher Council, but at least if a permanent private institution, uniting all our efforts.

capable of undertaking research, of establishing principles, of putting them into force by means of suggestions or advice or even executive machinery, were the outcome of the present Conference, the Conference could be considered as having done a good work.

Dr. K. S. Inui (Japan): Most of us are dreamers with figures. It is refreshing and encouraging to hear another, one who occupies a ponderous executive chair, as does our esteemed speaker. I am in hearty accord with the program as outlined by him. I realize with him the enormous task, wisdom and patience involved in the plan, particularly the difficulties that emanate from the expressions of extreme nationalism on both sides of quarantine stations. Meanwhile there are many things we must do and we must have.

The first thing we need is accurate and scientific statistics of land and opportunities available and of the type of workers and settlers that is needed for them. In this survey, thorough and wise criteria must be formulated. These should be so comprehensive that I would not even dare to mention them. All I wish to say is that a more comprehensive and scientific system of selection and classification of the types of immigrants than we possess to-day should be improvised. I use the word classification in preference to discrimination. For classification can be applied horizontally to a social group, but discrimination can only be applied vertically.

Once this is done, within a lapse of ten or twenty years, we shall more wisely be able to cooperate internationally. For this, I venture to propose two guiding principles:

Principle 1: No nation should send emigrants where they are not wanted.

Principle 2: Invitations to migrate or admission to settle should be issued to all peoples alike. (The only exception may be a temporary condition arising out of the assimilability of the immigrant, and not a discriminatory application of the power of the receiving country to absorb the immigrant, what I would call "vertical absorptivity".)

I am sure that the first needs no further comment. The second, especially what I mean by "assimilability" and "absorptivity" might call for an explanation. I am using the word assimilability in contradistinction to accommodation or adjustment. If we divide immigrants into temporary and permanent, though I admit that it is not easy, accommodation to new conditions is all that we can expect of temporary immigrants. So long as they accommodate themselves, adjust themselves and

are not an obstacle to national progress, they must be accepted and tolerated.

But for permanent immigrants, the right to settle depends upon their assimilability. It involves effort on the part of both parties. Inasmuch as assimilation means becoming a member of the new society, while retaining the best that one possesses, every freedom must be afforded the immigrant; especially is it necessary that he be given opportunities to advance in this undertaking, in an individual capacity. This should be done, since assimilation varies conversely with the amount of the immigrant's ties with the country from which he withdraws his membership, and social and traditional ties cannot be wiped out by mere determination. It may be even better that they should not be eradicated, for they are an asset rather than a detriment. Any further effort to perpetuate these ties, therefore, on the part of newcomers, or any pressure or irritation on the part of the old settlers which arouses the former's traditional group-consciousness, is to be avoided.

An emigration country does well to free the emigrant from any political or military ties, or at least to make it easy for him to change his allegiance, to renounce his nationality, especially in countries where *jus sanguinis* is in force. Or the nation can encourage its citizens to rely upon the local authorities rather than upon the agents of the parental Government, as is now part of the fixed policy of Japan.

Assimilation is a process of growth and completion and not of stagnation. It must be a process of uniting the in-group majority and out-group minority in a common undertaking to support and develop their growing national life. The degree and facility of assimilation vary directly with the amount of participation that one enjoys in the affairs of the country and the confidence that one enjoys in a given society. I maintain that loyalty is the reward of confidence. Hence, all avenues of participation in the national life should be opened to immigrants.

The assimilability of the newcomers varies inversely with the proportion of this group to that of the old settlers. Mass contact is naturally to be avoided. Assimilability also depends upon the degree of similarity of the civilization streams of the countries of immigration and emigration. Some departures from the principles above proposed are admissible, so long as they are temporary and exceptional in nature, and are in agreement with the principles applicable to all nations, and so long as they take into consideration the solidarity and universality of humanity.

A word about "absorptivity" might be added. If assimilability is an objective attitude of the newcomer, what I call

"absorptivity" for lack of a better term is a subjective attitude of the immigrant-receiving nation. It depends upon the ideals of that nation. If she considers that a nation is a spiritual union, as does Oaksmith, who defines it as "an organic continuity of community of interest", then absorptivity is only measured by her ability to influence or persuade the newcomer to accept and support her ideals and spiritual entity. If physical elements, particularly race, are to be considered, the essential criteria of a nation, then assimilability includes a biological process, and becomes at once a question of racial amalgamation. In this case, absorptivity will be extremely restricted by a vertical limitation. If such a view on the definition of nation is held permanently by a nation or group of nations, it will necessarily create a lasting cleavage between them and other nations and races. This will bring about a self-exalted ethnocratic majority and forever leave a foreign and unincorporated minority in the organic body politic, thereby endangering its spiritual and moral strength.

Granting stern and delicate realities, in what direction shall statesmen and diplomats set sail on the ship of humanity?

Dr. W. Keilhau (Norway): Mr. Thomas, in his splendid speech, referred to the general opinion that there is a contradiction between the old democratic ideal of the liberty of migration and the new migration policies of some countries. I do not really think that any such contradiction is to be found. There exists such a natural right for the individual, founded on the fact that we are all compatriots of the same planet, but it has been given too wide an interpretation. You have a natural right to go wherever you like, but, if you wish to settle abroad and work there, you cannot do so without becoming a member of a new State organization, and thus you touch on another natural right, that of cooperation. Correctly understood, each should have the natural right not only to choose, but also to refuse cooperation. That means that every organization should have a right to fix for itself the rules for the admission of new members.

If migration is to be controlled, however, there is one great difficulty which is encountered. This arises from the fact that most migrants are unknown men and women and it is not very easy for them to prove who they are. For the practical solution of this question, therefore, I should like to draw your attention to an idea put forward by my compatriots, Dr. Mj  en and Mr. B  , namely, a proposal about a so-called identity book.

Their idea is this: Every person in each country when about fifteen years of age should get an identity book which would contain his handwriting, photographs to be renewed from time

to time, his finger-prints, and perhaps prints of the surface of his hand. Then, he would always be able to prove that this book belonged to him and to no one else, and, if it were lost, it would be of no use to anyone else. This book should contain all those important certificates which under present circumstances are given in the form of a number of special documents. There should be a birth certificate, mentioning the names of the parents, the place where born and the date of birth; there should be a baptismal certificate, a school certificate and anything else which is important to enable an individual to prove who he is. Through amendments in the penal laws, it should be provided that any conviction for a crime, but not for a misdemeanour, should be registered in the identity book. If, therefore, a person was able to present an identity book with no record of any judgment against him, the controlling office in any country would at once be sure that he was not a criminal.

Mr. Thomas suggested that an international institute for migration questions should be founded. Such an institute would have a most important task before it. I do not think, however, that it is needed, because migration questions, economically speaking, are generally labor questions, and we have already in existence the International Labor Office, which deals with questions of migration. I should therefore like to propose that Mr. Thomas should do all he can to establish a scientific branch of the Labor Office to carry out work in the investigation of these questions.

Dr. C. B. Davenport (United States): Immigration to the United States has passed through four phases. The United States was settled largely by refugees from countries where there were religious persecutions — by Puritans and Huguenots, and also by some imprisoned debtors and others who were in trouble. Later, in the early part of the 19th Century, the United States received a large immigration from Ireland, owing to the difficulties there, which were largely a question of food, later from Germany in consequence of the failure of a revolution there. All these immigrants were received very cordially under the general policy of the United States, it being, as Geneva and Holland have always been, a refuge for the oppressed of all nations.

There is, however, such a thing as overtaxing hospitality. The second phase in our immigration policy was an economic one. With the immense expansion of the United States after the Civil War, employers of labor brought Chinese to California and the cheapest labor they could get from Europe to work in the mines and factories. The Laws of 1882, 1885 and 1887 put a stop to the importation of contract labor.

The third phase in the immigration policy of the United States was a hygienic one. In 1891, a medical examination of all immigrants was required, and defectives, epileptics, tuberculous persons (and also anarchists) were barred.

The fourth phase of immigration has been a eugenic phase. Between 1903 and 1913, there was vast immigration into the United States, reaching in a single year one and a-half million persons. The change of racial stock from the peoples of the North and West of Europe to those of the South and East of Europe was marked; and especially there came to us large numbers of South Italians and many Russian and Polish Jews. These immigrants were largely indigent and came in such numbers as to threaten to change the complexion of the whole population. The density of the population had meanwhile increased from about eight per square mile in the middle of the 19th Century to thirty-five per square mile, and our cities contained some of the most densely populated areas in the globe. No land remained for settlement.

In 1920 and 1925, legislation was passed to limit the amount of immigration and to provide for selective immigration. The present immigration law provides that in any year no more than two per cent of the number of individuals of any nationality found in the United States in 1890 shall be admitted to the United States. This constitutes each country's quota. The minimum quota is 100. Each immigrant has to apply for an immigration visa, and in doing so he has to give much information about himself and his parents. If the application is satisfactory, an immigration visa is issued, good for a period not exceeding four months, provided, of course, that the quota for that country has not yet been filled. The great advantage of this law is that it provides for a selection of each immigrant from Europe. The classes excluded from admission are numerous, and include among others, the following general classes: all feeble-minded, epileptic, and insane persons, persons who have had attacks of insanity at times previously, persons of constitutional psychopathic inferiority, persons with chronic alcoholism, paupers, beggars and so on, contract laborers, persons likely to become a public charge and many others which I will not enumerate. There are excluded also all aliens over sixteen years of age who are physically capable of reading, but who nevertheless cannot read the English language or some other language or dialect (certain exceptions in the case of aged relatives). The racial aspect of the present law is seen in the fact that there is a very slight reduction in the number of immigrants possible from the different countries of Northwestern Europe, whereas there is a marked reduction in the possible immigration from the countries of Southeastern Europe. The passage of this

law was not intended to carry the inference that different races differ greatly in their mental capacity. Chiefly two aims have been set, and we think have been gained: one a reduction in the number of immigrants, to give an opportunity for assimilation, and secondly, the preservation of a reasonable degree of homogeneity in the population of the United States. Possibly the lesson learnt in the great war in Europe, of the strong differences of feeling between different nationalities of Europe, led us to dread lest there should come about that which seemed imminent, namely, that we should have represented in the United States groups which would make it a little Europe, with warring nationalities included.

Finally may be mentioned again the policy of examination in their own countries of all applicants for visas. This is a humanitarian arrangement, diminishing the necessity for sending home thousands who had spent their savings to purchase their passage. It is a scientific arrangement, in that it brings to the visaing officer facts concerning the family of the immigrant that could not be obtained 3,000 miles from the immigrant's home.

The policy of selective immigration thus developed in the United States has brought to the front the question of the right of any country to restrict immigration. In turn, however, there seems to have been established an international recognition of the right of any country to determine what aliens shall become eligible for citizenship in it. For example, to take an extreme case, each country must bear the burden of the defectives it breeds. The eugenic principle is now being recognized that the strength of any country depends, not upon its numbers only, but upon the quality of its population.

Dr. Nils Cederblad (Sweden): It may be interesting to illustrate, by a typical example, the relation between emigration and the conditions on the labor market, a relation already indicated by Mr. Thomas in his excellent speech. During the past century and the beginning of the present one, Sweden was drained of a considerable part of her population through emigration. Most of the emigrants went to the United States. In spite of rapid industrial expansion in Sweden, emigration continued until the year 1914, when it was almost completely stopped by the war and the subsequent legislation in the United States. I have recently had occasion to study the effects of this limitation of emigration on the labor market in Sweden. I have tried to answer the question of how numerous the working population would be at present in Sweden if emigration after 1914 had been normal.

The only problematic element in this study is to define

normal emigration. The number of emigrants has of course varied greatly in different years, but the great waves of emigration have recurred with surprising regularity, so that it is possible to speak of normal emigration.

From the figure for normal emigration thus obtained, I have deducted the number of persons who have actually emigrated and, after having taken into consideration the mortality among those not emigrated, I have arrived at the result that we now have in Sweden about 90,000 more men and about 60,000 more women between the ages of 15 to 65 than we would have had if emigration had proceeded normally. For a small country like Sweden, this surplus of working population to be provided with employment is of the greatest importance.

If this figure is compared with the number of unemployed in Sweden, it will be found that there are about 90,000 unemployed men, or exactly the same number as that for men who, owing to the restrictions of emigration, have been compelled to remain in the country. I do not pretend to maintain that the unemployed consist of those same persons who have not been able to emigrate, but I believe that it is more than a coincidence that the total of unemployed men and the total of the men who have not been able to emigrate agree so closely.

Sweden is a good example of the relation indicated by Mr. Thomas between the magnitude of the emigration streams and the conditions on the labor market. This is the central problem we have to deal with to-day.

Dr. Helmer Key (Sweden): We have heard from the previous speaker, my friend, Mr. Cederblad, that there exists in Sweden a normal need of emigration and that the reduction in emigration resulting from the restrictions imposed, particularly in the United States, has led to a surplus in the Swedish working population, which, in the opinion of many, must be placed in foreign countries.

But while views may differ as to the necessity of relieving the pressure caused by a surplus of labor, skilled and unskilled, by means of emigration, there is an interconnected problem on which all Swedish observers are united, namely, the need of measures for disposing of the large surplus in Sweden of professionally qualified persons, trained at the universities, technical and other colleges. It has been suggested that further restrictions should be imposed in regard to the facilities for higher education and the reduction of the quota of students admitted yearly to the universities and different technical colleges, thereby gradually reducing the number of graduates. Applicants less gifted for theoretical study would then, it is argued, turn to practical occupations; possibly to farm-work or productive labor of an equally useful description. In any case, no such restrictions

are in force, and it is doubtful whether a policy of that kind is feasible. Furthermore, the results are extremely problematical, even if it could be carried out. Other expedients, more rapid and reliable, are necessary if the surplus of intellectual labor is not to become an increasingly heavy burden on the Swedish community.

The remedy that comes first to mind is naturally emigration. For certain professions, such as teachers and graduates of commercial colleges, any sort of emigration scheme would necessarily be very difficult to arrange, but Swedish engineers, foresters, physicians, etc., constitute a potential asset which it ought to be possible to utilize in foreign countries, especially in transoceanic continents where, with the exception of the United States, the supply of highly trained professional people is in general insufficient.

Through official publications and professional directories, one obtains a rough idea of the existing amount of unemployment in the professionally trained class in Sweden. A mere superficial perusal of the membership lists of student societies, technical publications, such as the Journals of the Swedish Technological Society, the Swedish Medical Society, etc., will make it clear that there is by no means a negligible number of professionally trained men who lack opportunities of employment at home, of a kind warranted by their education and training.

The next questions are to what country or countries would it be profitable to send this class of men; and what kind of an organization should be instituted for conducting this emigration activity and placing the right men in the right places.

As regards the United States, the American Society of Swedish Engineers in Brooklyn has done good work in placing Swedish engineers who have emigrated to the United States and afforded them opportunities of attaining leading positions. But this Society has insufficient contact with the mother-country, and Swedish engineer graduates who would probably have done better for themselves and been of more service to their country, by emigrating to far-off countries or continents, are therefore compelled to accept poorly paid positions in Germany and other countries.

The Swedish Institute for Overseas Services, an organization established in Stockholm, has just begun its activity and the first task before it will be to create a network of connexions between Swedes in different parts of the world who are in a position to aid in providing employment in transoceanic countries, for college- and university-trained Swedes and specialists of various kinds. A census will be taken of all prominent Swedes already established in different places outside Europe. For this work the aid of Swedish legations and consulates abroad will be

enlisted, as well as that of semi-official institutions like the General Export Association of Sweden and the Swedish Technological Society, which have valuable facilities for supplying the information wanted. It may be added that the Swedish Technological Society has already on its own account placed Swedish engineers in positions abroad, but this work has now been transferred to the new organization.

It is worth noting that this Swedish Institute is not only able to find employment abroad for professionally educated Swedes, but also to facilitate the repatriation of Swedes who in foreign countries have acquired special qualifications that will be of service to the economic development of their native country.

The program of the Institute is in the first place devoted to the finding of employment abroad for Swedes trained in a profession, but may be later extended to embrace also the placing of other classes of workers and other questions connected with emigration.

You may have noticed that I have spoken specially about the emigration of Swedish engineers. I have done this because my country has proved itself able to produce excellent engineers. Every country wishes naturally to make itself known abroad by the best it can give, and for this reason we Swedes are anxious to make the Swedish name abroad represented by men who, we know, will render good service.

***Dr. Léon Bernard (France):** In analyzing the principles of migration, medicine and hygiene must be taken into account, or these principles will be ruined in their application the day that you attempt to put them into practice.

• The medical considerations are two in number. The first is consideration of race. This is perhaps a biological rather than a medical consideration. The application is found in the United States at the present time. As far as I can understand what is passing in the minds of Americans in this respect, I think that one of the reasons, perhaps the principal reason, for the almost complete prohibition of immigration decided upon by the United States is considerations of race.

There is another point of view, a more strictly medical one, that of public health. Here I can cite France, a country which, alas! has had admirable experience in this respect. The doctors who practise in the large towns are extremely alarmed at the number of aliens filling our hospitals. I mean to speak here simply of the question of public health. I shall not mention the financial burden to the country that these aliens who are being cared for in our hospitals represent. When the time comes to conclude international agreements for the regulation of

questions of migration, account should first be taken of the state of health of the migrants.

In connexion with this, we may take the United States as an example. Ellis Island is a model of organization. We see on the other hand what happens in countries where there is no immigration organization. That is the case in France. Before the war immigration in that country was nothing compared with what it was in America and that is why the control of immigration was never thought necessary. To-day this control has become an absolute necessity. France does not only attract immigrants, but it is also a country of transit, from the point of view of emigration, and we see the abnormal and monstrous fact that the French authorities cannot stop migrants who are undesirable from a sanitary point of view from entering the country, while the American or Brazilian authorities in France can prevent these same undesirables from embarking. In the ports of Cherbourg or Le Havre, we have seen epidemics develop which could have been prevented had emigrants been stopped on their outward journey by the authorities of countries overseas. Thus, we are in danger of becoming a receptacle for the outcasts of emigrant populations who are rejected on medical grounds.

***Dr. Marcello Boldrini (Italy):** Before the war, emigration was considered as a phenomenon which was not susceptible to any kind of influence, while to-day it is considered as a phenomenon which must be regulated and controlled. The Central Institute of Statistics has recently made a satisfactory calculation of the net loss sustained by the Italian population through emigration in recent years.

These facts have eloquently disproved the pre-war idea of the uncontrollable character of emigration. The growth of the Italian population is not regarded with the apprehension to-day that it was formerly, and this new idea has been recently affirmed, with great authority, by our Prime Minister in a speech which has had a wide effect. This is a summary of the facts: even if a consequence of the reduction of emigration has been a decrease in the amount of money sent to Italy by the emigrants, this has not been accompanied by that increase of unemployment which would formerly have been feared. Statistics show, on the contrary, a remarkable decrease in the amount of unemployment in the after-war period, particularly in 1925 and the first half of 1926. A certain increase in the amount of unemployment during the second half of 1926 and the first half of 1927 must be attributed to financial causes and, I think, has no relation to the phenomenon of migration.

Miss Gladys Pott (Great Britain): In connexion with the migration from Great Britain, I find the following observations in Mr. Thomas' report. The paper is divided into four headings, the second heading of which is entitled "The Present Trend of Migration", and in the text this sentence occurs: "Freedom of the migrant to act as an individual, to move from place to place, to seek work or to settle abroad, is becoming increasingly subject to the consent of official bodies", and in the same paragraph reference is made to the migration policy at present in force within the British Empire. I venture to think, so far as that migration policy has hitherto proceeded, no such deduction as might possibly be drawn from the sentence is justified. There is no control of migration from Great Britain in any sense at all, except with regard to those persons who ask for State aid in order to go to another part of the British Empire.

The proportion which these people bear to the total migration is small. The following figures illustrate my point. The Act of Parliament which allows State aid to be given at all came into force in 1922. During the following three years, the average of emigrants from the United Kingdom was, in round figures, 275,000. Of that number the average which went to places within the British Empire was (again in round figures) 123,000, and of that number about 45,000 received State aid. It will therefore be obvious that, of the 275,000 persons who migrated, only 45,000 were in any sense directed by Government control.

As is well known to all who have followed the question, State aid is given only to those persons who are accepted and selected by the country of immigration, that is to say, one of the self-governing Dominions. The State aid given is of two kinds. The migrant may be what is called "selected" or "nominated". The person who is "selected" by the Government representative of the Dominion to which he is going is chosen from among applicants who are prepared to go and for whom the Government of the Dominion concerned is prepared to guarantee that there will be suitable work, provided work is required. Broadly speaking, the men must settle on the land and the women must undertake domestic work. The other class which receive assisted passages are those who are "nominated". A nominated person is one for whom an individual or a group of individuals or a society, recognized by the Government of the Dominion concerned, is prepared to promise a home and if necessary suitable work, such work not being guaranteed by the Government, but the person who nominates being responsible for the future of the migrant.

Within the last two years there has been a most distinct and remarkable trend towards the increase of nominations as contrasted with selections. The nominated person is in no sense

controlled or directed by the Government of the country, whereas the selected person has a certain amount of supervision, at any rate at first. I think that, so far as Great Britain is concerned, there is at present no justification for supposing that it gives support to the theory that State control or international control is part of its policy. I admit that the whole Act has only been in force for the last five years, and it is probably far too early to judge the results.

* **Professor L. Hersch** (Geneva): We shall all agree with Mr. Thomas that the path along which we must proceed is that of regulation. In this regulation, however, we must have a guiding principle. The analogy between the movement of goods and the movement of human beings is far from simple. It is evident that for international trade there must be treaties of commerce. But what principle is to guide us in those treaties, free exchange of goods, or prohibition? It is the same question that we have before us here. We all agree that there must be international conventions and treaties regulating migration. What, however, should be the final object of these treaties and conventions? Should they aim at free migration or restriction?

Both in public and in the Press, problems of migration are often shown to lead inevitably to war. An attempt is made to explain human migrations by the Malthusian theory. We are told that in certain countries there are too many people; their expansion is a natural necessity; conflict with the countries to which their peoples tend to emigrate is inevitable, and war necessarily results. Putting the problem on such a pessimistic plane does not tend to mitigate the conflict. I believe also that this is the reason why the legislative assemblies of the different countries and the Governments will not face this question. They have a thought at the back of their minds that it is insoluble. We must combat such an idea, for the problem is not insoluble.

Let us leave on one side secondary considerations on which agreement can easily be reached. I am convinced that, at the root of the problem, the antagonism between countries of emigration and countries of immigration is not insusceptible of change.

The reasons for migration are not found in overpopulation, which, properly speaking, has no very definite meaning. They are found rather, and above all, in the division of work within given societies and the world's economic system.

Let us take the case of a factory comprising several workshops (A, B and C) working together for the manufacture of one single product. Let us assume that in one of these workshops, B for example, a technical invention is adopted or organization is

improved by which it is possible to obtain the same product as formerly with less labor, or a greater product with the same amount of labor. What will happen? If the distribution of labor between the different workshops remains the same, the balance of the contribution of each workshop to the final output of the factory will be upset. Either the men employed in workshop B will be thrown out of employment because that workshop will not receive the same proportion of material as the other workshops to keep their labor in full employment or else it will furnish to the other workshops a greater amount of material than they can utilize. Consequently, for the factory to resume its normal progress, it must either dismiss a part of the workers in workshop B, or increase the labor force in workshops A and C by workers from outside, or it must transport a part of the labor force from B to the workshops A and C or, again, it may adopt all these three courses together. In other words, any technical change in production brings with it inevitably a redistribution of the population in the different branches of work.

If, instead of considering a factory, you take the case of a country, you will see again that any modification of the technique or organization of a certain branch of activity leads necessarily to a re-grouping of the population. Either this change will attract workers to a country or it will cause the emigration of a certain number of them or, again, it will bring about a change of occupation between the workers of the country. It is also possible that these phenomena will all become apparent at one and the same time. The real significance of this is that any improvement of technique or of the organization of production leads to a redistribution of labor in society by emigration, immigration or changes in occupation or economic activity.

Now, the economic system of large industry under which we live is a system by which production is being incessantly revolutionized, and the inevitable effect of this is a constant movement of the working population, appearing essentially in emigration and immigration. In old countries with a large population, mainly rural, the most striking phenomenon following the adoption of the new system is emigration. This first affects the rural population, who, from being general producers, now become more and more specialized. They become agriculturists in the strict sense of the word as the development of urban pursuits renders useless the exercise of such pursuits in the country. But there also appears an immigration movement of some importance. It should be noted that, to some extent, all countries of emigration are also countries of immigration. Take Switzerland as an example. It is a country of emigration, but you know that before the war there were 200,000 Italians on Swiss territory. How can you explain this? Simply that two phenomena manifest

themselves at one and the same time. On the one hand, there is an inward movement, on the other there is an outward movement; an incoming movement in certain branches of industry, an outgoing movement in certain other branches.

In new countries, it was impossible to develop the natural resources without the aid of workers from outside, that is, of immigration.

There is one special point. Does immigration cause a fall in the wage level? It is said that it does, and at first this seems inevitable. An increase in the labor supply must inevitably lead to a reduction in price. This is, however, a mistaken idea. It would be so if all labor were of the same kind. In reality, the immigration of laborers of a certain class (for example, unskilled or semi-skilled) causes in that country an increase in the demand for labor of the other classes (skilled labor) and this helps to raise the wage level of these latter classes, just as generally an increase in the supply of a certain commodity tends to increase the demand for other commodities.

Professor J. W. Gregory (Great Britain): There will probably be unanimous agreement with Mr. Thomas as to the importance of this problem and as to the need for new information to settle some of the difficulties. There will probably be, therefore, widespread agreement with the proposal for a new institute to collect information. If that institution were limited by its constitution to that function, it would be practicable, useful, and, I think, generally welcomed; but if it were given any executive powers or were urged to strive for such powers, I think it would be doomed to failure, as none of the great emigration countries would support it. The institute would probably add more to international friction than it would allay. I was therefore glad of the emphasis laid by Mr. Thomas on the scientific scope of the proposed institution, but I am not quite clear as to the implication of some of his remarks.

I seemed to hear two voices. One voice recognized that a supernational institution would be impracticable, and that, therefore, the new institute should do only scientific research. But then the other voice pointed out that the scientific studies were to be the primary task, implying other undefined tasks, that the new body was to be provisional until a supreme emigration tribunal could be established, and the new institution was urged to make constant and untiring efforts to secure the authority to satisfy national requirements, and these would, in this connexion, be those of the great emigration countries. According to the second voice, the international authority is further to lay down the conditions for the occupation of unoccupied lands.

If those are to be the functions of the new institute, I fear it

will not be welcomed or supported by the great immigration countries, and if the fourth requirement, that is the laying-down of conditions for the occupation of unoccupied lands, be included, I am afraid the institute will have no support from some countries whose cooperation would be essential to its success. On the other hand, widespread cooperation with such an institute would no doubt be secured if it were limited to the purposes of scientific investigation, and the immigration countries would be all the more ready to join with Mr. Thomas in his scheme, as he accepts principles which would allay their most serious fears.

The two opposing national principles which should control emigration, he remarks, are extreme, but I think it would be possible to devise an intermediate policy which would secure support by satisfying the reasonable requirements of the immigration countries and yet allowing an adequate emigration from Europe. This policy is nearer the Australian than the American system. Australia is perhaps able to use its system because it is protected by its distance from Europe. Possibly the quota system may be essential for America, but it might be relieved of its harsher and less satisfactory features by further scientific investigations, if it were shown by those investigations that certain theories that are now under discussion were fully justified. If the new institution, therefore, could supply the investigation on these lines, it would be an incalculable service to humanity (see also page 302).

***Dr. A. Boháč** (Czechoslovakia): I think it opportune to tell you a little about the movement of population in my country, Czechoslovakia, which may contribute to the study of the problem of immigration in general. It is of interest because, as you know, Czechoslovakia is composed of two countries which are very different from the social and economic points of view. Formerly, during the period 1850 to 1890, there was considerable emigration from the Czech countries — Bohemia, Moravia and Silesia — to the United States. But, through the progressive development of agriculture and industry, this overseas emigration has been checked and restricted to such an extent that, in the 19th Century and at the beginning of the 20th Century, not more than 2,000 to 3,000 Czechs embarked annually for the United States. This, then is the first conclusion: the economic development of the country is the best remedy against emigration.

The policy of our Government since the establishment of the Republic has been contrary to migration. We fear the loss caused by emigration. If you study our emigration law, you will see the tendency is to restrict and fight against this danger. But in order to keep men at home, they must be offered the pos-

sibility of employment. To avoid exporting men, we must export goods. That is a well-known fact. However, the development of the export trade does not depend only on the exporter. If the free exchange of goods is restricted, then alien labor must be allowed to enter the country. It is impossible to restrict at one and the same time the export of goods and the export of men.

In 1922-23, the migratory movement in our country assumed the character of a spontaneous, irresistible force, so that many people were alarmed. But it is a characteristic feature that it is not in the most densely populated districts that this movement was most striking, but in districts in which the density of population was not great. One is therefore confronted with this paradox, that the less populated districts furnish the greatest emigration.

As regards Czechoslovakia, one may also study the consequences of the restrictions laid down by countries of immigration, above all, the United States. The most urgent problem in Czechoslovakia is that of the Slovaks, and fundamentally, this problem is economic and social. Before the war 25,000 to 30,000 Slovaks emigrated each year from the former Kingdom of Hungary to the United States. To-day, only some few hundred of them are admitted to American territory. Consequently, these Slovaks cannot find work and are discontented. The assimilation of Slovakia with the Czech countries has become more difficult.

I am convinced that it is impossible to find a solution of the problems of migration by reference only to the principles laid down by the countries of emigration. The point of view of the countries of immigration must also be considered. Unyielding nationalism leads to disaster in this field as in others. These problems can only be solved by an international point of view and we are very grateful to Mr. Thomas for having given us some guiding ideas in his brilliant report. May these ideas serve to enlighten mankind!

†**Dr. Henriette Fürth** (Germany): We are faced with problems of a higher order, which cannot be solved by methods of cooperation, at present at a primitive stage. I do not want to enter into problems of colonization or of politics, but the excellent report of Mr. Thomas has shown us that we should try to create this international court which would have as its task the duty of investigating what are the most fruitful soils and how population can be brought thither. We should try to determine which country, which territory and what mental structure is needed in order that a certain piece of work can be done comparatively most satisfactorily and most cheaply. If we

should, on the strength of this extreme pacifist conception, because its execution would exclude every form of war, attain an economic order based on comparative cost, then we should need to export goods only, and not human beings.

It is my opinion that the country of immigration should be grateful for its immigrants and the country of emigration should regret having to give up people. On investigating the figures for emigration from Germany, I noted that in 1923, the year in which the figures for emigration were higher in Germany than they had been for centuries, nearly nine-tenths of the men who emigrated were in their most active years (14 to 50). In the case of women emigrants this figure was eight-tenths. In 1924, for the men it was eight-tenths and for women three-fourths. This means that one country has borne the expense of bringing up these people, but the results of that upbringing are for the benefit of the country of immigration.

The country of immigration should not say that it has too many people and can therefore accept no more. Men who work are always an asset, and the increase in population for which these people are responsible contributes to the country of immigration more than they cost that country. In order to prove that this is really so, I should like once more to refer to Germany. Unless I am much mistaken, from 1900 to 1910, we had an annual increase of fourteen per cent and, during those years of increase of density of population, we had figures for emigration which can hardly be looked upon as such, but which must rather be considered merely as an international fluctuation. The country of immigration need therefore not be afraid, for immigration can only benefit it.

And now a few brief remarks on the eugenic aspect of the question. The question of density of population should be determined from the point of view of eugenics. The fear of overpopulation is as immaterial as is the fear of underpopulation. There is therefore no reason for being very much afraid of the decrease in the figures for population, because the greatest decrease in the birth rate is due very largely to the fact that twelve million men of an age to become fathers were killed in the war. Further, we have to consider that the economic distress (unemployment in many European countries), lack of housing, housing difficulties and other crises have reduced the joy of having children and have destroyed the will to have them. From estimates made for Germany, it appears that in thirty to forty years' time the present excess of women over men will be replaced by a preponderance of men. The result of this will necessarily be reduction of prostitution, and an increase of marriages and consequently of births. We do not therefore need to be very greatly exercised about this. What we should

do on the contrary is to try to regulate births in a reasonable way, prevent births of defectives, look after pregnant women, mothers and babies, and, by dealing with the question of illegitimacy more fairly, see that those children which are born healthy are brought up carefully.

That is the duty of this Conference, to introduce economics of human beings instead of economics of goods.

Professor Percy Roxby (Great Britain): I have been asked to try to summarize certain features of the population problem in China in its bearing on the present discussion. I ought to say that the migration aspect can hardly be separated from the problem as a whole. It is well known that the difficulties in the way of estimating the population of China are very great, but two recent estimates, both made with very great care, the official estimate of the Chinese Post Office and the unofficial estimate of the China Continuation Committee, both agree at putting the population of China, exclusive of the dependencies, at over 400,000,000.

However, the total population of China is of much less importance than the question of its distribution, which is in the highest degree unequal. The greater part of the population of China is concentrated in about six lowland regions: the central part of the northern plain, the Yangtse Delta (roughly speaking, a triangular tract from Nanking to the sea), a narrow coastal belt between the Yangtse and the Si-kiang, the Canton Delta, the central basin round Hankow and in the far west the basin of Si-Chwan. There is probably no other country in the world where the population is more unevenly distributed.

So far as the first two regions I mentioned are concerned, there have been in recent years careful investigations, carried on under the auspices of the China International Famine Relief Commission, to which I should like to pay a tribute. I do not think justice has been done to the invaluable work, scientific as well as humane, of this Commission.

Investigations carried on by that body and by groups more or less subsidized or encouraged by it have revealed some extraordinary densities of population. I think this is perhaps the first accurate information we have on the subject of the density of the population in certain critical parts of China. By way of comparison, we may remember that the density of population in the rural country of Norfolk in England (I take that as a typical rural district) is 230 or 240 to the square mile. Also by way of comparison, we may remember that the density of the population in parts of Bengal, which is the most densely peopled part of India, is about 1,160. In comparison with that, in some of the rice-growing districts of Kiangsu and Che-Kiang at the mouth of

the Yangtse, the density is calculated at over 6,000 to the square mile, and in parts of the province of Shan-dun, a mainly rural area, at over 3,000. While these actual estimates of density have been made, there has also been carried on a series of investigations into the size of holdings, and into what one may call the poverty line. It has been conclusively proved that these rich regions of China are supersaturated to an alarming extent.

It has been calculated that, in the northern wheat- and millet-growing regions of China, about 4.7 acres, roughly two hectares, and in the rice-growing regions of the Yangtse Delta, about 1.7 acres, or about three-quarters of a hectare, are necessary to support a family of five persons in any degree of comfort. It appears, however, in the case of the regions investigated, that thirty-three per cent of the holdings are less than one acre in extent and fifty-five per cent are not more than one and a-half acres in extent, and that the average size of the families who have as much as one and a-half acres is 5.7 while the number in the family increases with the size of the holding.

On the basis of enquiries carried out by Professor J. B. Taylor, of Peking, when the poverty line was very carefully calculated, it was found, in the case of 240 villages examined, that, in the northern provinces like Shan-tung, more than four-fifths of the families had incomes below the poverty line and, in the case of the eastern provinces, more than half of the families had incomes below the estimated poverty line. It is of course true that these investigations were carried out in the year following a famine, but these famines occur every five or six years, so that the situation can hardly be taken as abnormal.

There is much to uphold the thesis that the chronic distress due to the overpopulation of the richest regions of China is one of the chief factors, if not the main factor, in the whole economic problem of China, and is one of the chief obstacles in the way of China's reconstruction. What is the fundamental cause, looking at the matter from a purely scientific point of view? I think there is no doubt that the fundamental cause is the social philosophy of the average Chinese, a social philosophy which makes the begetting of male posterity the main consideration, and which incidentally involves the begetting of a correspondingly unwanted female posterity. This philosophy had originally a strong economic justification, but it has outlived its utility and is now one of the chief obstacles in the way of the re-creation of China, which we all desire.

From the economic point of view, a better redistribution of the population within China itself and a well-organized migration, especially in the case of Northern China to Manchuria and Inner Mongolia, would without doubt ease the situation. But the problem can never be solved, as I see it, until there is a very

considerable modification and a re-orientation of the Chinese social ethic and, underlying all the specific remedies of irrigation, afforestation, and the rest is the problem of the mass education of the Chinese people.

Dr. A. Koulischer (U. S. S. R.): The first thing you must do about migration is to study it. We have only just begun to study it, and we know little about it. Laws exist and they operate with tremendous force. It is my contention that you can discover at every period of the world's history great currents, expressed in peaceful as well as in warlike movements.

It is curious that, if immensely complicated military, political and economic facts are regarded from a sufficiently detached point of view, you see a rather simple mechanical process, a mass movement going on, and I believe it can be shown that this process goes on all through the ages like the ebb and flow of the ocean. As Mr. Thomas has remarked, the second half of the 19th Century was a time of absolutely unique conditions. Emigrations then changed their character; they became peaceful. At the end of the 19th Century and the beginning of the 20th, you had at the same moment the two facts of the closing-up of these immigration countries which so significantly coincided with the general rise of the cost of living on the one side, and on the other side in 1910 the Russian Government was forced to restrict and to cut down drastically the further immigration of the Russian population into Siberia. The movement had begun to turn to the East, and there was a movement to America and to Germany.

It is no use shutting our eyes to the gravity of the situation. Cheap optimism will not help, but I think that these questions must be solved and will be solved. On the lines that Mr. Thomas indicated, something will perhaps be done. I will call your attention to another thing, the fact that it would be a childish illusion to think that the richer countries can be forced to admit the populations of the poorer countries; they will not do it, and to force a country to admit emigrants is to promote the making of war. The richer countries should help the potential emigrants to get a living at home.

† **Dr. Karl Thalheim (Germany):** Having dealt with the question of German emigration for some years, I should like to refer to a point in which, in my opinion, considerable difference exists between the interests of the countries of immigration and the European countries of emigration, as far as these latter are chiefly industrial countries. German emigration offers a good example. As far as European industrial countries are concerned, a great difficulty lies in the fact that the quality of human

material which may be looked upon as the excess of a country is of a very different kind from what is needed in the country of immigration. Overseas countries of immigration need, above all, people who can settle in and colonize the countries to which they go, independent farmers who bring a little capital with them in order to settle down overseas, or farmhands, as, for instance, in Canada and in the Brazilian State of São Paulo. In many European countries, it is a matter of great moment that they should keep their own rural population. We have considerable unemployment in Germany; nevertheless, we have to employ more than 100,000 Polish agricultural laborers in the east of Germany. It is contrary to our interests in Germany to let farmhands or farmers emigrate overseas.

Certain groups of people for whom we have no use in Germany (groups of industrial workers, business men and employees in business firms, and similar categories) are not needed overseas. That is a big difficulty for the world emigration problem, as far as it is connected with emigration from European industrial countries. There is only one means of bridging-over this difficulty. If we are convinced that Europe is overpopulated and that it is necessary to send certain classes of the population abroad, then those countries will be forced to set up schools and experimental farms, training farms, in which people from other professions can be trained to become colonists overseas.

† **Professor A. Paldrock (Estonia):** I heartily agree with Mr. Thomas that proper attention must be paid to the supposed over- or underpopulation of a given country before national or international regulation of migration is applied.

There certainly are countries in which the economic means of existence will still permit a considerable augmentation of the population. Especially if the country is a small one and is by no means overpopulated, it is undoubtedly in the interest of mankind to let that particular nation develop its own national civilization and not to hamper it by an immigration of other races. In this particular case too, it is the quality and not the quantity that is of capital importance. To my mind, the quality can be far better looked after in a State that has an unmixed race than in States where the population consists of very mixed races.

* **Mr Pedro Paulet (Peru):** The chief interest for Peru, which is so underpopulated that the density of population is only five persons per square kilometer, is in the influence of migration on this question of population.

We already know that, beside questions of the birth rate and the death rate, we have to consider what I should call the

migration rate as one of the three principal factors modifying population.

In Peru we are in a good position to examine all these questions. Before the Spanish conquest, it was by their remarkable population policy that the Incas founded the greatest and richest American empire of former times. The Incas tried to preserve at all costs the life and happiness of the peoples they conquered. If a conquered country did not submit, its people were transported bodily, but carefully, to another part of the territory.

The following fact proves that this was a sound policy, for, in spite of the Spanish conquest, four centuries of abuse and neglect, despite the fact that the native inhabitants of our country have been to a great extent dispossessed of their lands, these native races have been preserved much better than elsewhere in Peru, Bolivia, Ecuador, a part of Colombia and the Argentine, that is, all those republics that have inherited the land of the Incas.

There are three aspects to the population problem in Peru. In the first place, there is the problem of increasing the general density of the population, for, if this density were even equal to that of the United States, Peru would have more than forty million inhabitants. Following that is the question of assimilating or civilizing our native races, who from a physical and moral point of view are readily assimilated. Finally, there is the question of how to colonize the country without injuring or destroying the immense natural wealth, perhaps unique in the world, of the still unexplored heart of South America.

The recent restrictions imposed by certain Governments make emigration and immigration so difficult that the right to emigrate is still an open question and I see only one solution of this problem. It is the remedy suggested by Mr. Thomas, the creation of an international institute or permanent office of migration formed under the auspices of the International Labor Office.

It would be a good thing if, in the creation of an international organization of population, as the best outcome of this Conference, the capital importance of migration and the urgent need for its international regulation were recognized.

* **Dr. Stavzos Zurukzoglu** (Greece): I should like to draw your attention to a point which may perhaps be of considerable interest to the Conference. It is the national and international organization of colonization within a country.

When in the autumn of 1922 the last flames of the city of Smyrna flickered out, a migration of refugees driven from their native homes after the war began to flood the free State of Greece.

This movement is unique in history. Within a few weeks it led to the settlement of one and a-half million refugees in greater or smaller groups in Asia Minor and Eastern Thrace. The fact is without parallel in the history of human migration. Consequently, it is worth studying, not only because of its importance from the point of view of the science of population growth, but also from the point of view of population problems. Greece at that time had about five million inhabitants, and was confronted with the necessity for receiving one and a-half million compatriots, who were arriving without any means of subsistence and who had not only to be fed, but also to be settled in the country in some way by which they could obtain enough for their needs. What, then, was the situation of Greece regarding the extent of land in relation to the number of inhabitants? According to studies made by Mr. Chasiotis, one of the most eminent specialists on agricultural conditions, Greece, with her 12,000,000 hectares of territory, of which only a little more than half is capable of cultivation, could, by the development of agriculture, irrigation, and sanitation, easily support double the population that it does to-day, that is to say, twelve millions. But such establishment as is possible in principle from the point of view of density of population is extremely difficult from the economic point of view, for the refugees arrived for the greater part without resources, and Greece was impoverished by ten years of war.

Once the first disorganization had been dealt with, some plan of settlement had to be worked out, and the League and the International Labor Office were appealed to for aid. The great mass of the refugees came from a rural population, and a smaller part of them from an urban population. The rural element could be settled in the fertile plains of Macedonia and Eastern Thrace, where there were vast spaces of land. These spaces were divided up, for small estates are worked more intensely than large and therefore yield work and food to a denser population. The settlement of the rural population is now complete, with the exception of about 10,000 families, whom it is hoped to place with a fresh loan from the League of Nations. The blocks of land allotted to each family of cultivators are large enough to guarantee them an honest sufficiency, but are too small to allow for any growth of the families established there. There is, however, in Greece still about 1,000,000 hectares of land which, at present, cannot be cultivated because of its unhealthy condition. Once these regions have been made healthy, they will afford means of subsistence to a considerable number of peasants. The growth of the rural population in Greece is therefore possible.

The establishment of the urban population presents greater

difficulties in view of the fact that their numbers are so large relatively to those of the rural population.

In spite of the disaster which was its cause, this will have been a source of prosperity for the country which can concentrate all its forces in the work of internal development. Naturally, it is not desirable that a people should be brutally expelled from their homes in order to be re-united under their own Government. However, Greece has been doing her best to solve the problem of settlement. The question of the refugees is a problem which confronts Greece to-day and forces her to take an intense interest in all general questions of population.

As you see, the problem of the refugees in Greece, that is to say, the establishment of one and a-half million persons, has been possible with international aid, and I have not the least doubt but that Greece would not have been able to accomplish this gigantic task unaided. These facts convince me that the new institution which will be the result of the present Conference should consider seriously the problem of internal colonization, for it is by this means that, in these times of restricted emigration and immigration, the difficulties of the growth of population may be overcome. In conclusion, I will summarize my proposals as follows:

1. Questions of the density of population from the point of view of the national units and from a world point of view should be studied in a scientific and objective manner. I think that Professor East was a little too pessimistic in his report. The studies made by Penck show us that there is still enough room for an increase of population.
 2. Internal colonization must be encouraged in those countries where there is still enough land available, and the different problems should be solved by international help, as has been done in the case of Greece. There are countries which would willingly encourage international colonization, but they lack the capital necessary for the establishment of the surplus population and for making deserted regions habitable.
 3. International aid could be given to countries of immigration for the establishment of immigrants.
 4. Finally, I think that attention should not be paid exclusively to quantity, but essentially to quality.
- What will humanity gain by an increase in numbers without sufficient means of subsistence?

Professor E. M. East (United States): I should like to call the attention of the Conference to two points regarding migration which seem to me to be the most important of all, yet

which have not been touched on in the discussion. The first is the question of the ultimate result of immigration from an overpopulated to an underpopulated country. It seems to me that no statistician who has adequately and properly studied the facts can deny that, if emigration takes place from a country in which there is population pressure to a so-called underpopulated country, there is an immediate increase in the birth rate in the former country which restores the previous equilibrium. The same thing happens after war, pestilence and famine as well as emigration. Anyone who has studied the statistics of recent years will agree on that. Emigration, therefore, cannot be more than a very temporary solution of the population problem.

Secondly, though the immediate consequences of emigration are economic, the ultimate consequences are biological. During the last twenty-five years, the mechanical problem of heredity has been solved as accurately as the fundamental problems of physics and chemistry, and, without discussing whether one people is more intellectual than another, we know that within a country there are variations in inherent mental capacity. The variation is around the so-called normal curve.

Which side is the side likely at present to send out emigrants? In general, to-day and for the last twenty-five years, they are the people who are pressed out by population pressure in their own country. They are the people who are not able to compete with their own fellows in their own land. In the later 19th and early 20th Centuries, speaking of course by averages, it is not the successful engineers, the successful authors, or the successful university professors who emigrate, but the men on the other side of the curve.

•• Mr. Jean Bourdon (France): The question of immigration is interesting for the French from two points of view. In the first place, since the world war, France has become, in respect of numbers, the second country of immigration in the world. Each year our country receives the greatest number of immigrants after the United States. Moreover, the United States absorbs its immigrants into its population of 120 million Americans. We, for our part, have only a population of forty million French to absorb the immigrants, which means that, proportionately to the number of inhabitants, France is the first immigration country of the world.

The idea has been presented to you, both in the speech of Mr. Thomas and in his report, that there might be an organization of immigration on an absolutely international basis. It is very possible that this project will be realized one day, but allow me to put before you a present-day point of view and to tell you that at this present time, although there is a growth of interna-

tionalism and national cooperation, national characteristics and racial opposition are becoming more marked. It is much more difficult to weld together the alien elements in a population and to assimilate them than was formerly the case. The United States themselves are giving us an example of this, since they have welcomed immigration for the last fifty years, and to-day they are closing their doors to certain immigrants. Under these conditions, some selection is necessary; selection on physical grounds (the present insufficiency of which has been pointed out by Professor Léon Bernard); selection on moral grounds to exclude persons convicted of crime; selection on occupational grounds to attract workers to those occupations in France in which there is a demand for their labor, not where the labor supply is already in excess; selection on grounds of race to keep away those races which do not assimilate easily; selection on national grounds to hinder the formation of minorities which are alien in spirit if not in race. All these discriminations are necessary and must be enforced if we regard the problems of France, not from an international point of view, which will come later, but from a French point of view.

The obvious effect of such selection would be to reduce the total immigration into France, and the gap made in the French population by the war would then be filled by the French themselves through an excess of births over deaths. In this respect, I am rather opposed to the ideas put forth by certain Frenchmen who have a tendency to internationalism, who not only wish to have a large immigration, but oppose a growth of the birth rate, or, at least, they regard it with an evil eye.

There is an aspect of the immigration question for the French which does not concern France but our colonies. One hears it said in certain quarters that the French colonies should be in part taken away from France to furnish an outlet for the overpopulated countries of Europe. This idea is absolutely untenable. To settle a large number of Europeans in a country, there must be found at one and the same time a fertile soil, a temperate climate and no native inhabitants. The French colonies are almost all tropical, thus excluding the possibility of the establishment of a large European population. There, indeed, remains North Africa, of which the coast land has a fertile soil and a temperate climate, but the native population is too large to permit the settlement of a large number of Europeans. If the interests of the native population are to be respected, then only a small number of Europeans can be sent to North Africa. The several hundreds of French established in Algeria represent all the colonists that this country can absorb. As for Tunis, the colony could only receive a hundred thousand settlers, which would be infinitesimal in comparison with the volume of Italian emi-

gration. In other words, the French colonies can in no way serve as territory for a surplus population, and the international conflicts that the attempt to take the colonies away from France would raise would in no way be due to necessities of population and economy, but, simply to imperialistic aspirations.

† Professor H. Grothe (Germany): The German nation, in its fight for food and existence, has had to undertake great migrations. From 1812 to 1912, according to fairly reliable statistics, 9,000,000 Germans emigrated and were in this way lost to Germany. This figure is exclusive of the descendants of those emigrants. Before the war, Germany was a country of immigration on account of its industrial development. After the war, it became, as we have already heard at this Conference, a country of emigration, so much so that a new administration, the Federal Migration Department, has been set up to try to do welfare work in connexion with German emigration. This Department does not undertake any kind of national emigration policy, but merely advises emigrants.

Professor Penck, of Berlin, a leading German geographer with a Greek name, being exercised with regard to the possibilities of the globe from the point of view of feeding people, has undertaken a journey round the world, a journey which will take some years to accomplish, with a view to finding out more about the physical and anthropogeographical side of the world. He will be accompanied by several of his students, and he intends making a map giving information about climate, surface of the globe, mankind, and the possibilities offered by the different areas as a dwelling-place for human beings. He believes that at present the earth can provide for 8,000,000,000 people.

In view of the great interest that exists in Germany in questions of emigration, we were particularly pleased to hear Mr. Thomas incorporating an idea which is of enormous scope and import, the idea of a supreme, if I may say so, Emigration Court, which would be in the position of serving a very necessary and debatable question of abolishing the dangers of national emigration. There is a great future in this thought, but at present it conflicts with certain actual circumstances. The globe is divided up politically. The ratio of living and food supplies of a German as compared with an Englishman, taking into account surface, is 1 : 35.

Mr. Thomas had another very interesting idea, which is mentioned in his printed statement, that emigration should be induced towards such areas as are not under any political sovereignty. In my capacity as geographical scientist, I should like to ask where we can find such a territory. I believe that at a future date we shall solve the question of obtaining territories

for countries which are overburdened with population and the people of which would make good emigrants, this solution to be the result of international agreement.

A big difficulty lies in the fact that individual countries have based their legislation on a certain principle, namely, the principle of freedom of immigration. The German Federal Law lays down in Article 112 that every German is entitled to emigrate to non-German countries. The present-day German, who has been placed in a peculiar moral frame of mind finds it difficult to accept compulsion, so that it is particularly difficult to lead him at present in a special direction. German science, which is at present much taken up with migration problems, is certain to support the far-reaching and welcome proposal of Mr. Thomas, namely, that of bringing to the fore all of the migration problems by means of a scientific institute of international composition, and it will be the great merit of this Conference to have started the idea that science in all States of the world is placed at the disposal of international humanity in its work of studying thoroughly all these problems.

* **Mr. Albert Thomas (Geneva):** I recognized in Miss Gladys Pott's remarks that spirit of English individualism which becomes a little uneasy at the thought that it also may be incorporated in a great system of regulation and discipline. I will ask my technical experts to verify the facts in question.

The discussion we have heard has above all shown the need for a closer examination of the facts. You will have noticed the contradictory nature of the information given by the representative of Sweden and that given by the representative of Italy. According to the former, unemployment in Sweden varied inversely with the degree of prohibition of immigration in the United States. Mr. Boldrini told us, on the other hand, that the prohibition of immigration had had no influence on unemployment in Italy. These are questions which will need closer examination, if we wish to establish some principle.

The second point that I should like to emphasize is the interest in this discussion of the opinion of different nationalities. I was much impressed with the remarks made by Mr. Hersch. I was not altogether convinced by his explanation based on the law of the supply and demand of labor, but I note his observations on the influence of industrial changes on migration, and also the psychological point, the statement that countries of emigration and immigration have a common interest in the regular exchange of population. The treaties of labor concluded between France and Poland, France and Czechoslovakia, are proof of the mutual interest that these countries have in the exchange of population. Another point with which I agree is that to represent, as efforts

are made to represent it, the question of migration as one of opposition between the policies of emigration and immigration countries is perhaps to risk increasing the misunderstanding between nations. There is a psychological aspect which could be developed by a scientific institute for the study of questions of population, so that nations may be restrained from rising up one against the other, with erroneous ideas regarding migration. I think that we should bear in mind the importance of this psychological factor. A scientific institute would have, therefore, first a purely scientific role and, secondly, a task of propaganda, or more exactly, the task of creating such a mentality as will favor partial or general regulation of migration in the future between the different nations interested.

We have seen this afternoon the importance of this question for China. We have been reminded of the interest it represents for other countries. Mr. Paulet has reviewed past history, showing us that, even in the periods long past, there were found attempts at methodical organization which bear a slight similarity to after-war effects. I think that even those who have not had the opportunity of seeing for themselves the achievement of Greece have had the opportunity this afternoon of hearing a report of the effort at internal colonization made in that country. It is really an unheard-of achievement that in the course of a few years, by international cooperation, a population of 1,500,000, after a sudden political catastrophe, should have been assimilated and put to work on a soil which had been drained and improved, and that they should all be able to live to-day in such a manner as will enrich and prosper the country.

All this shows the experience that can be gathered together, but also, if I may say so, the necessity for studying phenomena of this nature more deeply and in a more scientific way.

I have reflected on these problems at length, and I have been troubled by them as much as a Frenchman as an internationalist. I do not subscribe, and I think that the very words I used show this, to a premature doctrine of internationalism, and I have at heart as much as anyone the normal and healthy development of our country. But what has been said on the subject of France should attract all our attention. We must have occupational selection. Perhaps we need not carry it out as other countries have done by completely shutting our doors.

The project of an international organization, the idea of a supreme council, a supreme court of migration, has been considered rather premature. The interest lies in weighing the value of all the different agreements which can be established at the present time, to work out from them a general theory and a general attitude of mind by which the present problem may be solved. There is no solution to the problem of how to

work out, develop, assure, make lawful any strictly national policy, but, on the contrary, it is necessary to work out and assure by international cooperation a solution of the difficulties. I think that there is enough goodwill here to understand that there exist examples of international cooperation which justify our trying by passionate and resolute study to find a solution of the serious problems which we have before us.

I do not wish to create any misunderstanding on the question of an institute. I had in mind an institute for scientific study and information. I did not think for one moment of giving it executive powers. If this were done, the institute would immediately become an official institution. In acquiring executive power, it would lose a certain liberty. If this institute is created, I hope that, even with financial support from the Governments, it will have a really independent character.

The method of work in our international organizations is remarkable. Sometimes the questions are purely legal, sometimes it is a question whether during four or five successive sessions of the Governing Body of the International Labor Office a committee will be composed of five members or whether it will be composed of only four. Nothing else is discussed, but in reality all those behind the scenes know that it is really the antagonism between the countries of immigration and those of emigration which is hindering the discussions. It is because of this that I say that the problem is not quite ripe and that it must be helped to ripen. It is a question of creating the necessary mentality as well as obtaining the equally necessary information.

It has been said, since an institute exists, why do we not depend on the development of the scientific services of the International Labor Office or the League for an international solution? I was a little amused that the proposition came from a subject of a country which, each time that the International Labor Office has wished to increase its budget a little for purposes of research, has held us back terribly. That is the reason why I think that it is from the side of private organizations that development can be achieved at the present time to create the necessary mentality with all the different resources of information, study and propaganda.

To summarize:

- (1) Our discussion shows the necessity for critical scientific study.
- (2) Our discussion shows that full and organized discussion of these points diminishes the hostility between States which arises from psychological and political causes.

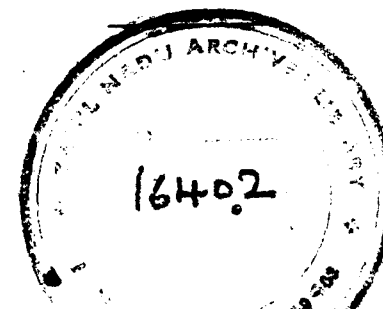
and the problem appears as a social problem, a labor problem, a problem for the whole of humanity.

- (3) As for the institute, I ask that it should have a wholly free and scientific character.

SUPPLEMENTARY REMARKS.

† Dr. Leon Wernic (Poland): Poland is one of the greatest emigration countries of Europe. After the war, more than half a million Polish emigrants went to France in addition to those who migrated to Germany and America. In view of the world crisis, the economic situation of Poland is such that there is not enough work for all, though the number of unemployed is decreasing every month and industry is expanding with great rapidity.

The Polish Government is desirous of securing for its emigrants in a peaceful way territories for colonization, where they can have scope for free development and can cultivate tracts of untilled land. This has been done in Brazil, where thirty per cent of the whole State of Parana is cultivated by Polish colonists. Under these conditions, international goodwill requires the carrying-out of labor agreements. Individual employers should not break their contracts with the emigrants owing to an unforeseen local trade depression. The question of setting aside populated territories for the use of the surplus population of emigration countries is one of great moment at the present time.



THE PRINCIPLES OF MIGRATION RESTRICTION

by

Professor J. W. GREGORY.

The problems of migration have entered a new phase owing to the Quota Restrictions of the United States. Those restrictions on migration have intensified racial feelings in the United States in consequence of the shortage of white labor, and are forcing Europe by increased population pressure to seek new outlets. Australia is likely to be regarded as the most spacious asylum for refugees from the overcrowded rural population of Southern and Eastern Europe, who can find no room in their own towns and who cannot be excluded on the ground of race or color.

The closing of the United States may divert to Australia as many recruits as can be absorbed, and many of them will be well fitted by their native climates for settlement in tropical Queensland and the new territory of North Australia. Australia, proud of its ninety-seven per cent of Australian or British birth, may hesitate to admit a flood of settlers from Southern and Southeastern Europe. The claim that any country with a population of only one or two per square mile must be ready to let in the overflow from countries with 200 or more per square mile appears at first sight reasonable. No nation has made the land it occupies, or has the right to prevent its adequate use. The justification for breaking-up the large stations in Australia and New Zealand into farms by the closer settlement policy may be applied to countries as well as to estates. No nation on our fast-filling earth has the right to a dog-in-the-manger policy regarding land. No ring fence has long protected an unoccupied land from its overcrowded neighbors, and it is generally recognized that migration can no more be stopped from an overcrowded poverty-stricken area to one where the same race enjoys more prosperous conditions than water can be prevented from flowing from a higher to a lower level on an open slope. The right, however, of an overpeopled land to discharge its surplus into

an underpeopled area is limited by the right of every country to control immigration on several grounds:

- (1) The occupants of a land have to prepare it for a denser population.
- (2) A country can only absorb immigrants at a certain rate.
- (3) The pioneers who have done the rough work in subduing a waste land have a just claim to a fair reward.
- (4) Every country has the right to prevent that lowering of its standards of life that would inevitably result from the unrestricted entry of people who live at a lower stage of culture.
- (5) As there are large areas in the world which are uninhabited or sparsely occupied, nations with a large surplus of population should do their share of breaking-up new land, and not expect free admission to an area that one people has subdued for the benefit of its own children.
- (6) Every nation has the right to protect itself from deterioration by racial intermixture.

The principles that have led to the United States Quota Regulations and the claims for a White Australia and for the restriction of immigration to a rate which will not endanger the high standard of life and opportunity which Australia offers its people are ethically and politically sound. In view, however, of the overpopulation of the British Isles, of Italy, Germany and of parts of Russia, the restriction of immigration in areas available for European occupation can only be justified within limits necessary to safeguard the wellbeing of the sparsely peopled land. The United States Quota have been established on an arbitrary and unscientific basis, the 1924 Act limits the annual immigration from any country to two per cent of the number of that nationality resident in the United States in the year 1890. This principle may be defended on the ground that the American race is so excellent that the new ingredients admitted to the "melting pot" shall be added in the proportions that have secured so happy a result. The basis on which the percentage is estimated is, however, fortuitous. A potato famine increased the Irish percentage in the States at one time; a boom in lumber led to a spurt in Scandinavians; German immigration was predominant at one period, and Italian at another. The principle of the United States Quota considers only the result to America and pays no heed to the needs of the nations which must secure relief by emigration to prevent deterioration. Quota based on the density of population — allowance being made for the supporting power of the lands concerned — would be more in accordance with general justice and consideration. Countries

with a density of 362 per square mile, such as Italy, or 654 as Belgium, or the British Isles with 389 per square mile, have a greater need of emigration than countries of similar geographical conditions and resources but with a sparse population. A country like Italy with a high density throughout has a greater claim for consideration than a country like Southern Russia with large areas that might support a bigger population than they have at present. A country such as China, which is the thirteenth of the large States of the world in density of population and has vast areas that would support a larger population if they were provided with adequate roads and other means of communication, has no claim on sparsely peopled land elsewhere until it has made full use of its own.

Australia is biologically well supported in its claim to restrict immigration to the white race, and it would no doubt prefer to maintain its present British racial solidarity, but immigrants from Southern and Eastern Europe cannot be excluded as belonging to a different race. There is weighty scientific evidence for the inferiority of mixed races, but the balance of evidence is against the necessary appreciable inferiority of the offspring of different sections of the same race. There is no biological support for the view that the intermarriage of Italians and East Europeans with the people of Western and Northern Europe produces inferior progeny. Whether immigrants from the various European nations should settle in national groups or whether they should be scattered is a problem upon which American experience is the most important, though opinion is divided as to which is the better plan. Colonies of people of the same race are probably easier to manage in the beginning, but large national alien colonies may long resist assimilation and are apt to be more difficult of control. The difficulties due to such isolated national groups have been experienced in the United States, in Eastern Europe and in Asia. The Australian Government has already the power, by its Immigration Amending Act of 1925, to prohibit by proclamation the entry of any class not likely to be assimilated. The host country should trust by wise regulations, fair play, and a sound system of national education to secure in time solidarity in character and interests. In the case of Australia, the distance from Europe is so great that immigration must be necessarily so slow that there is no serious threat to the supremacy of the present Australian stock. The proportion of non-British blood in Australia is insignificant. According to the Census of 1921, the numbers of the ten nationalities most largely represented were British, 5,387,205, Chinese 13,799, Italian 4,903, German 3,555, United States 3,257, Greek 2,817, Japanese 2,629, Russian 2,317, French 2,088, Dutch 1,617. The immigration from Italy

has increased the figures varying from 1,278 in 1921 to 6,102 in the year 1925, of Greeks 258 entered in 1921, 472 in 1922; 922 in 1923, 2,028 in 1924, and 645 in 1925.

Canada is likely to receive an even higher percentage of people from Southern and Eastern Europe than that which has led to the restrictions of immigration into the United States. The number of Italians resident in the United States, according to the Census of 1920 was 1,610,109, and in one year, 1914, over 283,000 Italian immigrants entered the country. No such number could be absorbed in a year in Australia, but Australia has the chance of securing sufficient white settlers to utilize its tropical lands, and thus secure the financial success of the railways that are indispensable for the occupation and development of its isolated northern areas.

SOME ASPECTS OF THE MIGRATION PROBLEM

by

Dr. A. KOULISHER.

I do not think that the importance of migrations has been as yet sufficiently emphasized in the theory of population. As a matter of fact, there is no such thing as the independent development of the population of a country, if it is at all accessible from abroad. There is a tendency, always at work, if never actually attaining its object, towards the equalization of population conditions prevailing over the whole area, within easy reach of existing means of transport. Any country which presents an exceptionally favorable balance between the numbers of population and the available means of subsistence, as compared with its neighbors, will be necessarily confronted with immigration, tending to bring it down to the average level. This tendency may, of course, be checked by natural barriers,

hampering migration, or by the resistance of the native population. We must remember that the free and peaceful admission of foreigners, as a general rule, and in any numbers (what Mr. Thomas calls "the anarchic liberty"), was a special feature of 19th Century civilization, unknown to former epochs and not practised to-day. In fact, most of the great migration movements in history were accompanied by, if not identical with, war.

Now, every migration movement is apt to engender other such movements. The means of transition are various. Emigration may create a vacuum, which will attract a new emigration. Unrestricted immigration may produce or hasten the overpopulation of the country, which will send forth emigrants in its turn. Again, war is as often the cause as the consequence of migration. There may be an actual driving-off of the population, or depopulation by death, providing an opportunity for immigrants, or, on the contrary, an artificial overpopulation may be produced through the destruction or waste of means of subsistence by the ravages of war or by the burdens of militarism. Nothing is more common in history than the flight of peasantry, who abandon their fields to avoid intolerable taxation, occasioned by military expenditure, and start far-off colonization movements, if they do not simply seek refuge from the tax gatherer or the hands of the recruiting sergeant. Hence, poverty producing migration and war and war producing poverty, the movement is propagated onwards and onwards, and sweeps over immense areas, the peoples pushing one another, or, as the case may be, opening the way for one another in definite geographical directions.

For example, the 15th and 16th Centuries were a time of Chinese expansion in Southeastern directions, by means of conquests in Indo-China and great overseas expeditions. At the same time, China showed a complete weakness on her north-western frontier, as against the Mongol tribes, who, having crossed the desert of Gobi, harassed the Chinese provinces in the 16th Century and expanded to the East, till the Manchus were, too, stirred into the movement: they had no further outlet to the East and turned South, conquering China herself in the first half of the 17th Century. In the meantime, the migration of the Mongols had opened the way for the Russian conquest and colonization, in the second half of the 16th and the first half of the 17th Centuries, of the country to the east of the Volga and of Siberia. This great movement of the Russian population to the East was, as has been noted by Russian historians, the cause of the military weakness and the territorial losses of Russia in her wars with Poland and Sweden in the same period. Again, the expansion of Poland to the East and Southeast was accom-

panied by a migration movement of the Lithuanian and South-Russian population (then subject to Poland), who colonized the Ukraine, while Poland, on her other frontier, received a considerable immigration of Germans, who fled from the horrors of the Thirty Years War. This emigration, coupled with the destruction of the population in the war, turned Northeastern Germany almost into a desert, and, in the second half of the 17th Century, the Government of Brandenburg encouraged immigration from Western Germany, Holland and France. This migration was stimulated by the French aggressions against the Netherlands and the Rhine country; on the other hand, the havoc and depopulation wrought in those countries by the wars of Louis XIV provided the opportunity for the immigration of the French Huguenots, who also pushed further on, to Brandenburg. In the last quarter of the 17th Century, the German movement was continued to the Southeast, when Austria took South Hungary and Transylvania from Turkey: a conquest accomplished by an army recruited from all parts of Germany and followed by a considerable German immigration. But, meanwhile, the tide had turned in the Far East. In the last quarter of the 17th Century, China turned to the Northwest, conquering Mongolia and beating back the Russians on the Amour, and the expansion to the West was vigorously continued in the 18th Century. Even earlier, the movement of the Mongols had taken the Western direction. Southern Siberia and the Volga country were more and more filled with nomad tribes and, at the end of the 17th Century, their depredations almost stopped Russian colonization. The Russian peasants, flying from taxation or serfdom, went to Poland and the Baltic countries instead of to the Eastern steppes, others swelled the armies of Peter the Great, conquering the Baltic coast. At the same time, the war of the Spanish Succession put an end to the expansion of France.

And so the waves roll on through the ages, in a perpetual ebb and flow, on a sea of misery and blood.

The root of the matter is, of course, overpopulation and, in that sense, the fact of continuous movements is a confirmation of the Malthusian theory. But it is not at all necessary that a tendency of the population to outstrip its food resources by natural increase should be universally present at any epoch. It is enough, if such a tendency appears in a number of places, to produce a general movement, whose direction will be determined by that of the stronger currents, forcing back the weaker.

The immensely strong strategical position of England permitted her to hold at arm's length the devastating movements of the Continent and to make that progress in industrial, as well as in political, life which, when imitated all over the world, seemed for a time to have changed the essentials of the popula-

tion problem. In the 19th Century, the exceedingly rapid opening-up of virgin countries at once relieved Europe from her surplus population and placed prodigious food resources at her disposal. A consequence of this situation was a transformation of the migration movements themselves: they assumed a dispersed and peaceful character. At the end of the century, the "filling up" of America, expressed in the growth of immigration-restrictions, significantly and ominously coincided with the general rise in the cost of living. It somewhat preceded the point of culmination of the colonization of Siberia. The immigration to that country from European Russia reached its maximum in 1908 (759,000), then it was greatly restricted (falling after 1910 to half of the former number), owing to the exhaustion of fit land, while the Russian population increased at the rate of 22.7 per 1,000. Even earlier there had already appeared a new movement to the West from Russia to Poland and from Poland and Western Russia to Germany and America. In Germany, the immigration of Polish agricultural laborers precipitated the internal migration, which went from East to West and from the country into the towns. But it must be added that the situation was severely aggravated by the policy of agrarian protection, adopted for military reasons. Real wages declined after 1905 and there were food riots in Berlin in 1912.

Thus the catastrophe was prepared. In fact, the movement to the West assumed a violent form, and America had to help in beating it back. In the East, the German army brought about a parallel reversal of the movement. Central Russia was filled with the refugees from the western provinces and then the central industrial region was starved and ruined by the disorganization of railways, cutting her off from her resources of food and raw materials. Bolshevism came into being in the towns of Central Russia: the Red Armies invaded the agricultural provinces of the East and South, in the search of food, under the convenient pretext of communist distribution. They were preceded and followed by a mass migration in the same directions. But the civil war killed people at a lesser rate than it ruined agriculture. In effect, starvation was transported in an aggravated form from the industrial centres to the agricultural East, and the great famine on the Volga in 1921 was really the last stage of the world war. Then the movement was restricted once more and, parallel with the general re-population of Russia (she has already outstripped the pre-war numbers of 143 millions in place of 137) there went on and is continuing to-day a movement from East to West, filling, in particular, the towns of the Centre with unemployed and with vagabond youths, a result of that "agrarian overpopulation" which more and more disquiets the Soviet Government.

As the period of the exceptionally rapid increase of food resources and of the "open door" for migrations seems to be closed, birth control might be perhaps an alternative to the return to the ancient conditions if it prevailed universally. But we must wait a long time before this solution is universally adopted. In the meantime, the richer nations, which are also those with a sharply declining birth rate, if they refuse to admit the surplus population of the poorer countries, will be forced to help the potential emigrant populations in finding a living at home.

THE PHENOMENON OF EMIGRATION IN ITALY

by

Professor L. LIVI.

The marked density of the population, the remarkable fecundity of the inhabitants, and the limited possibilities for the development of big industry had, before the war, accustomed most statesmen and students to consider emigration abroad, in the growing proportions to which it was rising from year to year, as an inevitable and necessary phenomenon for the maintenance of the economic equilibrium of the country.

Even when, in the years immediately preceding the war, the mass of emigrants attained truly exceptional heights, approximating twenty persons for every 1,000 inhabitants, no action was taken and no measures were considered advisable to stem this alarming movement.

Convinced of the inevitability of the phenomenon, general attention was turned to watching the number of departures; much less care being taken to note the number of returns, complete statistics for which were only undertaken by the Commissariat of Emigration after 1921.

It is, however, possible to obtain reliable figures even for the pre-war years showing the loss of population suffered by Italy annually as a result of emigration, taking as a basis for the calculation the two census returns,* that for 1901 and that

for 1911, and the number of births and deaths during the decade. This calculation shows that the total number of inhabitants lost by Italy owing to emigration during that period amounted to 1,650,000, an average of 165,000 a year; and it is certain that 1911 to 1913 the deficit rose annually to some 200,000 persons, with a tendency toward a rapid increase.

Thus, in the last years of the period of peace, emigration deprived Italy of nearly one-third of the natural increase resulting from the excess of births over deaths.

The following table for the period 1876 to 1920 shows the figures supplied by the General Direction of Statistics based on the passports issued, and for 1921 to 1926 those for emigrants and returns calculated from the more complete statistical data supplied by the General Commissariat of Emigration, emphasizes the aforesaid striking development of the phenomenon, its arrest caused by the war, followed by a resumption during the first two years after the war, and finally the less intensive and declining movement during the six-year period 1921-26.

Period	Annual average number of emigrants	Emigrants per 100,000 inhabitants			Number of returns	Difference between emigrants and returns
		Conti- nental	Over- seas	Total		
	a	b	c	d	e	a-e=f
Annual average						
1876-80	108,800	295	95	390	—	—
1881-85	154,100	331	205	536	—	—
1886-90	222,000	304	440	744	—	—
1891-95	256,500	353	478	831	—	—
1896-1900	310,400	465	508	973	—	—
1901-1905	554,000	743	938	1,681	—	165,000
1906-1910	651,300	756	1,155	1,911	—	
1911-1913	706,000	848	1,163	2,011	—	—
1914-1918	168,500	250	217	467	—	—
1919-1920	416,400	490	688	1,178	—	—
1921-1923	319,600	381	439	820	149,600	170,000
1924-1926	312,900	467	318	785	202,400	110,500

The loss of population (see column f) falls in the last three-year period to an annual average of only a little over 100,000 persons. It should also be noted that in 1925 the figure stood very nearly at 82,000, and at 72,000 in 1926.

The prevalent impression of the unavoidable need of an out-

let in the form of emigration on a scale equal to that at which it stood before the war, took even deeper roots during the years of the conflagration, during which the mass of Italians who returned from abroad largely compensated for the losses suffered during the conflict; and it was strengthened in the first post-war period by the economic depression of the country and by the consideration that its population had increased.

So general was this opinion that on the Commission appointed by the Government in 1918 to study the post-war measures to be taken for demobilisation and the gradual return to peace conditions, the opposite view was only upheld by Professor Gini, who expressed a doubt as to whether the migratory current of the pre-war period responded to the real interests of Italy, and who maintained that the work of reconstruction and the general improvement in the economic structure of the country could and should make it possible to meet the pressure of population. He also asserted that emigration represented a loss to the nation.

The limitations enacted by the leading immigration countries forced Italy to put the issue to the test; and the test, assisted by the political and economic readjustments of the Fascist régime, has fully confirmed the above-stated thesis.

From 1925 until to-day the loss of population caused by emigration has been reduced to a little over one-third of that sustained in 1913; not only has the country stood this exceptional reduction without disturbance, but it has been accompanied, on the whole, by a gradual decline in unemployment.

The restrictions enacted by the immigration countries, which were at first considered to be a danger, are now considered to fall into line with the emigration policy followed by the Fascist Government.

• This policy considers disorganic emigration to foreign countries as an unnecessary and undesirable phenomenon. The reserves of population should, as far as possible, and no one any longer has serious doubts as to the possibility, be kept in the country, and should go abroad only when it is possible and desirable to encourage an organic colonization movement.

In accordance with this policy the Ministry of Foreign Affairs has recently laid down strict rules for the control of those persons who wish to go abroad to secure work, or to join relatives who have previously emigrated for that purpose.

Under these rules passports are only issued to those who hold a regular contract for work or who can show a regular request sent by near relations.

AUSTRALIA AND ITS IMMIGRANTS

by

CHARLES H. WICKENS.

inrush of an eager crowd hungering for the riches of the new Eldorado, and surging over the land wherever the report of a new discovery of the precious metal led to what had appropriately come to be known as a "rush". Our immigrants in that feverish period not only migrated from their overseas homes to Australia, but were decidedly migratory for a long time after their arrival there. Probably many if not most of those who came to seek gold never intended to be permanent settlers, any more than those who are now leaving Australia for the recently discovered goldfields of New Guinea expect to be permanently absent from Australia; nevertheless, many of those who came to dig remained to plough and the result was in many areas a substitution of agricultural for pastoral pursuits per medium of gold discovery.

5. In that decade of stress and strain between the beginning of 1851 and the end of 1860, the population of Australia grew from 405,000 to 1,145,000, an increase of 740,000 persons, or an average of 74,000 per annum. The increase was not uniformly distributed over the ten years, for 1851 saw an advance of only 32,000, a figure no larger than that for 1850 and not as large as that for 1849 when an increase in population of 41,000 was recorded. As a fact, from the beginning of 1848 onwards, the tide of immigration on a mild scale had already set in, due in large measure to the troublous political condition of Europe at that date. The gold discovery of 1851 served to accentuate that flow, and the waning of the earlier fervour of the Californian gold rush of 1849 increased its volume. In 1852, the population increase totalled 76,000, in 1853 it was 87,000, followed by 94,000 in 1854, 98,000 in 1855, 84,000 in 1856, 94,000 in 1857, and 81,000 in 1858. Then a marked decline to 46,000 in 1859 and 48,000 in 1860. These figures represent total increase in population, comprising not only net immigration, that is the excess of arrivals over departures, but also natural increase, that is the excess of births over deaths. Complete data for an analysis of the increase on these lines are not available for the gold rush period, but from the data available for the succeeding decade I estimate a natural increase for the ten years 1851-60 of about 140,000, leaving a net migration of some 600,000 for the ten years under review.

6. This is, of course, a much greater migration increase than has been experienced in Australia in any decade before or since, the nearest approach to it being 383,000 in the boom decade of 1881-90, and the next to that 208,000 in the decade 1911-20, when the losses due to the war were offset by the heavy immigration of 1911, 1912 and 1913. Of these latter years, 1912 with a net immigration of 92,000 persons holds the record

1. One of the outstanding Australian questions at the present time is that of immigration. Evidence of this is furnished by the fact that an important Commission consisting of experts in various lines has recently been appointed to deal with the appropriate expenditure of a sum of £34,000,000 to assist in the development of Australia's resources with a view to the absorption of British immigrants. With the objects for which that Commission has been brought into being I am sure we are all in accord, and I am sure we all wish it every success and will do everything in our power to assist it to that end.

2. This, however, raises the question "What is to be taken as a measure of success?" Some years ago, I undertook for my own information to investigate this question, and from my training as an actuary which inculcates the application to the future of the experience of the past modified by a knowledge of the current trend of events also derived mainly from the experience of the past, I set out by ascertaining what our past experience had been in this matter of immigration.

3. Our whole range of experience extends back to the arrival of the "first Fleet" in 1788 with its contribution of compulsory immigrants, but it appeared to me that there was nothing in the experience of the sixty-three years between 1788 and 1851 that would be of service to me, as the conditions were so different from those which have obtained in the last half-century or were likely to obtain in the future.

4. With the discovery of gold in 1851, a change came over the activities of the Australian people. The slowly progressing pastoral population which had grown from zero at the beginning of 1788 (the first settlement took place on January 26th in that year) to 405,000 by the end of 1850, or at an average of some 6,500 persons per annum, received a rude awakening from the

for any normal year since the settlement of Australia, the exceptional figure of 166,000 for 1919 being of course mainly due to the return of soldiers from the war.

7. I have, I find, digressed somewhat. I set out to indicate the unsuitability of the pre-gold period to furnish a measure of success in the matter of immigration effort, and to supplement that by a reference to the turmoil of the 'fifties indicating that that decade also was hardly a suitable basis. At the end of the ten years of gold rush, there was a set of the current outwards and the departures from Australia in 1861 actually exceeded the arrivals by 6,000 persons. In that year there was a somewhat heavy movement to New Zealand to participate in the gold discoveries which had recently been made there. This loss was to some extent offset in later years by numbers of persons who returned to Australia after disappointment in New Zealand gold-mining.

8. From the end of 1860 onwards the development of Australia has mainly been based on more or less normal procedure, that is, on the extension of agriculture and dairying in areas previously devoted to pastoral pursuits, on the extension of all three of these industries into new districts, on the gradual extension of the other primary industries, on the introduction and growth of the manufacturing industry, and on the development of those professional, commercial and transport services which supplement the primary and secondary industries in making up the life of the community. With the exception of the Western Australian goldfields rush, which may be roughly said to have taken place in the fifteen years 1891 to 1905 inclusive, there has been nothing in Australia corresponding in any way to the population growth associated with the discovery of gold in 1851. As I have mentioned the Western Australian gold discoveries and as there are features of this and the associated development which are somewhat similar to the experience of gold discoveries in Eastern Australia, I will say what I have to say here and avoid further recurrence.

9. The earliest development of gold production in Western Australia of important character was in 1886 when a small rush occurred to the Kimberley goldfield mainly from the Eastern States. This rush is reflected in the population figures of the State, which showed an immigration increase of 6,300 persons for that year and the succeeding year combined as compared with a total immigration increase of less than 5,300 persons in the twenty years preceding 1886. The aftermath of the rush appears in 1888, when the departures from Western Australia exceeded the arrivals by 850 persons. From 1889 onwards, there was a steady increase in the flow of population to Western Australia

due in part to the prospecting for and minor discoveries of gold and in part to the adverse economic conditions which were developing in the Eastern States, the after-effects of the boom of the 'eighties. The rush to Western Australia, however, was never at any stage comparable to that induced by the gold discoveries in Eastern Australia in the 'fifties, and, as before mentioned, it was largely drawn from the Eastern States. Taking the period of fifteen years 1891 to 1905 inclusive which covers the principal gold discoveries in Western Australia in the earlier years and the peak of gold production in 1903, the net immigration to Western Australia totalled 167,000. The origin of the bulk of these migrants is shown by the fact that for the same fifteen years the other five States taken together experienced a net loss by migration of no less than 159,000, the net result for Australia as a whole for the fifteen years being a gain by immigration of only 8,000 persons. This period covered the disastrous financial crises of 1893 and the almost equally disastrous drought of 1902.

10. It may be of interest in passing to call attention to the similarity in the mining and subsequent agricultural histories of Victoria and Western Australia. In both cases there was a considerable accession of population due to gold discoveries, in both the main rush of population practically exhausted itself in a relatively short period of ten to fifteen years, in both a substantial gold-mining industry still remained but it was of continuously diminishing annual value, and in both the population attracted by the gold discoveries diverted their main attention to agriculture. I do not propose here to deal with Western Australia's wonderful development in this respect further than to say that whereas at the end of the century, in the height of her gold-mining prosperity, Western Australia's area under wheat was less than 75,000 acres, at the present time she has 2,500,000 acres under wheat for grain and expects with a reasonable season to harvest a crop of 30,000,000 bushels, and have available for export 25,000,000 bushels. To such an extent is the agricultural consciousness developing in Western Australia that one hears it freely said locally that the modern goldfields of Western Australia are the wheat belt of that State. Whether in her further development Western Australia will also follow Victoria in the matter of secondary production remains to be seen, but it appears certain that, with her relatively assured rainfall at the appropriate season for wheat-raising and her extensive area of suitable land, Western Australia promises to play in Australia the part played in Canada by the prairie provinces.

11. Coming back from this further and even more extensive digression, I may say that I decided, in the effort to obtain a

measure of the success of present-day immigration activities in Australia, that an examination of what had resulted in this respect over the period of sixty years from 1861 to 1920 inclusive should furnish a fair indication. I accordingly obtained the necessary particulars and computed the ratio which over the period the net immigration per annum bore to the mean population. I found by such means that, although we had had in 1912 a net immigration of 92,000 persons (our maximum normal migration for any single year representing nearly twenty per 1,000 of mean population), we had also had some years apart from the war years in which there had been an actual excess of departures over arrivals. In fact, including the war years, there were in all fifteen years out of the total of sixty years in which there was such an excess of departures, and in ten out of the remaining forty-five years the total gain by immigration failed to reach 10,000 persons per annum. Prior to 1911 there were, in the sixty years under review, only two years in which the net immigration exceeded 40,000 persons, and these were in the bright heyday of the boom, when there were 70,000 recorded for 1883 and 51,000 for 1884. Including 1911, there have been from that year onwards only five such years, of which 1919 with its total of 166,000 mainly due to returning soldiers was one. The others were 1911, 1912 and 1913 with 74,000, 92,000 and 63,000 respectively, and 1924 with 44,000. For the whole period of sixty years, I found that the ratio of net migration per annum to mean population averaged $5\frac{1}{2}$ per 1,000.

12. Data are now available concerning the net immigration into Australia for the five years 1921 to 1925 inclusive, for which the figures vary from 15,650 in 1921 to 43,750 in 1924, and average 34,500 or slightly more than 6 per 1,000 of mean population. On this basis the net migration for the current year 1926 should be about 36,000, a figure which appears fairly likely to be realized. It would thus appear that, for the past five years, the net result of our immigration effort has given an average of 6 per 1,000 of mean population as compared with an average of $5\frac{1}{2}$ per 1,000 for the previous sixty years. Further, the records for the five years contain one year with a total exceeding 40,000 compared with six with a total in excess of 40,000 in the previous sixty years. I am not suggesting that, having attained or even slightly exceeded the record for the sixty years 1861-1920, we should rest satisfied with our efforts: that is a matter entirely for those determining our immigration policy; all I am concerned with at the moment is the measurement of the success of the present immigration effort on the basis of past experience in a similar line.

13. Having reached such a result (my figures at the time

did not then extend to the end of 1925, but the indications were somewhat similar to those now available), I rashly accepted an invitation when on a visit to a neighbouring State to give a lunch-time address on population, with special reference to immigration, and proceeded to make my pearls of wisdom available to my assembled hosts. As, apparently, it would have been contrary to the canons of hospitality to do other than speak kindly of their guest who had gone to the trouble of preparing an address for their delectation, my hosts gave me nothing but bouquets, and as I left the State that night I knew nothing for some time of the wrath which my address had aroused in the breast of one at least of my hosts and hearers. He was the editor of the local paper, an extremely respectable and well-conducted journal, which gave me a good report of more than a column in length. Having duly complied with all the canons of hospitality, my friend the editor then proceeded to pulverize me for suggesting that the rate of $5\frac{1}{2}$ per 1,000 of mean population appeared to be some sort of measure of our power of absorbing immigration. This he did in a leading article about equal in length to the notice he had given to my address and containing some choice epithets such as "Dismal Johnnie" bestowed on myself. The impression that my address made upon him is shown by the fact that, in commenting some two years later on a pronouncement on Australian development made by my distinguished predecessor, he characterized the author as a statesman as compared with "his successor the politician who goes around assuring the people that, as regards populating Australia, all is serene in the best of all possible worlds, and that we shall be quite full enough by the end of next century". I am not quarrelling with this gentleman's later opinion of my allegedly roseate views, nor would I have objected if he had sought "apt alliteration's artful aid" and had dubbed me an "official optimist", but it is hard treatment to be classed earlier as a "dismal Johnnie" and later as a "politician" because I ventured to say that an experience of Australian data extending over more than sixty years might reasonably be taken as an indication that our power of absorbing immigrants had been per annum about $5\frac{1}{2}$ per 1,000 of our mean population, and that the experience of the world indicated that, with such limited power of absorption, Australia in the forty years 1881 to 1920 inclusive had been able to maintain a rate of population growth unequalled in the same period in any country of the world, except our sister Dominion, New Zealand. My figures in this respect are perhaps worth quoting, and, in a slightly supplemented form, are as follows:

In the forty years 1881 to 1920 inclusive, New Zealand's population increased at a rate of 23 per 1,000 per annum, Australia

ranked second with 22 per 1,000, U.S.A. third with 19, and Canada fourth with 18. Corresponding figures for some other countries for the same period are as follows: Chile 15; Ceylon 14; Holland 13; Denmark 12; Finland 12; Jamaica 12; Japan 11; England and Wales 9; Germany 8; Switzerland 8; Norway 8; Belgium 7; Italy 7; Sweden 7; Scotland 7; Spain 5; and France 1. My experience in this matter has shown me that the policeman's lot is not the only one deserving of sympathy, since it is undoubtedly true that:

"When Immigration duty's to be done, to be done,
"A statistician's lot is not a happy one."

14. In view of the fact that we have never at any time in Australia had a net immigration which reached 100,000 in any normal year, and never, except in one year, 1912, closely approached that figure, the actual figure then being 92,000, it may be asked why it is that so many people have the notion that a net gain to Australia of 100,000 in a year by migration requires a relatively small effort and represents a relatively small result. It is probable that in many cases the notion is due to general lack of knowledge concerning Australian immigration, accentuated perhaps by the not unnatural desire that our own country should justify by her numerical strength the occupation of a leading position amongst the countries of the world. Such a desire, however, does not carry us far and we are brought back to cold reality by the hard fact that, in an experience of sixty-five years from 1861 to 1925 inclusive, there have been only seven years in which a net immigration of 40,000 persons has been exceeded, and in one of these years the result was due almost entirely to the return of our own soldiers from the war.

15. In a pamphlet issued by an ex-member of the Federal Parliament since I completed the rough draft of this address, it is stated that "the scheme now in hand, though a vast improvement on previous efforts, is still ridiculously inadequate in the face of Australia's necessities". The author goes on to say that "we are told that the proposed arrangements, if carried into effect, will settle 450,000 persons in ten years, or at the rate of 45,000 a year. Yet before the war Australia, without any definite scheme, was getting on an average 50,000 from Great Britain annually. That number should be doubled every year if Australia is to be regarded as in earnest about filling up her vacant spaces with people of her own race". I am unable to ascertain from what source the author obtained his data. Taking as the measure of immigration the excess of arrivals over departures, it may be said that, in the sixty-five years of Australian

history from 1861 to 1925 inclusive, the five-year period which was most prolific in immigration was that from 1909 to 1913 inclusive. This gave a total of 281,193 and an average of 56,239 per annum. As I have already shown, this was preceded by a period of seventeen years which gave a net loss of population by excess of departures over arrivals of some 13,000. The period of five years 1921 to 1925 inclusive, with an average net immigration of about 34,500 per annum, has in fact been more productive of immigrants than any similar period since 1890, with the single exception of the period 1909-13 just mentioned. Concerning the author's suggestion that an annual net immigration of 100,000 should be maintained if Australia is to be regarded as in earnest, I would point out that at present such a net immigration would represent a continuous stream of more than 16 per 1,000 of mean population per annum, a rate which, since 1890, has been only attained in three single years — 1911, 1912 and 1919 — and in the last-named year was produced by returning soldiers. I would like to point out here that if the objective mentioned is that of securing a net immigration of 450,000 in ten years and if it be assumed that the population of Australia will continue to grow at the rate of two per cent per annum, an inflow in proportion to mean population throughout the ten years would be as follows:

Year	Net immigration	Year	Net immigration
1926 . .	41,100	1931 . .	45,400
1927 . .	41,900	1932 . .	46,300
1928 . .	42,800	1933 . .	47,200
1929 . .	43,600	1934 . .	48,100
1930 . .	44,500	1935 . .	49,100

On the assumptions mentioned, this would represent 6.8 per 1,000 of mean population per annum throughout and, in view of our past experience, would appear to be a reasonably heavy task. From present indications, it does not appear likely that 40,000 will be attained for 1926.

16. Up to the present, I have been considering in the main the aggregate amount of net immigration for somewhat lengthy periods, but there is some advantage in having greater detail and, for this purpose, I have taken out the ratio to mean population of the net immigration or net emigration for each of the sixty-five years 1861 to 1925 and have prepared a graph representing the actual number of such net immigrants and also the ratio for each of these years. I will not now weary you with the numerical details further than to point out that the period under review commenced with a net migration loss of 6,000 followed by gains in succeeding years reaching a maximum of 31,500 in 1864

and thereafter declining to a minimum of 3,000 in 1872. From this point onward, the migration gains increased with minor fluctuations to a peak of 70,000 in 1883 and 51,000 in 1884, moving downwards thereafter with some fluctuations to 27,000 in 1891. Then migration gain may be said to have ended for a long period. In the seventeen years from 1892 to 1908 inclusive there was no year in which the net immigration to Australia reached 7,000 persons, and in ten out of these seventeen years there was an actual loss by migration, totalling nearly 10,000 in 1903, when the effects of the drought of 1902 were being severely felt. For the full period the losses exceeded the gains by some 13,000 persons: that is, during this period of seventeen years, Australia failed to retain the full benefit of her natural increase by excess of births over deaths. This period of dearth was succeeded by five years of the most active immigration experienced in Australia since the 'fifties. It commenced with 22,000 in 1909; followed by 30,000 in 1910; 74,000 in 1911; 92,000 in 1912; 63,000 in 1913; and totalled 281,000 for the five years. The war came in 1914 and it is very commonly supposed that it was this outbreak which put an end to the migration boom. In view, however, of the fact that the first half of 1914, when there was no word of war, was responsible for a net immigration of less than 13,000 persons, it would seem that the migration wave had spent its force and that, war or no war, we were in for a period of reduced numbers. As matters turned out, it is a certainty that, even if there had been no war, the severe drought of 1914 would have resulted in a marked retardation of immigration even if it had not, as did the drought of 1902, resulted in net emigration. With the outbreak of war, normal conditions were at an end and the net loss by emigration, mainly soldiers, was 239,000 persons during the four years 1914 to 1917 inclusive. By the end of 1920, practically all Australian soldiers who intended returning to Australia had come back and the net immigration for the three years 1918-1920 was 217,000. For the seven years covered by war and the main post-war activities, the migration result was thus a net loss to Australia of some 22,000 persons. Following that we have the period of five years 1921-1925 to which I have already referred as furnishing a net immigration averaging 34,500 per annum or about 6 per 1,000 of mean population. It will thus be seen that, throughout the sixty-five years under review, there have been immigration booms and immigration depressions followed by further booms and in turn succeeded by still further depressions. In dealing with this matter elsewhere, I have suggested that "like the boa constrictor, we are in the habit of bolting our immigrants and then resting until we have digested them", and I have hinted that "such a process of alternate gorging and inertness does not

seem the most desirable way to organize the development of the country".

17. It is very interesting to notice the objective pictured by some of our immigration enthusiasts. I remember on one occasion being on a private committee engaged in considering this question and being startled with the proposal of one of our most prominent members that the objective should be that of doubling our population in twenty years. I pointed out that this would involve an annual increase over the twenty years of $3\frac{1}{2}$ per cent and that, if our natural rate of increase, which was then $1\frac{1}{2}$ per cent per annum, were maintained, this would mean an immigration rate of two per cent of our mean population involving a net immigration of some 110,000 per annum at the beginning of the twenty years and some 220,000 per annum at its close. I am afraid that my warnings fell on deaf ears, but in any event the proposal did not materialize and the doubling in twenty years has yet to be achieved. On other occasions, I have been asked to indicate the uniform annual number of net immigrants necessary to enable a population of 20,000,000 to be attained in a given number of years, assuming the existing rate of natural increase, about $1\frac{1}{2}$ per cent, to apply to existing and immigrant populations alike. My calculations indicated that, to reach 20,000,000 in twenty years, a uniform net immigration of 512,000 persons per annum would be necessary, and that to reach it in even forty years would require a net immigration of 167,000 per annum. What is not seen by many of the people who ask these questions is the fact that in our community we are dealing with a highly complex organism which, like the human organism, may suffer severely from anything approaching overfeeding. With such an organism, growth must be more or less gradual and it is desirable that it should be continuous. The alternations of feast and famine are not unknown amongst primitive people, but would not be recommended by either doctor or economist as a desirable mode of life. At any given time in any community, the channels of occupation appropriate to the stage of development then reached by that community are reasonably filled and any attempt to overload them would be as disastrous as the turning into irrigation channels of supplies much in excess of what they are provided to carry. To accommodate such extra supplies, higher banks are required, new channels are needed and perhaps even more urgently new fields for irrigation. This indicates the wisdom of associating development with immigration.

18. We have recently seen in the Press comment by the "Gloomy Dean" concerning the dog-in-the-manger policy of the Dominions, with large open spaces, in declining to relieve Great Britain of her surplus population. Suggestions have been made

that some 500,000 of such surplus could or should be absorbed annually by these Dominions and the impression is given that we are barring our doors against our unfortunate kinsmen. How entirely untrue such an impression is I need hardly say here. Not only have we never barred our doors against reasonably sound free immigrants from the motherland, but we have spent large sums and have undertaken large liabilities to assist these people to come. In all cases the man who pays the piper has the time-honoured right to call the tune, so we, in paying for our assisted immigrants, stipulate that those paid for shall comply with certain standards. If those who do not quite come up to such standards or who object to submit to a test will emigrate to Australia at their own expense, they will find that, unless they are likely, through extreme physical disability or moral depravity, to become a charge on the community, there will be no opposition to their merging into Australia's population and obtaining what share they can of her empty spaces.

19. Let us pause here for a moment to examine this question of the annual absorption by the Dominions of some half-a-million immigrants. I have already shown that, in forty years 1881-1920, no countries in the world have increased in population more rapidly than have Australia and New Zealand, the rates for these two Dominions differing from each other by comparatively little. It appears certain therefore, without further detailed investigation, that none of the Dominions has absorbed immigrants during this period more rapidly than we have, or, on the principle of estimating our future possibilities on the basis of our past experience, that none of them appears likely, in the absence of some exceptional development, to be able to absorb more than say 6 per 1,000 per annum of mean population. The present white population of the Dominions is about 19,000,000 and 6 per 1,000 on this figure would represent a total of 114,000 only per annum. To absorb 500,000 immigrants annually would require, for all the Dominions, absorption at the rate of more than 26 per 1,000 of population per annum, a rate which, in Australia, has in normal times only once been attained, and that was in 1883 at the peak of the land boom migration, when the rate recorded was nearly 29 per 1,000. Our lengthy experience indicates that such a rate, if attained, could not possibly be maintained.

20. The feeling of resentment on the part of the "Gloomy Dean" and others is somewhat similar to that which is apt to be felt by some of our own producers of fresh or dried fruit or butter or boots, or other commodities for which we may have at the moment a difficulty in finding a ready outside market. Such producers are at times inclined to think that, because they have

applied themselves industriously to the production of wholesome food or excellent wearing apparel or what not, they have a right to expect that a market will be found for the result of their efforts not locally required. Such a market may possibly be found, but, if that cannot be done, the only available remedy may be a restriction of the output to the available market and a transfer of energies elsewhere. Is it not possible that some of the countries of the Old World are producing immigrants more extensively than the world's market for immigrants warrants, and that serious attention should be paid by them to the appropriate adjustment of such production? The quality of the immigrant, like the quality of our dried fruit or our boots, may be excellent, but, if there is no market, they constitute a glut with all the trouble which a glut signifies in markets elsewhere.

21. Some years ago I made an estimate of the value of the human capital of Australia and came to the conclusion that a fair average value of each person as at June 30th, 1915, was approximately £1,250. With the change in price levels that has since taken place, a similar calculation would give a much higher figure now, and I would not be surprised if an average in the neighbourhood of £2,000 were obtained by similar calculations. In view of these results, I may perhaps be asked why I suggest prudence in the matter of immigration. If each person is worth on the average £2,000 to this community of which he will be a unit, why not bring him out in shiploads? What I have just said in respect of markets applies in this case. Australia has some 90,000,000 sheep at the present time. If these were now worth £90,000,000, it would not follow that, if we increased the number to 180,000,000, they would be worth £180,000,000. On the contrary, there is a strong probability that we would be so overstocked that, in the rush to save as much as possible in view of an impending drought, the value of the 180,000,000 at prices then current might be much less than the £90,000,000. A glut is a glut whether in sheep, fruit, boots or population, and one thing which we learn from this study of immigration is that the whole question of population, whether in the case of those supplying or those taking immigrants, requires much more constructive criticism and investigation than it has yet received anywhere. The principle of *laissez faire* cannot continue to be allowed to rule in such matters. We must in all cases decide upon our objectives, and then devise the appropriate means to reach them. Mere talk of empty spaces here and surplus population there will relieve the situation nowhere, and mere transference of the surplus population to the empty spaces without adequate consideration of the ability of the empty spaces to sustain the surplus population will accentuate and not alleviate existing difficulties. There is no doubt that in this, as in other

matters, we should take Emerson's advice to hitch our wagon to a star, but in these days it is at least advisable that we should have some particulars concerning the star which is to act as tractor and an estimate of the length of the hitching chain that is necessary.

APPENDIX.

Australian Net Immigration (Excess of Arrivals over Departures) — 1860-1925.

Year	Net immigration		Year	Net immigration	
	Number	Per 1,000 of mean population		Number	Per 1,000 of mean population
1860	23,949	21.4	1893	— 7,379	— 2.2
1861	— 6,283	— 5.4	1894	3,163	0.9
1862	8,299	7.0	1895	2,857	0.8
1863	22,321	18.1	1896	6,545	1.9
1864	31,550	24.4	1897	6,995	2.0
1865	30,259	22.3	1898	— 507	— 0.1
1866	23,945	16.9	1899	— 1,736	— 0.5
1867	7,552	5.2	1900	— 8,810	— 2.4
1868	17,962	11.9	1901	2,959	0.8
1869	15,044	9.6	1902	— 4,293	— 1.3
1870	15,916	9.8	1903	— 9,876	— 2.5
1871	11,682	7.0	1904	— 2,983	— 0.8
1872	3,037	1.8	1905	— 2,600	— 0.6
1873	11,368	6.4	1906	— 5,049	— 1.2
1874	17,121	9.4	1907	5,195	1.3
1875	18,454	9.8	1908	5,437	1.3
1876	25,082	13.0	1909	21,783	5.1
1877	34,384	17.2	1910	29,912	6.8
1878	21,602	10.5	1911	74,379	16.6
1879	25,300	11.9	1912	91,892	19.7
1880	23,774	10.8	1913	63,227	13.1
1881	28,528	12.6	1914	— 8,226	— 1.7
1882	37,856	16.1	1915	— 84,410	— 16.9
1883	69,865	28.6	1916	— 128,737	— 26.0
1884	51,067	20.0	1917	17,822	3.6
1885	36,724	13.9	1918	23,359	4.6
1886	38,702	14.1	1919	166,303	32.0
1887	33,822	11.9	1920	27,606	5.2
1888	38,927	13.3	1921	15,654	2.9
1889	22,606	7.5	1922	38,023	6.8
1890	24,644	7.9	1923	37,540	6.6
1891	26,873	8.4	1924	43,749	7.5
1892	— 3,122	— 1.0	1925	37,357	6.3

* Period dominated by war departures and returns.

SIXTH SESSION.

Chairman: Dr. GOLDSCHMIDT.

Paper presented to the Conference:

HEREDITY, DISEASE AND PAUPERISM, by Mr. E. J. Lidbetter

Supplementary Papers:

RACE BIOLOGICAL INSTITUTES, by Professor H. Lindborg.

SCRIPPS FOUNDATION FOR RESEARCH IN POPULATION PROBLEMS; by Dr. W. S. Thompson.

REPORT OF THE EXECUTIVE MEETING, Saturday, September 3rd, 1927.

CLOSING ADDRESSES.

HEREDITY, DISEASE AND PAUPERISM¹

by

Mr. E. J. LIDBETTER.

No examination of the problems of population can be complete to-day without a consideration of the problems of heredity, for population depends upon reproduction and survival and these in turn depend upon heredity. The problems of population are no longer to be regarded as essentially economic, but as mainly biological. In this respect, the teaching of the economists of the 19th Century needs to be modified.

If the economic theory of the last century on this important question needs to be modified, so also must the social theories that arose out of it, particularly in the matter of social inadequacy, in its various forms, for these, we now know, depend to a very large extent upon heredity and not, as was formerly supposed, upon economic conditions.

The social conceptions of the 19th Century failed to appreciate the primary significance of reproductive competition, or of the fact of human differentiation that arose out of it. It presumed a community of co-equal units in which all men stood on a uniform plane. However a man might differ from his neighbor, social theory assumed an equality of understanding and opportunity and an equal response to social and economic influences. The dangers that lurk in generalization were accentuated by a doctrine which ignored the diversities of character, temperament or condition, or obscured them under an assumption of uniformity.

To a large extent these views prevail to-day and it is probably the survival of this attitude in relation to the socially inadequate that prevents those in authority from squarely facing the questions as to what kind of person the pauper is, what his antecedents were, what he is likely to become, and in particular, what his children are likely to become.

¹ Diagrams for this study will be published by the Eugenics Society of London.

me questions such as these were in the minds of the members of the (English) Eugenics Society in 1910 when that Society commenced research as to heredity in relation to pauperism. The research then commenced has steadily continued, save only for the interval during the war. At first the work was somewhat disconnected in character, and later attempts to organize research broke down from various causes. The experience gained was, however, of very great value, and there emerged from those early efforts, first, a recognition of the great sociological value of such a research and, secondly, a clear understanding that, if full importance was to attach to results, the work must rest upon a statistical basis. We learnt that the mere collection at haphazard of a large number of pedigrees would be of much less value than an attempt to measure pauperism, heredity and disease in relation to a definite community — a statistical examination.

Accordingly, on a date in 1923, when post-war conditions had somewhat settled down, a census was taken of all the persons in receipt of relief in a certain Poor Law area in East London, care being taken to exclude the large number of persons in receipt of outdoor relief in consequence of the industrial depression then prevailing. The population of the area was roughly 120,000, whilst the number of persons appearing in the census so taken was 2,850, nearly all in institutions. This number included 500 insane and 230 idiots or imbeciles.

The figures give some idea of the extent of the work attempted. The scope of the work may be gathered from the objects sought, which may be stated as follows:

1. To ascertain the measure of family chargeability¹, and as far as possible to reduce the results to pedigree form.
2. To ascertain the age of onset of defectiveness and the incidence of repetition in chronic cases.
3. To measure the periods of chargeability¹ against the periods of independent support.
4. Generally to compare the ascertained family chargeability with cases of individual chargeability.
5. To obtain records of fertility and survival, infant mortality, birth intervals and suchlike information in the last generations.

As might have been expected, it has been found possible to incorporate into this work much that had been done in the years before and, whilst progress has not been as rapid as we had hoped, it is now clear that valuable results will be secured.

The extent of the research was sufficient to justify the view

¹ Chargeability means that the person concerned is wholly or partly maintained at the public expense.

that some broad general conclusions might be drawn from the results. In this we have not been disappointed, as will be seen later.

Concurrent with the larger work, an attempt is being made to provide a control investigation. This consists of an enquiry on similar lines into the family histories of 100 children taken at random attending the schools in the same area. This work is progressing but slowly.

Before coming to the actual results so far achieved, it is necessary to explain that progress is very slow because much of the investigation, as well as the whole of the supervision, is carried on by a voluntary worker, who is otherwise in whole-time occupation, and progress is limited by the amount of time he can give. Another difficulty is the absence of experienced or even capable assistance. The work requires great tact and skill as well as some knowledge of social organization. These qualities are not often found in the same individual, still less in persons willing to give time to this work. Progress is therefore very slow. In this connexion, it must be remembered that the population upon which we are at work is mobile, and was from the outset in large measure sick. In the result it is slowly dissipating whilst the work proceeds, so that many units must be written off before the investigations are complete or, in some cases, even begun.

When allowance is made for these difficulties, it will be seen that some time must elapse before a conclusion is reached, and it is possible at the present time to give only a general reference to the work in its present stage. There are at present completed about 100 pedigrees and about a similar number in various stages. Some of the former I propose to show you to-day. Data are complete in respect of the large number of persons who must appear statistically and not in the pedigrees. These data, however, need statistical treatment, which has not yet been attempted. On the control group, there are 100 pedigrees in skeleton only. Much work will be necessary before this part of the work can be examined. It is, however, so far advanced as to enable us to say that pauperism does not appear in these pedigrees to the extent that it does in the pauper pedigrees.

A first examination of the pauper pedigrees so far complete reveals matters of considerable interest. In the first place, whilst the persons included in the pedigrees have a sufficiency of common characteristics to constitute them a class by themselves, there appears to be an almost automatic segregation of kinds into particular groups. Broadly speaking, the pauper community is comprised of two elements: (1) that which represents original defect and its transmission, and (2) that which represents the perpetuation of low-grade stocks, "the mildly incompetent,

the spiritless and dull". These two groups appear faithfully from pedigree to pedigree, revealing the distinctive character in each group. Whilst these two elements appear side by side in the same pedigree, nevertheless they segregate out in their several characters, so that it is possible to identify the groups as they breed true to type.

A group of low-grade individuals. Very little sickness shown, but a few bad patches.

Paupers.

Occasional	81	
Chronic	22	
Reared in Poor Law		
Schools	8	
Insane	9	Not paupers and no
Imbeciles	1	particulars
Tuberculous	12	172
Epileptics	3	
Blind	1	
	—	
	137	

This study commenced with the record of four brothers shown in generation II at 7, 8, 9 and 10. This record is as follows:

- No. 7. Entered workhouse at 60 years of age and was out for two short periods, average 35 days each, and had on the appointed day been in continuously 6 years, 4 months and 15 days. Total chargeability 7 years and 11 months. (Period 1844-1915.)
- No. 8. Entered at 48 years of age and has never been out since. Period chargeable 20 years. Has a clubfoot. (1846-1910.)
- No. 9. Entered at age of 34 years. Total period chargeable 15 years, 7 months, 21 days. Last unbroken period 7 years, 6 months, 20 days. Has been out 32 times, average stay-out 7 months and 1 day, total period out since he first came in, 13 years, 2 months, 13 days. (1850-1923.)
- No. 10. Entered at 26 years of age. Total period chargeable at the appointed day 20 years, 9 months, 17 days. Last unbroken period 4 years. Has been out in all 60 times, average 2 months, 13 days, aggregate since he first came in 12 years, 3 months, 13 days. (1863-1923.)

Of these four brothers, two were unmarried and the others had wives and children. The wives carried on the homes when the men entered the House.

The paupers shown in the following group, whether in this immediate stock or collaterally, undoubtedly became chargeable because they were so poorly endowed mentally or physically, or in both respects, as to prevent them competing with the normal individual so as to be at all times self-supporting.

The numbers in this group are as follows:

Paupers:

Occasional	98	Epileptics	4
Chronic	6	Tuberculous	4
Reared in Poor Law			
Schools	15	Born in Workhouse .	16
Insane	13		
Blind	9	Not paupers and no	
Insane, Blind	4	particulars	161
Imbeciles	6		

The law of anticipation, or antedating, has long been recognized in pathological inheritance in man. These studies invariably confirm that law. But it is interesting to observe the effect in mental disorder, for not only does the operation of this law result in the manifestations of disorder in childhood in the fourth generation so as to bring the persons under control before the procreative age, but its effect in such cases is to form the meeting-place of insanity and imbecility. The generally distinctive characteristic of these separate disorders merge in the imbecility of the child.

These studies serve to illustrate my point as to the peculiar grouping of special kinds of defect. They also show the very remarkable extent to which assortative mating occurs. In the most unaccountable way like not only produces like, but like is attracted to like in marriage and parenthood. This appears in all these groups.

In families where insanity occurs, and often before the onset of insanity, the members intermarry. Also among tuberculous persons. Three groups of feeble-minded persons are linked up by marriage whilst two families with a history of tubercle are connected by the marriage of persons not themselves affected, and produce a large tuberculous stock. Similar associations are to be observed among those stocks in which no pronounced defect appears — the groups of people who are poor all round.

This no doubt accounts for the consistency of the types to be found in the pedigrees. It probably also means that, by

inbreeding, the types have become more settled or fixed than is common in normal groups of the population. This is perhaps a good thing for the community in general, for if defectives must reproduce, it is better that they should do so together than that good stocks be vitiated by interbreeding, or, on the other hand, that the strength of the healthy people should be available to carry on the defect.

This attraction of like for like and the inbreeding resulting from it confirm, and in a measure explain the first impression that an examination of the diagrams gives, namely, that there is in existence a race of chronic pauper stocks, breeding together in and through the community, closely intermarried, not to any extent recruited from the normal population nor sensibly diminished by the agencies for human improvement, education, and other environmental conditions. Indeed, the general rise in the standard of living appears to have no effect upon this community save an improvement in personal comfort and an increase in survival, made evident by the fertility rate to be found among them.

That conception of "national degeneracy" which presumes the occurrence of widespread admixture of defectives with the normal community is probably unsound. Whilst the term might be justified in the statistical sense, *i.e.*, to indicate a disproportionate increase among the unsound as against the sound members of the community, it is probably incorrect if it is intended to suggest that wide sections of the sound people are being vitiated by these defective stocks. The evidence suggests that this group of defectives and of low-grade types are closely intermingled and overlap (of 100 pedigrees very few are without a lunatic, and some have several), but they preserve their general characteristics from generation to generation and probably do not often vitiate good stocks by intermarriage or derive strength from that source. A few thousand family stocks probably provide the great burden of inherent defectiveness which the community has to bear.

The existence of such a section of the population is of great social significance in many respects, but in a conference on population its fertility rate is of great importance. The studies as presented show a high fertility rate, and unfortunately this is the minimum. In the last generation shown in the studies, few of the marriages are complete; in the generation prior to that the data are incomplete and some of the marriages are not complete. The results shown are therefore not final on this important point. We must wait until the statistical work is complete before we can form an opinion as to the fertility rate in these groups. Meanwhile, we may be assured that the rate of reproduction in these groups much exceeds that of any

other sections of the community. I am not suggesting here that in these groups there is a naturally higher fertility than in the normal community, but rather that they have neither personal, parental, nor social responsibility in these matters.

Whilst the trend of all social movements for at least a century has been in the direction of emphasizing parental responsibility (for all normal people) it has lifted the burden of responsibility from the shoulders of these people, so that the worst can survive as well as the best. For many of them, adaptation to slum conditions and endowment from various public sources have probably produced a community that could not survive in other conditions.

It is generally agreed that for many years past there has been a steady rise in the standard of life and health. It will probably be agreed that this has been accompanied by an ascending status in social and economic life, a general process which is often referred to as "vertical mobility". Has this process affected the kind of person represented in these studies? The research affords no evidence that this has occurred. This, however, is not final. The census upon which we are engaged was taken in 1923. It included only such as were at that time in the area and chargeable. It could not include those who had left the district. Now the first evidence of an improvement in economic status would be the removal of the individual to a more desirable neighbourhood. This has happened with all the better class. I need not discuss the implication of this; the point is that our census would not include a person who had left these conditions for something better. To some extent our investigations in connexion with those for whom he is responsible and has left behind would tend to discover such a person and record his circumstances, but this would be in a few cases only. There is little evidence in such cases that the persons or families so removing have survived in better circumstances. On the other hand, in many of the cases investigated, we have particulars for five generations, in some cases, six. This is as far back as corroborative records will carry us — about 100 years. At that period many of these people were well-established residents in the same area where their descendants yet remain. The family conditions do not appear to have greatly altered, except that, as their numbers have increased, they have not enjoyed that improvement in the standard of living which has been common, and the measure and intensity of their dependence upon the public have increased. They appear to have waltzed around on the same spot for some generations, living the same sort of life, doing the same sort of work — a little more adapted to their conditions, that is all.

There is another point closely related to this. It is sometimes

suggested that from these defective stocks there may issue from time to time some individual of better quality, a kind of sporadic reversion to the normal. Here, again, the evidence does not support the suggestion; but, for the reasons already given, the evidence is not final on that point. But, if more desirable stocks were being founded upon such sporadic issue, there would surely be some evidence of the fact.

Such happenings might be expected under simple Mendelian conditions, but the assortative matings and consequent inbreeding disclosed in these cases lead us to expect the opposite, that the low-grade will become more fixed and established and that the defectiveness will become more acute and more intense.

It is a platitude in these days to speak of natural selection as the essential agent of human progress. Yet the fact remains. The arrest, or actual reversal, of that process will be found when the selective death rate is suspended and the relative fertility of the defective groups exceeds that of the normal. The differential death rate is still very high in those groups in which actual defect appears while, among the mildly incompetent and low-grade types of people, it is not nearly so high. In either case the incidence is not established. But there can be no doubt as to the high fertility rate in both these groups, in a few cases reaching the limit of human fecundity. The trend of all modern organization is towards the accentuation of both these factors. Their conjunction affords the most serious problem that human organization has to face at the present time.

The problem is no longer national and it must be regarded as forming an important part of international economics. We have been far too much under the dominance of the political economy of the 19th Century and of the logic that flows from its social assumptions. And we have allowed that dominance to hamper the development of just that body of knowledge, just that scientific spirit of enquiry which is essential if a practical policy is to be evolved. It is upon the need for a wider, more searching and systematic examination of the facts that I would conclude this paper. We need far more knowledge of our destitute and dependent populations, particularly in relation to family efficiency. We need a far more exhaustive estimate of their capacity and limitations, and an altogether more scientific knowledge of the play of environment upon their qualities and the possibility of restorative treatment suitably applied. Our present ideas are limited and localized and deal merely with expedients and present necessities. We need to turn to ampler methods and considerations that reach into the third and fourth generations.

It is beside the point to say that, if we had exact knowledge, we lack the means to apply that knowledge. It is a secondary and debatable thing whether we shall find the means to apply

the knowledge that energetic investigation must bring. Of this we may be assured that, when science has shown that there is an undesirable reproductive element in human societies underlying its social problems, the collective intelligence of mankind may be relied upon to find a means to apply that knowledge and to make it effective.

DISCUSSION.

Mr. E. J. Lidbetter (Great Britain), in opening the discussion, said: It falls to me to deal with what I may refer to as the more intimate side of the qualitative aspect of the population problem. My paper deals with an investigation begun many years ago in the East End of London and which is still continuing. I can therefore only show you certain phases of the investigation and some of the results as far as they appear. I first want to emphasize the fact that appears in my paper, namely, that this is a statistical investigation; in other words, it is not the mere haphazard collection of a number of pedigrees showing pathological conditions.

One of the first results of this investigation is to point to the fact that the destitute population consists of a more or less separate element in the community. It is a highly concentrated element and may be definitely classified in relation to the several conditions.

We have a case of a blind woman who was married to a man who became insane. They had two children, one of whom was an insane man, who married a woman who had an insane sister. That man was in the asylum four times, and these ten children shown here were born in the lucid intervals, three on the first occasion, three on the second occasion, and four on the third occasion, after which he returned to the asylum and died.

There is another case of a chronic pauper female who had an illegitimate daughter (also a chronic pauper who was tuberculous) by an epileptic man who ultimately became insane; she had an epileptic daughter who ultimately married, with the result that a number of defective children were born, one of whom is imbecile.

Here, again, is the case of a tubercle. This insane man had a tuberculous father, who was one of three, and three children

were born of his marriage. He had two sons, one of whom was tuberculous, and the daughter was tuberculous. The tuberculous daughter married a tuberculous man, and they had seven children of whom two died in infancy and three were tuberculous. The four men referred to in my paper were able-bodied men, and were chargeable for a collective period of just on sixty-four years. This group was more or less, as I said, a group of able-bodied paupers, but there are those few bad patches shown on it.

Another group referred to in my paper is peculiar in the production of a large family, two girls and twelve boys. Of the fourteen children, four died in infancy and only two are normal. All the others are tuberculous. This is the one referred to in my paper as having been in and out of the workhouse on 120 occasions. The father was one surviving out of a family of eight, the other survivor being an insane person, whilst the grandfather of this group was also tuberculous. On the mother's side, she also was one of a family of fourteen of whom four survived, three as paupers and one tuberculous. The parents are both alive at the present time, one over seventy and the other just under seventy, and they exhibit no sign of tuberculosis.

Another case shows four generations of mental disorder, in which blindness is an accompanying factor. This man became insane when he was very old, but he had five children, of whom one was tuberculous and three were insane. This woman, who was insane, was also blind. She went into the asylum at about the age of twenty-three and then got her discharge and subsequently married this man. He ultimately became insane, and he had an insane brother. Having had six children, she returned to the asylum, where she died. Now, of those six children, one died in infancy, three survived and ultimately became insane and also blind, whilst two others, as far as we know, remained normal. In the last generation, the last blind and insane man married a woman who was the daughter of an epileptic. The first child was normal, the second one tuberculous, the third one blind, then an idiot, then a normal son, a blind daughter, one died in infancy, and then two idiots, one of whom was blind.

This man's brother married a woman whose whereabouts we have never been able to discover, but they had five children. One died in infancy, and the other four all showed the mental disorder of the family as well as the blindness.

There are, of course, other groups. In these there is some association of insanity and pauperism and a certain amount of blindness.

I think that the collective results of this investigation well establish that there is in existence a group of chronic pauper

families, closely intermarried, closely related, not to any large extent recruited from the normal population, nor sensibly diminished by the agencies for human improvement, education and suchlike matters. Working among those groups for many years has led one to the conclusion that it is hopeless to expect that those latter agencies are likely substantially to improve them. A point that must be of the very greatest interest to a conference on population is a recognition, if that be possible, of the fact that this is an isolated group in the community. It is probable, as I say in my paper, that those who speak at large of national degeneracy are not accurate in that reference. It seems to me that the normal population is probably not being to any large extent vitiated by these defective communities, but that they are self-contained, and do not to a large extent overlap and intermarry with the normal community.

I want to mention one matter because it is so important from the point of view of possible remedies, and that is the large amount of transmission one finds through the apparently normal members, what may be called indirect transmission. Here is the case of a woman who had seven children, three of whom were insane. Her parents were both normal, but her father had an insane brother. Thus you get a transmission through the normal parent leading to this condition. Here is a case of one of a family of five, one of whom is insane. The father is classed as a chronic pauper and tuberculous, the mother a pauper occasionally. She was an illegitimate child and had an illegitimate brother who was also insane. Thus, again through the apparently normal, we come to a defective condition.

A great variety of defectiveness may be found in a particular group. In this epileptic case, out of this large family of thirteen, there are five who died in infancy, an epileptic daughter, an insane son and an imbecile daughter. The father is classed as a chronic pauper, and his mother was insane. On the mother's side, her mother was a criminal. There, again, you get not only the indirect transmission, but you get also the variety of defectiveness appearing in a particular group.

I just want to emphasize, with regard to this matter of indirect transmission, the problem it offers to those who are interested in the matter of remedies for this state of things. I refer in particular, of course, to the suggestion for sterilization or segregation. It must be obvious from this type of case that those so-called remedies do not and cannot offer an effective remedy for the trouble that is often claimed for them, for this reason: if you are to get a large amount of recessive defectiveness made manifest from time to time through the apparently normal member, then sterilization or segregation may cut off the direct line of defectiveness, but it is not likely to

touch that line of defect which comes through the recessive individual. Lastly, I should just like to mention one other point, and that is the problems which arise in connexion with the phenomena known as anticipation or antedating. I have no doubt that most of you are acquainted with these phenomena, but for those who are present and do not know this, I ought just to say that it amounts to this, that, where defectiveness is found in successive generations, it will appear in most cases at an earlier age in each generation.

It has been found to be common with optical troubles. The late Sir Frederick Mott examined 400 pairs of insane people, parent and offspring, and found the rule invariable and that no less than fifty-two per cent of the offspring were insane before reaching twenty-five years of age. Its importance with regard to mental defect is that, while from the medical point of view mental disorder is usually regarded as a very distinct congenital condition distinct from insanity, yet when one comes to analyze the subject genealogically, as in this case, the insanity of the earlier generations becomes congenital idiocy or imbecility in three or four generations. That is a very important point which has a considerable bearing on our subject to-day.

The question of the fertility of these groups has not yet been dealt with. That is because the information is incomplete and, the investigation being incomplete, the statistical treatment of the data has not even been attempted. Obviously that is not possible now, nor will it be possible for a year or two, but I ought to say we are hoping in the next few months to get out the first volume of diagrams. It is hoped the statistical data may be got out in a few years. However, so that we may get some idea of the fertility of these groups, I may say that roughly they give the impression that in completed marriages the fertility probably works out at from eight to nine a family.

† Dr. Hertha Riese (Germany): In these interesting scientific questions of population, we women, on whom the increase in population depends, have not been asked for our opinion. I do not intend giving you my personal opinion, but will speak about my patients, who have been thoroughly examined by our medical men, those of them who are considered to have had the best training for that kind of work. The results of these examinations of people who are unenlightened, underfed, overworked and overburdened from a childbearing point of view, who belong to the poor proletariat of Frankfurt, will afford us many lessons. These people revolt against the excess of childbearing which is still being forced on them in Germany. All these women suffer from psychical disturbances when they come to us. They have defective sight, bad memory, a feeling of being

lost, which is sometimes so marked as to constitute confusion of ideas, instability of temperament, very marked internal disturbances and other troubles.

Abortion amongst our women is spontaneous. I should like to say to my colleague Dr. Engelsmann that I do not undervalue the significance of the so-called criminal abortion which is so rife in Germany and which is due to circumstances of great distress, but that he undervalues to a very great extent the spontaneous abortion amongst these wretched women. But we see in our University hospitals and in other clinics much of these spontaneous abortions, while people go on consulting as to whether it is a case in which abortion should be practised. Most abortions of this type take place among women where abortion seems to be indicated, and this because most doctors, when they start on abortion, forget the future. They only interrupt the action, then they let the women go home and do not use measures for sterilization, nor do they initiate the women into preventive means. I know, for instance, of women who have undergone eight, and even up to fourteen, abortions when the symptoms seemed to call for it; this was before our Advisory Bureau was set up. Now, as far as in our power lies, we have tried to put an end to such abuses.

The mortality among children who come to us for advice (we have seen about 4,000 to 5,000 people) rises quite apart from the aspect of transmission shown in the figure for births. That is very important. Transmission or inheritance depends on the health of the parents, mortality depends only on the number of children. And that is why our task in Germany, and indeed everywhere, is to reduce mortality. Amongst my evidence we have, in cases of children under five years, a mortality rate of twenty-five per cent, while the average mortality for babies in Frankfurt is about eight per cent. That shows us how far we shall get. That figure of eight per cent includes the very unfavorable mortality figure of the poorest of the proletariat.

An enormous mortality among very young children reacts on the statistics generally. The many thousands of children who die at the age of one or two make our statistics for duration of life appear low. When this great mortality is checked, the duration of life in the statistics will rise very rapidly.

The path we have trodden so far in Germany, a path of high figures for births accompanied by high mortality, means enormous suffering both for mothers and for children. There is one thing that all men forget, they do not know women. We want motherhood, we do not want to have no children, as a French speaker stated when speaking on the last subject, but we do not want an excess of births. We want economics of humanity; we do not want to follow a path that leads to suffering and waste

of the strength of the nation and waste of public resources in order later to have to go and knock at the doors of other nations, which in the end will refuse to let us enter.

*Mr. Lucien March (France): We should be very grateful to the English Eugenics Society for having undertaken the enquiry of which Mr. Lidbetter has reported the first results. This enquiry recalls that of the lamented Charles Booth. Just as a study of the defects of the human organism warns us of the dangers which threaten our health and helps us to prevent disease and sometimes to cure it, so a study of social defects leads us to a better understanding of the means by which the social organization may be perfected.

We must not exaggerate. For example, even if we have reason to fear microbes to some extent and to take precautions against infection, an exaggerated morbid fear of microbes encourages a kind of quackery and may put an end to life itself.

In France, at the time of the census of 1906, we asked for and obtained the number of children born to the head of each family and the number of children surviving. It has been possible to obtain these figures classified according to occupations or social groups. Among the persons who were a charge to the public—paupers, vagabonds, persons found in hospitals or prisons—the number of children born per hundred families was 285, while among the working classes, it was 395, among the salaried classes 290 and among the employing classes 358.

If one considers the total number of these families, one finds that the number of children dead per 1,000 children born is 335 for the persons who are a public charge, 233 for the working classes, 196 for the salaried classes, and 208 for the employing classes. It appears from this, then, that the group of persons who are a public charge have a smaller fertility than the other groups, but that the loss is greater.

On the other hand, the proportion of such persons to the total population is small. They are especially numerous in the towns. They are largely composed of sick and tubercular persons so that they tend to die out of themselves. Mental specialists whom I have consulted have told me that such defects tend to disappear after two or three generations. The evil can be encountered by the isolation of sick persons and criminals, by the suppression of slums, and by discouraging any considerable increase of the town population. England has done much to improve housing conditions. It is probable that she will not stop her efforts, but will continue along this fruitful path.

Let us care for misery, particularly the misery of women who are the victims of the brutality of certain men; let us discourage the growth of the town population, which is

already enlarged though by immigration from the countryside, but do not let us stop a moderate progress of population, and let us encourage the increase of the birth rate in the country. Let us avoid all propaganda, which, flattering the immoral tendency to seek for pleasure after pleasure, comfort after comfort, would ruin all the object of life and belittle the sometimes painful effort of humanity towards the attainment of perfection.

*Mr. Gustave Bonvoisin (France): I should like to know something which all the speakers appeared to regard as a self-evident fact for which there was no need of proof, that is, whether the density of the population and individual wellbeing really stand in an inverse relation one to another: in other words, whether all population growth does necessarily imply a lowering of what is called the standard of life of each individual.

Here it seems to me is something which is neither evident nor proven. In any case, it seems that there is a parallel between the development of the volume of population and the wealth of the community in those nations which we have had the opportunity of observing. From this we are led to look for a relation of cause and effect between these two phenomena. Would a consequence of this growth of wealth be an increase of the population? All the speakers have agreed in recognizing that, on the contrary, the more leisured classes of the population have the lowest birth rate. Is it true, then, that the effect of an increase of the population is the growth of wealth? That is the question that I would ask this audience, and I think that, if documentary information on this point could be obtained, it would be very interesting to draw some practical conclusions from it. I should like to make two particular remarks.

We have been told in the course of the report to which we have just listened that, from certain enquiries which are not yet completed, it appears that individuals belonging to the working classes or the lower social classes cannot better their conditions of life by changes of environment. I do not doubt at all the accuracy of the observation for the Anglo-Saxon environment in which the enquiries have been made. Indeed, the social classes of our neighbors are somewhat fixed. May I be permitted to say that in France we find a phenomenon which is diametrically the opposite of this? Accession from one social grade to another is always possible, and makes possible a continuous renewing of the social groups. May I mention the combined efforts of the State and private enterprise for the betterment of the social condition of workers, and especially for those workers who have the burden of a family. A characteristic form of this

aid is that of family allowances to which Mr. March has made allusion.

*Mr. Jean Bourdon (France): The discussion in which we have just been engaged is a eugenic discussion, and in this connection it seems to me essential to distinguish between eugenics properly so called and what one might call pseudo-eugenics. In the first place, what motives should guide procreation? H.G. Wells in his "Modern Utopia" proclaims that marriage should be prohibited to anyone without financial means. Thus material wealth should be the measure of the value of individuals and the measure also of those qualities which parents can transmit to their children. Is there, however, any need to remark that certain syphilitics can earn plenty of money, but their offspring are not therefore desirables? In a less extreme form, one finds in the different projects for marriage certificates (for example, in Leonard Darwin, "Eugenic Reform," p. 460), the idea of a required standard of comfort, for, it is argued, it is not sufficient that the married couple should be in good health, it is also necessary that they should be in a position to bring up their children properly.

This very justifiable consideration may lead to two different conclusions. Either you may aid worthy but poor parents to bring up children as worthy as themselves (this is the modern idea of which an expression is found in the family allowance system) or you may follow the old idea of trying to prevent all poor people from marrying. This is a very old policy. It was practised in many States, notably in Bavaria up till 1868. There the marriage was forbidden of all those who had insufficient means of support. But, even if one can prevent people from entering into a marriage contract, one cannot keep them from the essential and natural part of marriage, and therefore a third or, thereabouts of births were illegitimate. Is that what one wants?

On the other hand, one speaks of intellectual or moral characteristics as being hereditary. This is really such a hypothetical point that one has no right to base any reasoning on it. Mr. Léon Bernard told us yesterday that the extent of physical heredity must not be exaggerated, pointing out to us that only syphilis and certain forms of intoxication, alcoholism for example, could cause injury to the offspring. But there, again, do not let us exaggerate. If one takes certain cases for example, one discovers some really disturbing facts. The German philosopher Nietzsche was born of a father who died in a lunatic asylum. He himself became mad at the end of his days, but during the fifty years of his conscious life he achieved a work which, although open to criticism from certain moral points of view,

yet taking it all round, has been far superior to that of an ordinary individual. Without insisting on this point, it is reasonable to proceed to a physical test similar to that which stockraisers employ to obtain good strains of horses or bulls.

The second point is that, if one simply regards this point of view, one considers only the interest of the generation to come, and not the interests of the parents. Pseudo-eugenics does not see this. Real eugenics aims at the suppression of childbirth which is not desirable socially; this is quite a different thing from childbirth which is not desired individually. Here is a family (and at once an example comes to my mind) which, although quite defective, wished to have an heir to its name. Socially, the child has been very mediocre. From the social point of view, one should have prohibited such a couple from having a child, and this would have been contrary to their desire. On the other hand, there are numerous examples of couples who could have excellent children from the social point of view and who, however, do not want children. Real eugenics is to substitute the social point of view, the social interest for the individual will; it is the subordination of the individual man or woman to the interest of society.

***Professor Haury (France):** There are a certain number of points to which I wish to draw the attention of the Conference in order that it may not commit the unscientific error of arguing from the particular to the general.

I should like first to make it clear that population problems are not mainly biological, as Mr. Lidbetter says at the beginning of his report. But, if they were, the facts of biology should be well established before attempts are made to draw conclusions applicable to man.

Now, in the report of Mr. Lidbetter, it is affirmed as a scientific truth that social inaptitude is hereditary: Dr. Léon Bernard told us yesterday that there is nothing in this theory. Mr. Bourdon has just cited the example of Nietzsche in proof of the general idea that genius is often akin to folly. One does not know if from a line of defectives there may not come a man of genius, a being valuable to humanity.

Among the facts studied by Mr. Lidbetter there are three very special cases, as for example, that of a group which is closed, limited, composed of paupers, indigents, defectives. This is a case entirely peculiar to English society. I have not the time to show that in France the situation is quite different, that the paupers are often persons fallen in the social scale, generally without children, who are frequently supported by their brothers or sisters, who, for their part, have children.

Another erroneous statement is that families are tubercular.

I recall that, according to many other medical authorities, tuberculosis is not considered in any way hereditary.

Finally, in his report, Mr. Lidbetter constantly considers probabilities as facts which he himself indicates in several places, and from these probabilities he establishes a general theory. He foresees two objections on which the facts do not permit him to express an opinion: (1) From these defective stocks issue elements which will aid human welfare. Mr. Lidbetter says that those elements come from that group, that they emigrate, and thus escape his attention. (2) From these defective stocks there may come an individual of finer quality who may be said to be an isolated reversion towards normal. The speaker tells us that there is no definite proof of this point, but in his conclusions he seems to assume that there is. In actual life we know it is fairly usual, owing to the combined influence of education and philanthropy, to see what is called the flower of France blooming on a rubbish heap.

To sum up, the conclusions of Mr. Lidbetter seem to me to go far beyond his premises, and it is not without some surprise that one hears him declare that this problem of the suppression, not only of misery, but of the subjects of misery themselves, is one of the gravest with which humanity is faced. I do not say that he is not right, but we need to know the conditions under which this miserable humanity lives. Then I ask, how does he wish to use this knowledge? To what end will the international institute which you set up apply this knowledge of the conditions of life of these unhappy creatures. Is it to sterilize them? This idea appeared twice in the report. Or, will you use the knowledge to better their conditions, care for them, uplift them? It is on this second point only that I am in agreement.

Dr. C. B. Davenport (United States): We are greatly indebted to Mr. Lidbetter for his studies of the feeble-minded in an urban district. The thing which is striking about such defective families when rural is that they live in a limited locality, often in a mountain or a valley, and then breed extremely fast, and each of these different families is characterized by a set of traits quite its own. For example, the Zehrer family of Germany is characterized by being tinkers and wandering about as vagrants. The Jukes of New York State are apparently characterized by much sordidness, murders and crimes of a violent type. The Ishmaelites of Indiana are largely gypsies who steal as they go from place to place. Those traits I have mentioned are found over and over again in exceptional frequency in the different alien inbred families. Some studies have been made off the coast of Maine of islanders; one islander was characterized by epilepsy in the inbred popula-

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tion, whereas on the other hand I think there was no case of epilepsy, only cases of feeble-minded low grade.

The thing that strikes one in this study of Mr. Lidbetter is that so many different kinds of degenerate traits of sanity or feeble-mindedness and the rest occur. I am wondering how far this may be due to the fact of the crossing of more or less inbred strains bringing together so many different traits. Mr. Lidbetter spoke of the fact of so many of these traits of defectiveness and alluded to the fact that it is impossible to purify a population by segregation or by sterilization because traits are carried in normal persons. That is, of course, perfectly true, but I think Mr. Lidbetter will agree that, because you cannot purify a population completely, that is no reason why we should not take certain measures which would bring about a reduction. I have very little doubt that the cutting-off of reproduction of certain defective individuals would reduce at least the absolute numbers of defectives and, indeed, the proportion of defectives in the population.

With respect to tuberculosis, a phenomenon which frequently appears in pedigree charts of the feeble-minded, the question arises whether this is not due to the bad conditions of environment in which these people live. We do not have to go out and get tuberculosis; we have it. Why some people have active tuberculosis and die from it and others do not is that, among other things, some persons have a factor of non-resistance, and that is the factor which appears in these alien inbred families.

*Mrs. Cora Hodson (Great Britain): Mr. Lidbetter has asked me to reply to those speakers who have made their remarks in French.

There was a point which appeared to me rather interesting, that of Nietzsche. From the point of view of heredity, this is a difficult case, since Nietzsche was an unfortunate syphilitic who ended his life as a paralytic. For those of us who have made a thorough study of the question of heredity, this case is not of the same order as cases of real heredity.

Mr. Lidbetter, being a modest man, did not tell you that these little pedigrees he has shown us are only a slight example of a study carried on for eighteen years. His information sometimes covers four or five generations. These pedigrees prove that in East London we have to a certain extent a population which for four or five generations of urban life has always had a high birth rate. That is an interesting fact for sociologists.

Mr. Lidbetter soon saw that it was not enough to show only the pedigrees of these poor people, but that there should be a general control. To do this he took a sample at random. He chose a certain number of pupils in an elementary school and

commented a study from that point. At present we have the pedigrees of 100 persons of this controlled group. These pedigrees already confirm the theory that disease, all those disorders which leave their mark on character and cause dependency from one generation to another, do not manifest themselves to the same degree in all the families chosen at random for control. At the same time, all the families live under the same conditions of environment, that is to say, the same district, the same streets, and they earn the same wages. It is interesting to note that, in France, as the delegates from that country have declared, the fact is not verified in this manner. With us heredity may manifest itself differently within the same family. It may take the form of mental defect with one, criminality with another, etc.

For us, in England, the question of the paupers is a very serious problem. We have done our best to improve their situation. It is not only to study their social conditions, but considerable efforts have been made to improve and help their families in need. In spite of all our efforts, this burden still rests on our shoulders and it is a burden which is very heavy, both for the community and for individuals.

Mr. E. J. Lidbetter (in reply): One question sent up asks whether the high birth-rate of these bad stocks is not wiped out by the high mortality. It is clear, in the course of investigation, that the infant mortality rate in these groups is exceedingly high, but on that one has to make two comments: first, to call attention to the enormous wastefulness of a process that has the effect of bringing a large number of children into the world who have very shortly to leave it in that way, and secondly, that, notwithstanding the high death rate among these groups, their ultimate contribution to the population is probably very much higher than the contribution of the normal members of the community.

Professor Haldane suggests that the law of anticipation may be a statistical result, and he goes on to say that, if true, it is eugenically hopeful. Now, I have no doubt whatever about the truth of the law of anticipation. The only question is to what extent does it apply. That is one of the problems to which we hope to direct our attention in the final survey of this data.

Mr. Bourdon quoted Léon Bernard as saying that the only heredity proven was syphilis and alcoholism. It is a most unfortunate quotation because, so far as biologists go, alcoholism as an inheritance is discredited, and I think may be safely denied. I doubt whether there is any sort of inheritance in the biological sense. I think it is quite probable that alcoholism is dependent upon an inheritance factor, but that inheritance

factor is feebleness of mind, and not a tendency to alcoholism. With regard to syphilis of course, the suggestion is absurd because we all know that syphilis is an infection and not an inheritance in the biological sense.

Professor Haury suggested that it was unscientific to use exceptional cases to prove laws. I think that statement hardly does justice to my declaration that all our suggestions now are tentative, and subject to the final statistical analysis of these data. It is upon that final statistical analysis that laws may be founded, rather than upon the cases which have been specially selected for this meeting. Professor Haury also mentioned the popular delusion that genius and madness are allied. I doubt if there ever was a more popular or more hopeless delusion than this. Insanity has always been a morbid condition, and although you may pick out an extraordinary instance where it has been associated with excellent qualities of another character, that does not alter the fact that insanity is a morbid condition dependent ultimately upon some pathological condition of a physical kind.

I should like to mention Dr. Davenport's reference to sterilization and segregation. My point was not that sterilization or segregation offers no assistance in a solution of these problems, but that those suggestions do not and cannot afford a solution of the problem. They will contribute, no doubt, among many other suggestions and proposals, and upon that I would only say that, although I recognize the value of sterilization and segregation as a part of some scheme of reform, it is necessary to recognize also that he who seeks to solve these problems by a single remedy is, by that fact alone, hopelessly wrong.

Finally, Mr. March suggested that the conditions shown may be due to environment. This, of course, is a popular notion of the last century. No one here present, I think, will deny the enormous work that has been done in the improvement of the environment of the people during the last century. I should be the last to deny that myself, but recognizing that, we have to recognize also that under the best conditions it is the best that will improve. You cannot, by a good environment, make a stock inherently defective otherwise than defective. The conditions of environment, instead of improving a defective stock, must consistently widen the gap between the inherently good and the inherently bad, for the reason that the inherently good stocks are capable of taking advantage of the environment which you improve, whilst the defective stocks are inherently incapable of taking that advantage. It seems to me that it is right to say that the environmental doctrine was a half-truth which has probably by now reached its maximum vogue, and what we have to recognize is that you cannot organize

society on the basis that conditions can make anything of any man.

†The Chairman (Dr. Goldschmidt): I have to thank Mr. Lidbetter specially for his report. Eugenics, as we all know, is a science where the boundaries are very easily jumped over by pure idealism, and we have to be grateful to him in that he is such a sane and clear observer not only of the facts but also of the limits of our science.

RACE BIOLOGICAL INSTITUTES

The Swedish State Institute for Race Biology
at Upsala, Sweden,

by

Professor H. LINDBORG.

We are living in times when a complete restatement of all values is taking place, and these as often as not in an unfavorable direction. No matter how optimistically we are inclined to appraise this social development, we cannot help admitting that more and more we see phases of deterioration spreading from one cultural group to another. Many causes contribute to this phenomenon. Industry, commerce, and other trades, springing into unbelievable prosperity during the previous century, have brought in their wake, in Europe and other parts of the world, a state of overpopulation. A period of reaction has now, however, set in. The questions of emigration and immigration have assumed real significance. Young capable people are often leaving their native country in shoals — while less efficient elements of population migrate into the country they left and replace them.

We must never lose sight of the fact that a strong and healthy population is the greatest asset of a nation. The birth rate in overpopulated countries invariably declines. The decrease begins with the upper classes, which possess a more highly developed sense of responsibility, while it comes more slowly in the lowest and least efficient classes.

All this process naturally entails a complete restatement of standards and in a biological sense reduces the nation to a proletariat. From a biological point of view, the value of a people is not at all times the same. A period of prosperity may be followed by a decline. The decline of ancient empires proves clearly the inevitable result, when from generation to generation a race deteriorates in health and active enterprise.

Formerly, there was a tendency to attribute such decline to political and economic factors. To-day we realize that these changes are not so much causes as consequences, that is, the results of the degeneration. The real cause of the dying out of a people is chiefly the biological deterioration of the race.

Many a contemporary comforts himself in the fatalistic belief: "It must be so, we are powerless and can do nothing against it", "*après nous le déluge*" and so on. In former times these and similar views seemed more or less justified, for too little was known about causes of degeneration and decay of civilizations.

In these days, when the study of genetics, anthropology and race biology throws an ever-clearer light on these processes or happenings, such assertions are not justified. Certainly research has still an endless task before it, but this much we see clearly, that tribes and nations obey biological laws which we must master before we can change the course of events. An energetic and far-sighted population policy must solve the problems of the near future. And for this race-biology will be invaluable.

Among the masses many erroneous views persist. There is still a belief among men in the "equality" of all human beings, in the power of the environment and heredity of acquired qualities, of the so-called "modifications". The significance of heredity tendency (of the "genotype" for man) has not yet been fully grasped. Hence most efforts have tended to improve personal hygiene and the social milieu. Furthermore, too much faith has been put in education and instruction, thinking with such means alone to reach the desired goal, to create an ennobled human race. These hopes, however, were not fulfilled. Experience proves to us dearly that degeneration, in spite of education and a good social environment, may appear and spread. The error in our conception which has underlain all our activities has been, up to now, that we did not or would not understand the enormous importance of inherited tendencies, and that the mass-inheritance (genotype) obeys quite different laws from those of the individual (phenotype). Doctor Siemens' claim is to the point when he says "the future of a people is not determined in the greatest measure by those who educate it, but by those who give birth to it".

It will take students of heredity, race-biology, and sociology, decades of patient and self-sacrificing work to eradicate the

gross errors still so prevalent. Much of value will necessarily be lost. But humanity will sooner or later benefit from the newer knowledge by which we gain a little which will lead us onward.

Race biology is the science treating of conditions of life of tribes, peoples and races, and is occupied mainly with the examination of those factors as having a good or bad influence on races and nations. While race biology collects scientific material, race hygiene (or eugenics) draws conclusions and lessons from this material, which may prove of use to a people or a race. Its chief aim is the prevention of the beginning and the spread of degeneration, and the arrangement of social conditions so that future generations shall be biologically protected by their inherited tendencies. Even amongst ancient nations we find isolated ideas of race hygiene, but to the 19th Century fell the task of developing these into a science. Charles Darwin and his cousin Francis Galton gave the first impulse. But the true founder of eugenics was Galton. He was indefatigable and founded in London the Galton laboratory and a chair of eugenics.

With the rediscovery of Mendelian laws in 1900 and the rapid progress of genetics in our day, the foundations of race biology and eugenics have been made firmer and will lead to further developments. In many countries the idea of race hygiene has found enthusiastic adherents.

Sweden, in the matter of race biology, has shown wide vision. It is the first civilized country in which the State (executive and parliament) has recognized the great importance of research in race biology and race eugenics and has seen that the State should bear the cost.

In 1922, the first State Institute for the study of race biology was founded, but, before I speak of this in detail, I will give in general outline what, in my opinion, should be the organization and work of any such institute.

A complete and well-organised race biological institute should consist of several sections working together:

- (1) A section for experimental biological work on heredity in plants and animals.
- (2) A section for medical genealogy to study by means of family tables normal and pathological characteristics.
- (3) An anthropological section to study the race-mingling in different countries and the significance of mixed races, inbreeding and so on.
- (4) A demographico-sociological section to examine and explain the influence on nations in various directions of the environment and the social factors.

(5) A museum of race biology which should collect material which will show us the relations in general and those of our own land in particular.

The whole must be under the direction of a single and energetic head. It stands to reason that such an institute would be very costly.

The Swedish State Institute for Race Biology is far from having attained its full development. It works with very limited means, only 86,000 K = about \$23,000 annually, but in 1921, when it was founded, the Swedish Government promised more in the future.

At the present time we have in our institute the Director, who, in addition to good medical training, must have the necessary knowledge of genetics, anthropology, and the related sciences, and the following workers: a doctor for research in heredity, another as anthropologist, a statistician, a genealogist and assistants. The photography is done by a professional photographer. Last winter our institute published its first large work — Lundborg-Linders: "The Racial Characteristics of the Swedish Nation". We are to-day occupied on a detailed book on the race biology of the Lapps in Sweden and a second on our Finns. The Institute has also begun comparative serological examination of different groups in Sweden. We intend to undertake studies in race mixture and inbreeding in different regions of our country. To begin the museum for race biology, the Institute has a collection of the various race-types of Sweden, some 6,000 negatives and copies, classified from an anthropological standpoint. From the church registers we have formed genealogical tables and family trees. In 1925, our Institute brought together men engaged in race research from all Scandinavia, to hold the first congress of nordic race students; as a result a Nordic Union of Anthropology was formed.

Hence we see that the problems of race biology are so many-sided and of such far-reaching practical importance that their solution should not be left to individuals or societies. The carrying-out of race biological research should be a State duty. The desire for self-preservation will sooner or later lead the people of all civilized countries to establish institutes of race biology. We may then arrive at the firm conviction that the nations which early enough realize the importance of inherited health and act upon this realization will advance triumphantly: they will attain to a higher morality, a more intelligent culture, a healthier and happier state of being.

SCRIPPS FOUNDATION FOR RESEARCH IN POPULATION PROBLEMS

by

Dr. W. S. THOMPSON.

The Scripps Foundation for the study of problems of population was established by the late E. W. Scripps because he believed that these problems were among the most important of the day and would grow in importance steadily as the years went by. He hoped that the work he thus made possible would be of benefit in helping to a better understanding of these problems. The field of work of the Foundation is necessarily small and is determined by the interests of the men on the staff. At present, it may be said that the psychology of the birth rate and the relation of food supply and population growth are the lines of interest being pursued.

The Foundation issues no regular bulletins or reports, its studies being published as articles in established journals, as monographs or as general studies by various agencies. It is located at Miami University, Oxford, Ohio (a school supported by the State). This University is located in Mr. Scripps' home county. It was established in 1922 and is just now getting under way.

CLOSING ADDRESSES.

Professor W. E. Rappard:

I know that I am expressing the feelings of all when I offer thanks first of all to the intellectual promoters of this Conference. Several years have now passed since American biologists undertook the work which has resulted in the calling of this Conference. They have done a great preparatory work. But the initiative of several learned Americans alone would not have been sufficient to call this Conference together. What was also required, a necessary requisite of conferences as well as of wars, was material resources, in which the great Transatlantic Republic is so prodigal. We are indebted to American institutions for these resources, as well as to individuals whose names I am forbidden even to mention. American generosity is veiled with discretion, and I know of no more perfect liberality than that manifested by such discretion which is destined to leave entire freedom to those profiting by it. It is therefore to these British and American institutions, as well as to the outstanding personalities in these States, that we owe the deepest recognition for the generosity of which they have given such splendid proof.

I also wish, on behalf of you all, to thank the secretarial staff who also have desired to remain anonymous and who have even remained invisible. We have been enabled to see the result of their work, both daily and nightly. We are indebted for the publication of the *Journal*, not only to the labours of the staff but also to the foresight, imagination and generosity of Mr. Slee. I want to insist, Ladies and Gentlemen, on the ingenuity shown in the publication of this *Journal*, especially as, when I had the honour of being consulted about it beforehand, I declared that it was impossible. I did not imagine that, on the day following lengthy meetings, a faithful and detailed report of the discussions could already be printed. I was mistaken. Once more I bow down before the superior organizing genius of Americans.

I want, finally, to thank our eminent President, Sir Bernard Mallet, and all the learned professors gathered together from the four quarters of the globe to pool the results of their labors.

It is indeed a triumph to have brought together so many illustrious representatives of science.

Opinion seems to have been misdirected as to the object of this Conference. Some people seem to consider that we have been silently conspiring in doubtful obscurity against the future of the human race, endeavoring to promote, I do not know what policy of birth control. Others have the idea that we have come here to discover means of fighting against the overpopulation of certain countries; our neighbors from beyond the Jura are supposed to have come here to try to rally together the vital energies of the nation which seems to prefer quality to quantity.

As a matter of fact, there is nothing of the kind. They have come here, biologists, economists, sociologists and statisticians alike, to make common use of the results of their work and their research, and to study freely and with scientific impartiality the relations between population and human welfare. In thus defining the object of our work, I think I have made it quite clear. It has been declared that all our thoughts gravitate round one central question, the optimum of population. In other words, is there a quantitative point from which, if there is any deviation in one direction or another, a decrease in material wellbeing will result? Allow me to make a few brief reflexions on this subject.

To begin with, I maintain, though this has often been contested during the Conference, that this is a scientific idea. Is Switzerland, for example, with its four million inhabitants, overpopulated? Is it underpopulated? He would be a bold man who would uphold that theory. You would all agree that, if Switzerland had only 400,000 inhabitants, she would be less prosperous. She would possess neither railways, nor means of communication, nor the benefits which we derive from the density of population. On the other hand, if Switzerland had 400 million inhabitants, she would be less prosperous than she is to-day. In laying down this principle, you will recognize that the optimum idea of population is a legitimately scientific one. This is my first point.

The idea, as we have just defined it, is purely economic. It would certainly be quite possible that there should be above or below the population optimum another optimum, that of morality, of military strength or of culture. I think, however, that, if it were possible to determine the economic optimum of population, there would not be many statesmen or publicists who would uphold a policy which would tend to maintain the population above or below that optimum. It is possible, indeed, that a population denser than it should be might be absolutely prosperous. Will a population be more moral if it includes only 100,000 individuals instead of 400,000? Morality, wellbeing and

prosperity must gravitate around quantitative points sensibly related. This makes my second point.

The population optimum is a very complex idea, much more so than one would think in listening to certain of our biologist colleagues. We specialists in moral sciences derive a special and ever fresh delight in hearing from the lips of biologists the developments of economic questions. Everything is delightfully simplified in the rarefied atmosphere of the laboratory. I do not wish to mention names, but, in listening to certain of our biologist friends developing their ideas on the optimum population, I wondered if our countries really represented for them little islands isolated from the rest of the world where only corn was cultivated. Working on this hypothesis, it would be easy to determine an optimum of population. The last human being acceptable is he whose production would exceed consumption. There would be an optimum population at the time when a law which the economists entitle the law of proportionate returns would begin to take effect. Take, for example, our poor little Switzerland. We produce a fifth or a quarter of what we need in order to live. Should we be more prosperous if we reduced our population in the same proportion? Would the million Swiss remaining behind after this operation be more prosperous? Emphatically no. We are much wealthier, not only since we are less densely populated, but than we should be if we reduced the population in this proportion. I have no doubts whatever on the subject. It behoves us, therefore, to deal very tactfully with this idea, and this is the fourth and final point that I wish to make, namely, that the idea of population optimum is an international one. One of our colleagues has said that the question was quite complicated enough and that consequently it would have to be considered solely on a national basis. I grant that the question is complex, but I maintain that it should be considered primarily on a world scale. I will elaborate this.

There are in Switzerland, let us say, 50,000 watchmakers, workmen of a certain type, who earn quite a comfortable living, a much more comfortable one than if they turned to agriculture. Suddenly America changes its Customs tariff. These 50,000 workmen lose their means of livelihood. Is the optimum density of population in Switzerland affected by it? Nothing has changed in Switzerland, but an outlet has been closed up. Switzerland can therefore economically support fewer inhabitants.

Let us take another example, which to the ladies will come nearer home. Fashions change, and ladies consider that the less they wear the more elegantly they are dressed. 20,000 people lose their means of livelihood. Is the optimum of population affected? Undoubtedly. Switzerland would become over-

populated by the loss of its principal industries. What is there to be said about it? This, that it is impossible to determine the optimum of a population of a country in making abstraction of other countries, of their Customs policy and of hostile movements. The yearly flood of 500,000 tourists in Switzerland, does it not count for something in determining the optimum of population of our country? A war which deprives us of tourists lowers our point of optimum. In the world which we have before us in the years to come, it would be a mistake not to take these facts into consideration. The American promoters of these studies will perhaps feel a little surprised at hearing Customs policy spoken of when they wish to discuss the problem of the birth rate. The two things are inseparably connected.

What of the future? It was for all of us a great privilege to meet people coming from so many different countries and holding such divergent opinions. There are international gatherings of statisticians, biologists and economists. What is new is the grouping together of representatives of different ideas to study the same problem in its biological, economic and statistical aspects. If we economists have followed with particular interest the adventures of the honeymoon of the flies of Dr. Pearl, we hope that the biologists are not less interested in it. Was it pure chance that our first conference took place in Geneva? Was it not rather a presentiment of the vital importance of this question that brought us together here? It is a question of international importance in all its aspects. It is above all a question holding possibilities of grave consequences from the international point of view.

In concluding, and saying good-bye to you all, members of this Conference who have done us the honor and given us the pleasure of meeting here in Geneva for a few days, I think that the result of your work will be a widening of our knowledge to determine more precisely and completely humanitarian relations. You will return with a feeling of not only having contributed by your work to the clearing of the atmosphere but to the consolidation of peace.

Mr. Bernard Mallet :

I have to express the gratitude of the Conference to the State and City of Geneva, some of whose representatives are here this evening, for the brilliant reception they offered us at the Palais Eynard on the eve of our first meeting.

Nothing could have given the Conference so much prestige as that reception at its outset in which was associated the University of Geneva, whose Rector is in the Chair to-night. Mr. Rappard will forgive me if I express to him the great obligation under which he has placed us by his advice and assistance at every stage in the preparation and conduct of this Conference.

He has made our interests his own and placed his great experience and high abilities freely at our disposal.

Another prominent citizen of Geneva — Mr. Guillaume Fatio — a man whose knowledge of the history and antiquities of his native city is only excelled by his public spirit — has been unwearied in the assistance he has given to those responsible for the practical details of the arrangements both for the business of the Conference and for the entertainment of its members. Both these gentlemen have saved us from many pitfalls and guided us in the way we should go!

To the Reception Committee who have organized the several delightful entertainments we have enjoyed, to Mrs. McCormick for the splendid soirée at the Château de Prangins, and to many private Genevise citizens who have given us so pleasant a welcome, we owe a debt of gratitude. But I cannot sit down without an expression, perhaps too long delayed, of admiration for the work of Mrs. Sanger, and of recognition to her husband, whose genial presence and generous hospitality have done so much to smooth away difficulties.

Not that the difficulties, so freely prophesied to me by many well-meaning friends, have in fact arisen. When Mrs. Sanger some months ago explained to me her own interest in the proposed Conference, she gave me certain assurances which made the cooperation of myself and some of my friends possible; and she has devoted herself with wholeheartedness to further the interests of the Conference, that the great fundamental question of population should be discussed in a purely scientific spirit. The result has, I think, surprised both our friends and foes; and it has certainly surpassed my own anticipations: we may congratulate ourselves on having shown the world that population questions, which bristle with controversy, political, moral, and religious, can be discussed by sensible people without animosity or unseemly wrangling, and on having thus made possible, what many of the promoters have had most at heart, the formation of a permanent international union for the purpose of encouraging research and calling further conferences in the future.

Mrs. Sanger may be proud to have contributed so greatly to this result by the real ability with which she has done her part. I can say that I have greatly valued her opinion and advice to myself and my colleagues on the choice of papers and of speakers and that I am delighted to have this opportunity of expressing our obligations to her.

I have been constantly complimented on the perfection of the organization of the Conference, with which I have had personally little to do. I can only pass on these well-deserved compliments to Mrs. Sanger and her staff, with the assurance

that the work of the organizing staff will be fully acknowledged in the volumes of the proceedings of the Conference which it is hoped to bring out shortly.

I can only repeat my sincere thanks to all my fellow-members, whose able and zealous support and cooperation have made my work so pleasant and brought the Conference to so triumphant a conclusion.

I am much obliged to you, Ladies and Gentlemen, for your patience in listening to observations which convey so very imperfectly the warmth of my feelings.

Dr. W. H. Welch :

One outcome of our session has been that a group representing nearly every aspect of this great question is able to come together and calmly and in a true scientific spirit discuss these great controversial questions. Such emotion as has been shown has been directed mainly towards those who have occupied the Chair and presided at the meetings. Perhaps the Chairmen could rarely see the emotion on the faces of those who, after completing their allotted three or four minutes, were called on to stop. That meant, of course, that everyone felt he or she had a message to deliver so important for his fellowmen to hear that the short space of time allotted was utterly inadequate. Someone once said that no one had a message so significant for his fellowmen that fifteen minutes would not suffice for its expression. I think, however, that is about the only emotional disturbance which has characterized the meeting — the anguish of those who were called on to stop in the midst of important deliverances of great significance to humanity.

There are certain things I think this Conference has demonstrated. In a sense it may be regarded as a kind of dress rehearsal for what is to follow. I should like to think of it in that aspect. It has certainly demonstrated that there is no better place and no more fortunate and significant atmosphere for an international gathering than here in the City of Geneva. For that we have to thank our Chairman to-night, who has carried on a tradition which is characteristic of this City, that of the international mind; it creates an atmosphere singularly congenial for meetings of this kind, where international problems are to be discussed. I think also it has been demonstrated that there are some advantages in meeting where the League of Nations meets, but possibly not as an integral part of the League nor as summoned by the League. I rather surmise that, at such a gathering as this, such discussions as we have had are of significance in demonstrating to the League that there is a population question of considerable importance, and that it is a subject which should be and can be

discussed in a thoroughly impersonal and scientific way. I think we have made a contribution to the League in bringing forward a question of the very first magnitude in its international aspects, and by demonstrating that a gathering representing all these different aspects of the subject can be brought together without stirring up antagonisms, a gathering which will lay the foundation for what it is to be hoped in time will be general principles.

Our meeting has been successful in bringing together a large number of those who have made important studies of the various aspects of the subject. The sociologist does not always speak the same language as the economist, the statistician or the biologist. Nearly every aspect of the subject has been represented at our meeting, which has been a success in bringing together such a notable gathering. The main purpose of such an international conference as this, of course, is the opportunity it affords for the meeting of men and women who are distinguished for their work, and for the interchange of views. The contacts thus established are among the most important results of the Conference.

It has also, I think, been made clear that these discussions have taken place in the hope of laying a scientific basis for inferences, but it is not always necessary to draw the obvious inference. The important thing is the statement of the facts. A great Danish philosopher has said that the most important function of philosophy is a clear statement of the question, and I think one of the main purposes of such a gathering as this is a clear statement of the question with regard to these very controversial matters. In a word, speaking of this as a kind of dress rehearsal in the hope that it is the beginning of a series of annual conferences, these few results which occur to me as I stand here seem to me fully to justify the convocation of this Conference, and should be a sufficient reward for those who have unselfishly devoted themselves to its organization.

We are to discuss to-morrow the possibility of continuing this work in some form or other. I have no authority to anticipate what may be the outcome of that discussion, but something has been started here which is destined to go on and which I believe will be of historic significance. The exact form which future organization will take is to be decided to-morrow, but it will be a thousand pities if this single Conference is not followed by others. Not but that the results of this single Conference are not important, because I am confident that the published proceedings will constitute an extremely important contribution to the whole subject of the population question in its various aspects. The publication of the proceedings will be of great importance, because many of those who were cut short in the discussion will doubtless have the privilege of setting out their views more fully later.

In a word, I am sure we shall leave with the most delightful remembrances of our meeting here this week and with the feeling that it has been thoroughly well worth while, and that the results fully justify the efforts which have been made, and, above all, with the hope and assurance that this is only the first of many similar gatherings, because the problems are international and should be discussed internationally.

His Excellency Rudolph Holsti:

The honorable President of our Conference, Sir Bernard Mallet, in his inaugural speech, laid special stress upon the strictly scientific character of the World Population Conference. I need hardly say that the papers read before the Conference and the discussions that have followed have kept within strictly scientific limits.

On the other hand, the great question of the future of the human race has, no doubt, some particular aspects which can by no means be dealt with on strictly scientific lines. If we approach, for instance, the question of world peace, we all agree that it is of immense importance to mankind, but I am afraid it would not be an easy matter to discuss all the great problems of international peace and goodwill on a basis that everybody would gladly recognize as one of pure scientific principles. Nevertheless, I think some words ought to be said about the close connexion between the betterment of the human race and world peace.

Before the world war, there was in many countries a strong tendency to consider that war was an absolute necessity for the happy future of mankind. Two chief arguments were put forward in defence of war. In the first place, it was strongly emphasized that the highest political organization of man, the State, could not exist and carry out its fundamental functions unless it had the right to declare war. In other words, the right of waging war was considered to be an integral part of the sovereign rights of a State. Secondly, we were told that the highest form of group selection took place through wars. Thus the abolition of war would simply help the weak and inferior individuals and nations to survive and so contribute to the general deterioration of the human race.

Now, as regards the first argument, much could be said against it, but I will confine myself to just a few remarks. Before the world war we were often told, and even on the highest authority, that there never could come into existence such an international superorganization as prophesied by many pacifists, including the French pacifist Abbé St. Pierre. Yet the League of Nations is now a fact, and no longer a Utopia. Of course, I shall

not go into details as to whether the League is a super-State or not, whether it is there simply for the sake of preventing traffic in women and opium, or whether we could let it be simultaneously a more or less international debating society. The very fact that the League a few years ago solemnly declared an aggressive war to be a crime against humanity is in itself a testimony that the theory of sovereignty has lost a considerable part of its former hold over statesmen. As a matter of fact, every effort to limit the possibility of an outbreak of hostilities, as well as the means of warfare, implies by itself that we are willing correspondingly to reduce the application of the old theory of sovereignty. Now, are we to be sure that man in that procedure of reduction never will discover that there is nothing left for a further reduction of the scope of sovereignty for warlike purposes.

Perhaps a day will come when some conference of scientists will boldly tell the statesmen that that particular part of the theory of sovereignty which was very much alive for the sake of aggressive war has fallen mortally sick and, as a matter of fact, is now dead.

Let us turn to the second argument. Are we still, after the horrors of the world war, to believe that natural selection between men, between States, will best take place by using high explosives, submarines and poison gases? I am afraid there are very few people left in the world who still believe in a beneficial group selection by means of modern warfare. At any rate, in this Conference, according to my humble opinion, the only right ways to the betterment of the human race have once more been very clearly indicated. Perhaps a day will come when an international conference, interested in the racial welfare of mankind, will humbly send to the statesmen then living an address signed by the best men in science of that day, requesting them to make some amendments in the constitutional laws.

In the first place, the conference may insist that, from a scientific point of view, the worst enemies of the great statesmen are not the nations living on the other side of the political frontiers, but are all the anti- and a-social forces keeping even the highest of nations internally weak and socially sick.

Perhaps this same conference may go further and suggest the foundation of a new general staff consisting of the best brains in each country to fight social evils. And perhaps the conference may go as far as to suggest that barracks must be used for a compulsory service of young people to learn the obligations of citizenship and how to improve man racially by surer means than high explosives. And finally, perhaps it will also be taught that good patriotism can be displayed in a fight against all the social and racial evils diminishing the vitality

of nation and country and not merely on the battlefield of ordinary war. This may happen some day if there are and will be a sufficient number of people deeply interested in the betterment of the human race by scientific methods. If I had not been personally convinced of that, I never, of course, would have made these observations. But there is a special reason why my doubts have disappeared, and that is the presence in this Conference of so many women. It cannot be a mere blind coincidence that now, when women make their entry into political life, mankind awakens at any rate to some understanding that the human race really must be improved by other means than hitherto have been applied through only too many thousands of years. It is above all, mothers and wives, sisters and brides, that we have to look upon as the greatest moral factor in the application of really scientific methods for the betterment of individuals and thereby of entire nations.

The 19th Century gave to mankind the great theory of the struggle for existence, natural selection and the survival of the fittest. Let us sincerely hope that the 20th Century will go a step further and secure to mankind by all means the survival of the best.

REPORT OF THE EXECUTIVE COMMITTEE

Saturday, September 3rd, 1927, at 9.30 a.m.

CHAIRMAN: Professor R. PEARL.

The Committee appointed to consider the formation of a permanent organization for the purpose of securing more comprehensive and exact knowledge concerning the various historical, economic, social and other factors influencing the composition, growth and future relations of populations, reported to a private executive session of the Conference.

At this meeting of the executive, it was unanimously resolved that:

- (I) A permanent international organization be set up to consider in a purely scientific spirit the problems of population.

- (2) *A provisional committee be chosen and entrusted with the duty of setting up such an organization.*

The following provisional Committee was elected, and was given power to add to its number:

BAUR, Erwin (Germany),
 BERNARD, Léon (France),
 CREW, F. A. E. (Great Britain),
 EAST, E. M. (U.S.A.),
 GINI, Corrado (Italy),
 MAHAIM, Ernest (Belgium),
 MALLET, Sir Bernard (Great Britain),
 PEARL, Raymond (U.S.A.),
 RAPPARD, W. E. (Switzerland),
 WELCH, W. (U.S.A.).

The provisional Committee met immediately after the dispersal of the meeting of the executive. Dr. Raymond Pearl was elected Chairman. Dr. Welch asked permission to withdraw from this Committee, being of the opinion that it was undesirable that one institution should have two representatives thereon. He promised that all the help he could give to the Committee should continue to be given, though he was no longer a member. His resignation was accepted by the Committee. It was decided to invite the following to join the Committee:

AZNAR, S. (Spain),
 INUI, K. S. (Japan),
 LINDBORG, H. B. (Sweden),
 DE PAULA SOUSA, G. H. (Brazil).

To this Committee will be added a representative of the Slav peoples and a representative of the British Dominions, both to be workers in social science and one preferably to be an anthropologist.

The members of the Committee undertook to make known to the respective countries the proposed formation of a permanent organization for the study of population problems and to make a preliminary report concerning matters of organization and function of this body in relation to their own particular countries, the report to be sent to the Chairman, Professor Raymond Pearl. After further discussion, the provisional Committee adjourned at noon.

WHO'S WHO

AMADEO, THOMAS	ARGENTINE
Secretary-General, Museo Social Argentino.	
AZNAR, SEVERINO	SPAIN
Professor, University of Madrid.	
BABECKI, VINCENT GEORGE, M.D.	POLAND
Ass. Director, Hygiene Laboratory of Officers Sanitary School.	
BAUR, ERWIN, M.D. Ph.D.	GERMANY
Director of the Biological Institute, Berlin.	
BĚLEHRÁDEK, JAN, M.D.	CZECHOSLOVAKIA
Dir., Institute General Biology, Masaryk University.	
*BERNARD, LÉON, M.D.	FRANCE
Professor of the Faculty of Medicine, Paris.	
BLACKER, C. P., M.B.	GREAT BRITAIN
Department Psychological Medicine, Guy's Hospital.	
BOER, J. P. C. DE	HOLLAND
Editor of the Pedagogical Review.	
BOHÁČ, ANT., Dr.	CZECHOSLOVAKIA
State Statistical Office, Prague.	
BOLDRINI, MARCELLO, D.Sc.	ITALY
Catholic University, Milan.	
BONVOISIN, GUSTAVE	FRANCE
Director of the Central Committee for Family Allowance.	
BOURDON, JEAN	FRANCE
Lecturer at the Sorbonne, Director of International Studies.	
BRENIER, HENRI	FRANCE
Director-General, Chamber of Commerce, Marseilles.	
BUCKMASTER, Lord	GREAT BRITAIN
Member of the House of Lords.	
BUER, NABEL C., D.Sc.	GREAT BRITAIN
Lecturer in Economics, University of Reading.	
CALMETTE, POFESSOR, Dr.	FRANCE
Director, Pasteur Institute.	
CARR-SAUNDERS, A. M.	GREAT BRITAIN
Professor, School of Social Science, University of Liverpool.	
CARVER, T. N., Ph.D.	UNITED STATES
Professor of Political Economy, Harvard University.	
CEDERBLAD, NILS, M.A.	SWEDEN
Chief of Section, Royal Social Board.	
CHAROON, His Excellency Prince, LL.B.	SIAM
Minister Plenipotentiary of Siam to Paris.	
CHI-CHAO, His Excellency LIANG	CHINA
Lecturer at Tsing Hua University, Peking.	
CLOSE, Col. Sir CHARLES, K.B.E., C.B., F.R.S.	GREAT BRITAIN
Press Geographical Association (Great Britain).	

COLE, LEON J., D.Sc. <i>Dept. of Genetics, University of Wisconsin. Official Representative, National Academy of Science, U.S.A.</i>	UNITED STATES
COX, HAROLD, M.A. <i>Economist, Editor Edinburgh Review.</i>	GREAT BRITAIN
CREW, F.A.E., M.D., D.Sc., Ph.D. <i>Director of the Animal Breeding Research Dept., Edinburgh University.</i>	GREAT BRITAIN
DAS, RAJANI KANTA, M.Sc., Ph.D. <i>Economist, International Labor Office.</i>	INDIA
DAVENPORT, CHARLES B., Ph.D. <i>Director, Department Genetics, Carnegie Institution, Washington.</i>	UNITED STATES
DAWSON OF PENN, Lord, M.D., B.Sc. <i>Fellow Royal Society of Medicine.</i>	GREAT BRITAIN
DRYSDALE, C.V., D.Sc. <i>President, Malthusian League, London.</i>	GREAT BRITAIN
DUNLOP, BINNIE, M.B., Ch.B. <i>Writer on Population.</i>	GREAT BRITAIN
DUPRÉEL, EUGÈNE <i>Professor of Philosophy, University of Brussels.</i>	BELGIUM
EAST, E.M., Ph.D. <i>Geneticist, Experimental Biologist, Bussey Institute, Harvard University; Official Representative, American Academy of Arts and Sciences and American Philosophical Society, U.S.A.</i>	UNITED STATES
EDIN, KARL, Ph.D. <i>Statistician, Sociologist, University of Stockholm.</i>	SWEDEN
ELLIS, HAVELOCK, M.B., B.Sc. <i>Author of Studies in Sex Psychology and other studies.</i>	GREAT BRITAIN
ENGELSMANN, ROBERT, M.D. <i>Statistician, Director of Public Health.</i>	GERMANY
FAIRCHILD, H.P. Ph.D. <i>Professor of Sociology, New York University.</i>	UNITED STATES
FISCHER, EUGENE, M.D. <i>Professor of Anatomy, University of Freiburg.</i>	GERMANY
FISHER, R.A. D.Sc. <i>Statistician, Rothamsted Experimental Station, Herts.</i>	GREAT BRITAIN
FÜPETH, HENRIETTE <i>Doctor of Social Science, Frankfurt a/M.</i>	GERMANY
GIDDINGS, F.H., Ph.D. <i>Sociologist, Columbia University.</i>	UNITED STATES
GIDE, CHARLES <i>Economist, Professor University of Paris.</i>	FRANCE
GINI, CORRADO <i>Professor of Political Economy, and Director of Statistical Institute, Rome.</i>	ITALY
GINSBERG, MORRIS, M.A., D.Litt. <i>Sociologist, London School of Economics.</i>	GREAT BRITAIN
GLOVER, JAMES W., Ph.D. <i>Statistician, Professor of Mathematics, University of Michigan.</i>	UNITED STATES
GOLDSCHIED, RUDOLPH <i>Economist and Sociologist, Vienna.</i>	AUSTRIA
GOLDSCHMIDT, RICHARD, Ph.D. <i>Director, Kaiser Wilhelm Institute for Biology, Berlin.</i>	GERMANY

GREGORY, J.W., D.Sc. <i>Professor of Geology, University of Glasgow.</i>	GREAT BRITAIN
GROTJE, HUGO, Ph.D. <i>Lecturer on Foreign Affairs.</i>	GERMANY
GROTHJAHN, ALFRED, M.D. <i>Professor of Social Hygiene, University of Berlin.</i>	GERMANY
HALDANE, J.B.S., M.A. <i>Bi-Chemist, Genetical Department, John Innes Hor- ticultural Institution, Merton.</i>	GREAT BRITAIN
HARMSEN, HANS, M.D., Ph.D. <i>Technical Advisor, Labor Dept., Berlin.</i>	GERMANY
HAURY, PAUL <i>Professor of History, Lycée Condorcet, Paris.</i>	FRANCE
HERON, DAVID, D.Sc. <i>Secretary, London Guarantee and Accident Co., Ltd. London.</i>	GREAT BRITAIN
HERSCH, LIEBMAN. <i>Professor of Statistic and Demography, University of Geneva.</i>	POLAND
HERWERDEN, MARIA A. VAN, M.D. <i>Ass. Professor, University of Utrecht.</i>	HOLLAND
HIRSCH, MAX, M.D. <i>Gynecologist, Medical Research, Race Biological Institute, Berlin.</i>	GERMANY
HODSON, CORA, F.S.S. <i>Secretary, Eugenics Society, London.</i>	GREAT BRITAIN
HOLSTI, RUDOLPH <i>Envoy Extraordinary and Minister Plenipotentiary to Reval, Estonia.</i>	FINLAND
HORDER, Sir THOMAS, M.D. <i>Chairman, Executive Federation of Medical Services.</i>	GREAT BRITAIN
HUXLEY, JULIAN, M.A. <i>Biologist, Professor, Kings College, London.</i>	GREAT BRITAIN
INGE, The Very Reverend DEAN, D.D., C.V.O. <i>Member of the Royal Society of Literature, London.</i>	GREAT BRITAIN
INUI KIVO SUE <i>Expert, Professor-Lecturer, Tokio University of Com- merce.</i>	JAPAN
ISAAC, AUGUST, P.L. <i>President of the Federation for Large Families.</i>	FRANCE
JAHN, M.G. <i>Director of Central Bureau of Statistics, Oslo.</i>	NORWAY
JOHNSON, ROSWELL, M.S. <i>Professor in University of Pittsburg.</i>	UNITED STATES
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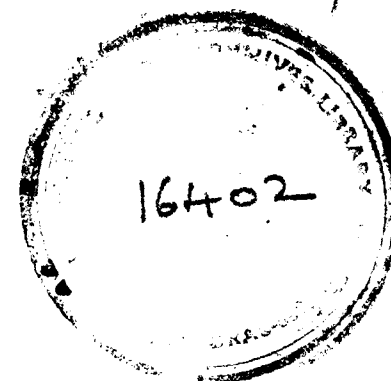
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