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MEDICO-SURGICAL SUGGESTIONS

Vol. 1

MARCH 1938

THE REGISTRAR OF DRUGS

No. 3.

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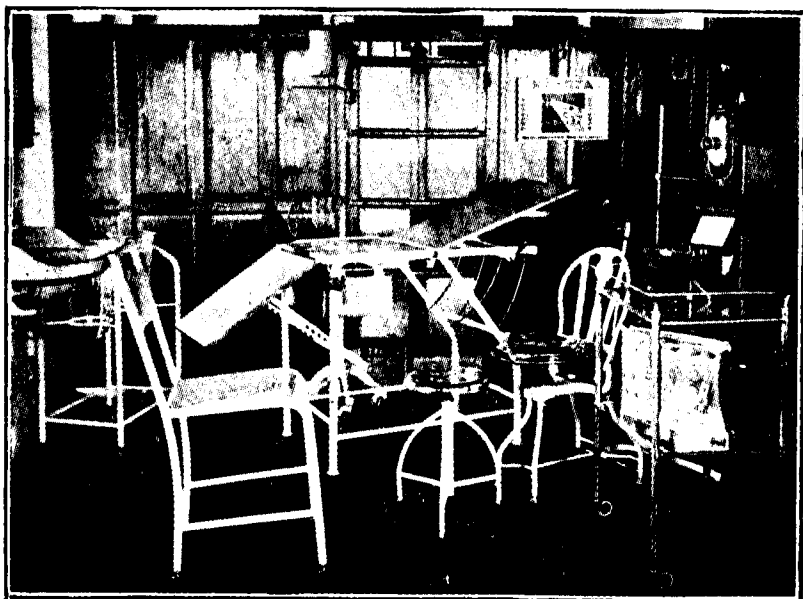
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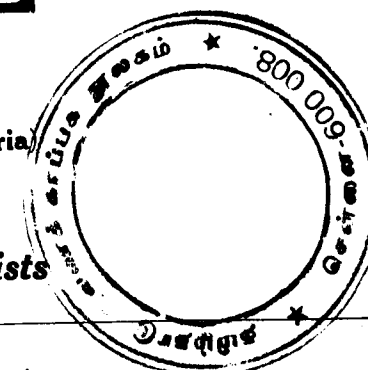
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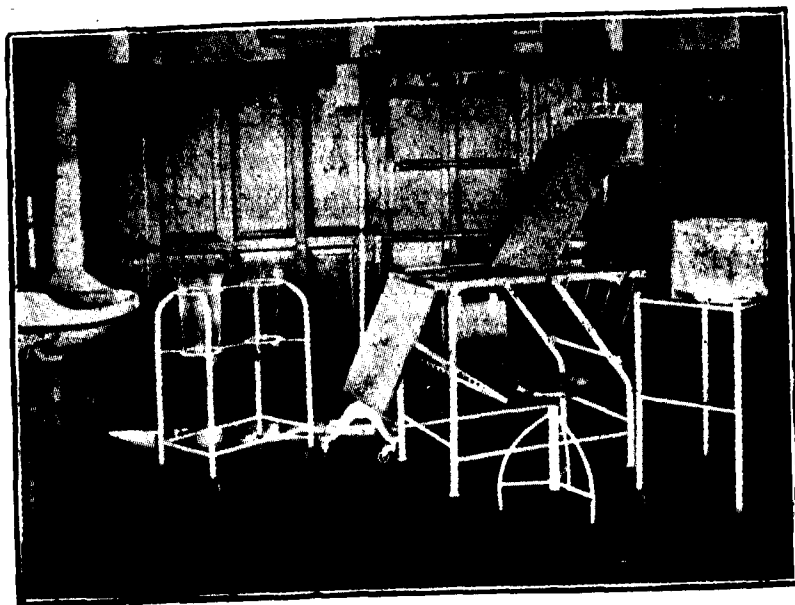
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A MONTHLY JOURNAL OF PRACTICAL MEDICINE & SURGERY

VOL. V

MARCH 1936

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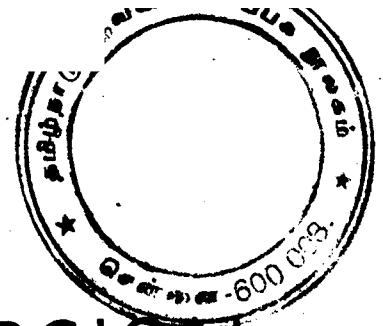
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MEDICO-SURGICAL SUGGESTIONS

VOL. V

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Leading Articles

AFFECTIONS OF THE LUNGS AND PLEURA

BY DR. SANKARA RAMAN, M.B., B.S.,

Cuddalore.

(Continued from the February issue)

PNEUMONIA.

The modern conception of pneumonia is as a septicaemia with predominating pulmonary involvement. Uncomplicated pneumococcal pneumonia is an extreme rarity. Secondary organisms as Streptococci, Staphylococci, Pfeiffer's bacillus, Friedlander's bacillus, Typhoid bacillus, Gonococci, and bacillus Pertussis are also found either alone or in combination with the pneumococci.

Pathologically, four stages are described;

- (1) the state of engorgement, where the lung is slightly enlarged, deep red in colour, heavier but floating in water, with the pleura over it showing fibrinous exudate;
- (2) red hepatisation, where the lung is completely consolidated and on section resembles the liver; heavier and bears the impress of the ribs. The alveoli are filled with R.B.C's., and fibrin and a few leucocytes;
- (3) grey hepatisation, where the lung is solid, non-crepitant and greyish in colour. The alveoli are less engorged but filled with leucocytes and desquamated cells;
- (4) resolution, where the lung returns to normal after its cellular exudate is removed after fatty degeneration, either by expectoration or mostly by absorption.

Although these four stages are described, all the four stages can be recognised at the same time with the characteristic of one of them predominating.

I do not wish to trouble you with the enumeration of the signs and symptoms and prognosis, but will deal with the modern lines of treatment of this malady. I have often observed that many

Coramine and Cardiazol all act as irritants, reflexly stimulating the medullary centre and not by direct action on the heart. Hence they are useless.

The Relation of Nephritis to Pneumonia: Conflicting statements have been made concerning this relationship, and Dr. A. V. Neale has examined 287 cases of acute lobar pneumonia in adults and has come to the conclusion that in pneumococcal infections, nephritis is uncommon, but mild recoverable degenerative conditions in the renal parenchyma are not uncommon. Professor Still records only 2 cases in his own experience. It usually runs a benign course and eventually clears up completely.

BRONCHO-PNEUMONIA.

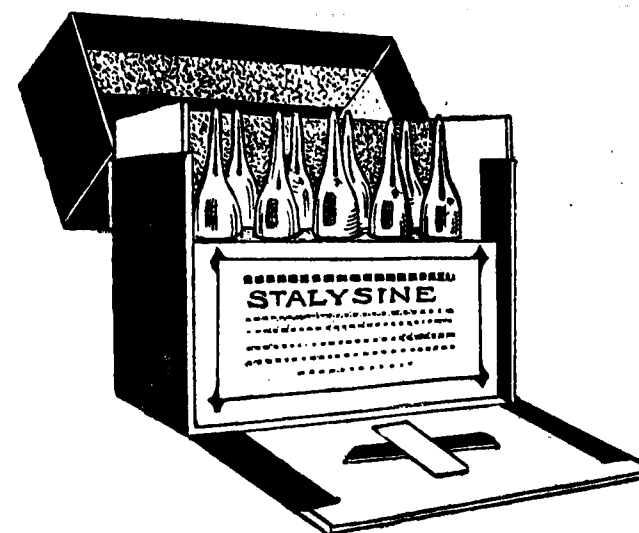
Efforts to give to lobar pneumonia and broncho-pneumonia their relative positions in childhood are hampered by the difficulty met with, in very many cases, of making a certain differential diagnosis by clinical methods alone. Still has pointed out that lobar pneumonia is by no means so rare in infancy as was formerly believed. In children, a classical text-book picture of lobar pneumonia is comparatively seldom seen and the well known signs and symptoms—mode of onset, cyanosis, dyspnoea, pulse respiration and the rest—are remarkably inconsistent.

Primary broncho-pneumonia occurs in infants. Widely scattered patches of consolidation are found in one or both lungs separated by areas of collapse. The stroma is heavily invaded by products of inflammation; expectoration is nil, since children swallow the sputum.

Secondary broncho-pneumonia occurs as a complication of measles, whooping cough, influenza, as a terminal infection, septic condition in other parts of the body as otitis media, as a deglutition broncho-pneumonia etc. It affects any age, expectoration is present and runs a course of two to three months even.

Treatment: Expectorants and stimulants are required from the first. Emetics for children.

(To be continued).



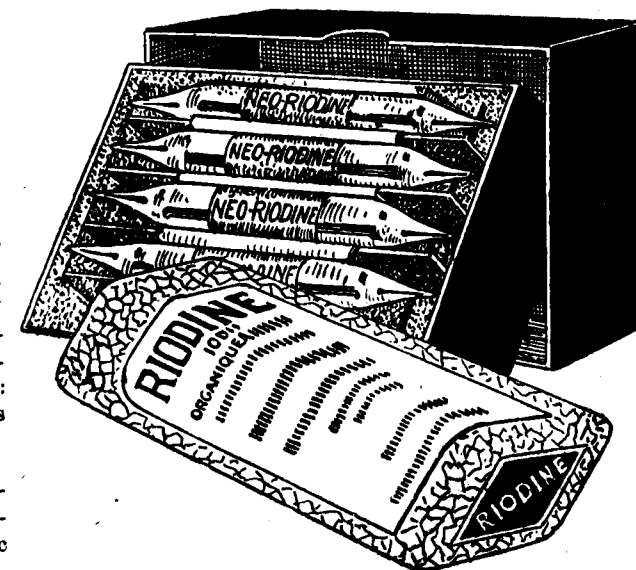
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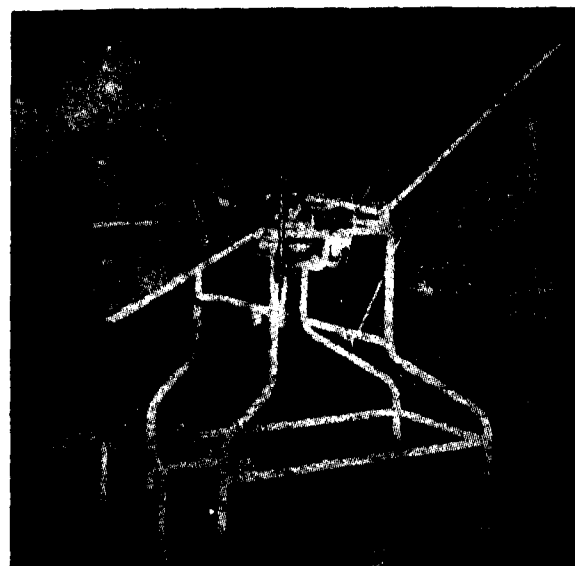
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THE ROLE OF SCIENCE IN THE RECENT PROGRESS OF MEDICINE

BY SIR U. N. BRAHMACHARI, M.A., M.D., Ph.D.,

Calcutta.

Presidential Address at the 23rd Indian Science Congress, Indore,
on January 2, 1936.

In rising to address you at this annual meeting of your Congress, I feel I am hardly worthy to occupy an office which is associated with the names of those with whom I cannot compete in greatness. A few years ago, Lord Rutherford stated at a meeting of medical men that the hopes of the world rested upon their success and ever-growing usefulness. Aviation, wireless, and television have now been accomplished, but one thing still left to wish for, Lord Rutherford very truly remarked, was long life and health, and it was the medical profession with whom it lay to give that guerdon to humanity. For 'Happiness lies, first of all, in health'.

'O blessed health! thou art above all gold and treasure
He that has thee has little more to wish for and he that is so wretched as to want thee, wants everything with thee.'

Standing here to-day as your president, I think I should show no partiality towards the science of medicine by choosing it for my address because I happen to be a medical man. As it is customary in the annual meetings of scientific societies for the president to refer to the recent advances in science and as the progress as well as the future achievements of medicine, which is concerned with the preservation and restoration of normal activity of living matter in the human machine, depends to a great extent upon the help that she has had and may yet get from the sciences that you profess, you would perhaps expect me, as far as practicable within the time at my disposal and as far as lies in my power, to give a review of the important contributions made by some of your sciences in recent times towards the advancement of medicine. I shall take cognisance of our recent knowledge of some aspects of living matter, as medicine is intimately connected with life, and I shall refer to some recent facts revealed by your sciences which may apparently have no particular relation to medicine in the present day, but may be of medical interest in the future.

The future happiness of mankind depends on the solution of the problems of life. These problems are much more complicated than those of physics and chemistry, and still more is this the case with the science of medicine, which deals with the pathological aspects of living matter. I shall probably be able to say nothing that is new, but presentation, from a different view point, of things already heard may perhaps be profitable.

BIOCHEMISTRY.

I shall begin by saying a few words about our present day conception of dietetics and nutrition.

As a matter of the most vital concern in nation-building, the problem of nutrition demands very careful consideration by statesmen and scientists alike, more so due to the fact, as has been recently observed, that a great part of the world's population is not consuming the necessary food stuff. An eminent Swiss authority predicts the decay of civilization unless there is a fundamental revision of the people's diet.

Dietetics and nutrition. Vitamins. It has been stated that the function of nutrition is probably the centre of medicine from a medical point of view, and that the proper dietary of man is a most important subject for the maintenance of health and prevention of disease. As has been observed by Hopkins, during the whole history the needs of nutrition and the kind and amount of food geographically available have played a great part in determining the destinies of races. It has been stated 'tell me what you eat and I shall tell you what you are.' 'Man's place in future history will depend in no small degree on the food he eats.' Nutrition is one of the essential functions of life and its value cannot be too much emphasized.

Up to 20 years ago, the reign of calories was supreme in the field of nutrition, and it was held that if the proper amount of energy required for maintaining nutritional equilibrium could be worked out in terms of calories, then the last word would be said about the problem of nutrition. But it has now come to be recognized that certain substances that had eluded detection in the past, are indispensable in our dietary for the normal activity of the tissue cells and the prevention of certain diseased conditions. Further the study of the problem of nutrition has increased in recent times from the quantitative to the qualitative standpoint, especially with respect to the proteins.

Though it was long known that diseases like beri-beri were due to deficiency in the food of certain substances of unknown chemical nature, it was Hopkins who made in 1912 the monumental discovery of the value of the 'accessory food factors' or the 'vitamines' as they were termed by Casimir Funk, in the maintenance of normal functional activity and growth. The progress of research upon the nature, distribution and functions of vitamins has been very intense in recent days. To attempt to summarize all that is known about them is beyond the limits of my lecture. The discovery of vitamins has led to the relief of a considerable amount of suffering and disablement that is particularly true in regard to rickets. Many of them are simple chemical substances and it is possible that each of them possesses a strict specificity in its action, though lack of more than one vitamin may be responsible for the causation of the complex phenomena manifested by disease.

The function of vitamins and the pathological lesions due to their deficiency are known to those among you who are biochemists or who belong to the medical profession. I shall not discuss them here.

It is possible that the lack of vitamins does not play such an important part in the causation of disease as has been claimed by some observers and that the symptoms following a deficiency of certain vitamins may be attributed to a disturbance in the gastrointestinal canal. It is realized to-day that the processes of digestion are much more complex than was hitherto thought. The secretion of the intrinsic factor is but a case in point. It is now known that vitamin B₁ deficiency is the cause of lack of appetite and defective movements in the alimentary canal. It requires but little imagination to conceive that these effects must have some fundamental cause and that they could lead to a number of abnormal sequelæ, such as, defective absorption, stasis and toxæmia, to mention a few.

Recent knowledge about the requirements of proteins, carbohydrates and fats in a dietary. The minimum amount of protein required for the dietary of man has been a matter of dispute for a long time. Originally found by Voit at 119 grms., it was afterwards raised by Atwater to 125 and subsequently lowered by Chittenden to 60. Sherman quotes it at about 44.4. It has now been recognized that the quest for a protein minimum is really an illusion, as it depends not on the quantity but on the kind of protein supplied. The work of Hopkins on the essential amino-acids in connection with nutrition has come into prominence in the present day. As has been pointed out by him, the food proteins which can be used with the greatest economy in the body are those which contain all the amino-acids in such relative proportions as will correspond most nearly with their proportion in the living tissues of the consumer. These are the proteins of so-called high biological value, constituting the 'first class proteins'. It has been observed that the average consumption of Cambridge under-graduates, those in training being excepted, is about 80 grms. of protein.

The problem of perfect diet. There are many problems that await fuller investigation by physiologists and biochemists in future before the perfect diet can be proclaimed. A food in order to be effective, must be ingested by a body both physically and psychically sound. It is possible to be well-nourished on the simplest of dietaries. Who can say for certain what is the optimum protein diet or the optimum intake of fat? What about the food of the Eskimos, the human carnivores of the world, who live for long periods on purely animal food? Hindhede has emphasized the superiority of the high fat, low protein diet of the Danish farmers over the high protein, low fat diet of the neighbouring Finlanders. But is this applicable to all mankind? There has been much talk about

the energy value of different foods expressed in calories. But, as Cathcart has said, are not these merely convenient units of measurement? How are we to explain the deleterious effects of 'very high' cereal dietary and how are they corrected by 'protective' foods, such as milk and leafy vegetables? Do the cereals contain any toxins, which are neutralized by a proportional quantity of the protective food? What definite information is available as to the body needs of the different kinds of vitamins? A further question is the problem of hypervitaminosis, as also the actual part played by vitamins, and any difference which may arise from taking synthetic or natural vitamins.

Nearly 90 years ago, Chevers taught that the dietary of the Hindus with a very moderate quantity of animal food was the fittest for a tropical climate. Thus he wrote, 'It is certain, that the law givers, who prescribed for the people of India a diet consisting mainly of vegetables and water, the lighter kinds of animal food, such as fish, pigeons and goat's flesh, being only occasionally introduced in moderate quantities, judged almost as physiologically as they could have done, had they studied at the feet of Liebig and Prout'. Similarly in a discussion on the dietary of man, the meatless diet of some of the finest soldiers of His Majesty's Indian Army who fought in the last great world war was highly extolled. This is an interesting subject for research in the quest of minimum animal protein required for human consumption and the future may show that it may be influenced by climatic conditions. Recent researches of Berg tend to show that apart from the nature of proteins, there are other factors which determine the minimum quantity of protein necessary to preserve nitrogenous equilibrium, such as, the particular protein the subject is accustomed to taking and the ratio of inorganic bases to inorganic acids available to or formed in the body of the subject.

This brings me to the question of animal *versus* vegetable protein. Investigators of the present-day hold that, in general, proteins of animal origin are superior to the vegetable proteins for the purposes of nutrition and that the testimony of human vegetarians is useless in determining the amount of animal protein requirement of man, because they were probably not vegetarians during the first part of their lives.

Are there first class fats? At present we know little about the nutritional value of different fats, but some work goes to show that certain fatty acids of the linoleinic series may be essential. It has been stated that the synthetic fat intarvin may be used by fasting persons of normal health without the development of acidosis. Do not these adumbrate the possibility of the existence of first class fats? Further work is also necessary to determine if there are essential carbohydrates.

Mineral constituents of diet. In recent years there has been an advance in our knowledge of the importance of inorganic substances, especially minerals in our dietary. Many of these such as calcium and phosphorus are required for structural purposes and their deficiency gives rise to structural diseases. There are others which are required to be present in minute quantities in our dietary and which are perhaps concerned with the stimulation of the active processes in the tissues. These are copper, manganese and perhaps yet other undiscovered elements. Their deficiency is regarded to be responsible for certain forms of anæmia, though very recently this view has been doubted by some observers. The possibility of the existence of undiscovered mineral deficiency in disease is for the future to reveal, and may I suggest that certain obscure diseases of India, such as, infantile biliary cirrhosis of children may be investigated from this point of view.

Complicated are the inter-relations of the vitamins, the hormones and the mineral constituents of the tissues in the prevention of certain diseases. For instance, biochemistry has shown that a supply of iron, copper, vitamin C and thyroxin are the essential factors in the formation of erythrocytes and hæmoglobin, in addition to an active bone marrow. Deficiency of any of these may give rise to certain types of anæmia. A generous supply of calcium and phosphorus together with a liberal supply of vitamin D is essential for the perfect development of the bones and teeth of the child.

Prolongation of life and rate of growth: In recent times, studies in nutrition have been concerned chiefly with the maintenance of normal health and production of a rapid rate of growth. It has however been observed still more recently that prolongation of life associated with a retarded rate of growth has been noted in many divergent forms, such as rats and brook trout, and that animals kept on a restricted food intake for long periods outlived by a wide margin those that were allowed to eat full from the time of weaning. The inverse relationship of the rate of growth and the time of onset of senility is also apparent from other investigations. Evans has noted that animals injected chronically with preparations containing growth hormone of the hypophysis show evidence of premature senility. On the other hand, Lee and Schaffer have shown that administration of the pituitary growth hormone results in retention of juvenile chemical characteristics by the tissues. Other clues for the study of these problems are furnished by the facts that thymus extracts greatly increase the rate of growth and maturity while pineal extract seems to retard growth. Wetzel in his work on 'Motion of Growth' has shown that excessive rate of growth during infancy and childhood is associated with excess of wasteful heat production and that this may have grave consequences. It is apparent that some of the current tenets in the field of nutrition require

reconsidering in an effort to determine the optimal rate of growth for each period in life.

It seems, however, that the preponderance of evidence indicates that the increased growth achieved by well-considered improvement in the diet is accompanied by general physiological betterment and definite improvement of the species. By intelligent improvement of nutrition of experimental albino rats through successive generations there has been developed a new species of these animals.

Environment and improved nutrition. In the present day, physiologists realize that a diet which appears to be adequate is not invariably the optimum diet. Better environment and improved nutrition will improve hereditary character and bring mankind to a higher level of physical development. Newer knowledge of nutrition may lead to the development of a larger stature, greater vigour, increased longevity and a higher level of cultural attainment (Mc Lester).

Recent investigations into the Indian and Indo-Javanese dietary. In a recent investigation into the diet of the Indo-Javanese in the Dutch Indies, it has been observed that on a diet which appeared hardly adequate from a European point of view the people of the country lived in a fairly good health, though their weight was of a somewhat low standard. The subject requires further investigation to determine what would constitute a proper dietary for the Javanese.

Coming to the Indian dietary, in recent times some interesting work has been done with the balanced diets for Indians by Tilak and his assistants. The dietary worked out by them is the inclusion with the staple food grains in common use by the people of India, of soya-beans, dried skimmed milk, rice polishings, fresh ground-nut cake and preparation of sprouted seeds. Such dietaries, if confirmed, may help in solving the problem facing large masses of people in India, i.e., how to obtain a reasonably good diet for 5 to 7 rupees a month. Aykroyd has found that diets which, in paper at least, adequately fulfil human requirements can be bought in Madras for about Rs. 4/ per month. 'Cheap balanced diets' of this nature must, of course, be subjected to the test of practice.

Perhaps millions of the people of India, especially among the poorer classes, suffer from various degrees of malnutrition which leads to lessened power of resistance to infection. McCarrison's work in this field is well-known. Sanitation and nutrition must go hand in hand in all countries, especially in India, where so many diseases epidemic and endemic prevail.

Gastro-enterology. Alimentary auto-intoxications, allergic conditions from imperfect metabolism, and auto-infections from the alimentary tract play an important part in medicine and the gastro-enterologists are claiming to-day that the science and practice of nutrition is becoming an independent and complete speciality, which

is to be identified with theirs. Perhaps the Science of Nutrition, including the problems of the dietary of the people of a country, will, one day, form part of the department of preventive medicine of the State, as it has already begun to be in certain countries.

Recent dietary in diabetes: In India where diabetes is common, the proper dietary of the disease is an important subject, and I shall very briefly refer to it. Since the epoch-making discovery of insulin in the treatment of diabetes, the pendulum is swinging from the fat diet of Newburgh and Marsh to 'high' and 'higher' carbohydrate diet of Sansum and others. Recently it has been observed that administration of carbohydrate stimulates the production of an unknown insulin-kinase, the insulin acting as a substrate in the metabolism of sugar (Himsworth). On the other hand large amounts of fat may inhibit the action of insulin. On this view a 'high' or 'higher' carbohydrate diet for diabetes aided by insulin finds a rational support and it is possible that, by the adoption of such a diet, the life of a diabetic may be more prolonged and death rate from diabetes more reduced than what has been achieved in the present day, in spite of the introduction of insulin.

Hyper-vitaminosis. Hyperhormonism. Antihormones. In speaking of vitamins in connection with maintenance of nutrition, one cannot help making a brief reference to a condition discovered in recent times and known as hyper-vitaminosis. This consists of a series of toxic symptoms following the administration of excessive doses of certain vitamins such as A or D. It may be incidentally mentioned here that excessive production of the internal secretions of the ductless glands in the system, and administration of an excessive amount of the same may also give rise to toxic symptoms. The condition may be described as *Hyperhormonism*. Further it is possible that inhibitory principles may be produced as a response on the part of the body to the introduction of excessive amounts of various hormones, and that the clinician in his endeavour to correct a hypoglandular state may actually add to the gravity of the condition by causing an overproduction of inhibitory principles, as a result of too persistent treatment with hormones (Collip). In diseases due to the deficiency of hormones, their artificial administration must therefore be intermittent and regulated according to the needs of the patient, just as they are normally manufactured and distributed according to the needs of the body in health. Whether inhibitory principles may be produced by excessive use of vitamins I cannot say.

Biological catalysts. Before I leave this portion of my address, may I make a passing remark about the biological catalysts. The catalysts of a living cell are the enzymic structures which promote reactions within the cells and determine their direction. Perhaps in the maintenance of the normal reaction within the living cells, the vitamins, the hormones and the minute mineral constituents play an

important part. The action of medicines and diseased products upon the permeability of the cells and upon the action of enzymes within them must be an important field for research and may be of great value in medicine for the study of chemotherapy and immunology.

PHYSIOLOGY.

No one can doubt that physiology has had a great influence upon the whole field of medicine in recent times.

Recent researches have thrown light on the mechanism of the fundamental reflex reaction for the protection of the animals and have shown how with the evolution of an anti-gravity mechanism and of extended movement, the brain stem has become evolved to take over this increased responsibility. Magnus has analysed the various nervous stimuli from the periphery which are concerned in this very delicately co-ordinated mechanism. The new data have completely revolutionized our conception of the nervous system, and signs and symptoms of disease which hitherto could not be properly understood have now become capable of analysis.

In more recent years Sherrington and his school have worked more exactly on the relation of the nervous system to responses produced when it is active. These fundamental studies will no doubt throw much light on the changes so often observed in disease. His researches have shown that the centripetal impulses do not pass straight through the spinal cord, but at certain stations in the cord they are transferred into an enduring excitatory state which may in turn set up fresh impulses yielding the reflex discharges.

Adrian's researches have also added greatly to our knowledge regarding the exact nature of the impulses which pass along nerves in different conditions. With a most admirable technique he has studied nerve impulse and its origin with highly profitable results. He has come to the conclusion that change of potential may be of fundamental importance in the activity of nerve cells. He has shown that damaged nerve fibres set up impulses at very high frequencies and these perhaps play a part in sensation of pain, though sometimes impulses in the smaller slowly conducting nerve fibres may also be concerned in the physical mechanism of pain. He has been able to observe the activity of a single nerve cell and has shown that human voluntary contractions are regulated in exactly the same way.

In Russia Pavlov and his school have elaborated the reflex reactions of the higher parts of the nervous system. Their results are capable of considerable application to many of the higher human activities.

A. V. Hill has studied the nerve impulses with exquisitely sensitive apparatus from the point of view of thermal phenomena accompanying it and it is becoming clear that the nerve impulse consists of a transmitted physico-chemical event, the whole cycle of

event comprising activity and recovery in the nerve being supported by the energy derived from metabolic oxidative processes, associated with the cycle.

Further it is possible to conceive 'the nervous impulse as a succession of transformation of chemical into electrical energy, and conversely—these transformations being necessary by the structure of the fibres'.

Haldane and his pupils have continued their well-known work regarding the control of respiration. Carbon dioxide, formerly looked upon as a product of excretion, to be got rid of as soon as possible, has been shown by them to be an essential stimulus to respiration. This discovery has been of immense value in modern anaesthesia. Further it has been shown by Yandell Henderson of Yale University that carbon dioxide is also essential for the tone of the blood vessels. Dale and Evans have shown that carbon dioxide is essential for the activity of the vasomotor centre, just as it is responsible for the activity of the respiratory centres. Barcroft has shown the principles by which oxygen is transported by the blood. As a result of the work of Haldane, Barcroft and their co-workers, it is now possible to deal with respiratory distress and failure by more scientific methods than what was possible in former days.

Areas such as the cerebral and pulmonary vessels which were once thought to have a poor vasomotor supply have now been found to be much better supplied than had hitherto been imagined.

With regard to the heart, the earlier studies of cardiac disturbances by Mackenzie have played an important part in advancing our knowledge regarding the physiology of the heart, and the work of Starling and of Lewis has placed much of it on a strict experimental basis in more recent times. A new interpretation of the electrocardiogram in disease has been recently evolved.

The discovery of the function of the carotid sinus by Hering and its study by Heymans have been of great value to physiology and to pharmacology as well. By the recognition of the activity of this sinus and its possible variations one can now explain many of the differences in response which hitherto have been a great drawback in experimental work. In the nerve connection of this sinus and the effect of pressure on it lies, according to some observers, the explanation of sudden death under gas anaesthesia.

One of the most important new facts discovered in recent years regarding digestion is the relationship of the proper functioning of the stomach to the production of blood, and the subsequent application of this to the treatment of pernicious anaemia. This work had its origin in the physiological studies of Whipple on the normal regeneration of blood after hæmorrhage and administration of liver. Following the same line of research Minot and Murphy found that administration of fresh liver had a remarkable curative effect on

pernicious anæmia. This led to the recent liver therapeutics for treatment of the disease.

The researches of Castle, however, connected the etiology of pernicious anæmia with defective gastric secretions. Recent experiments of Meulengracht have shown that pernicious anæmia in human beings may be due to atrophy and inactivity of that part of the stomach which comprises the pyloric-gland region and may be said to have localized the seat of origin of pernicious anæmia in human beings. Thus stomach preparations for the treatment of pernicious anæmia may with advantage be producible from the pyloric-gland region.

From a physiological point of view, these experiments give the pyloric glands a function. As we know, it has hitherto been difficult to ascribe such a function to the pyloric glands and the special pyloric-gland cells. Now it seems possible that the pyloric glands are the seat of special secretory function and secrete the substance Castle's 'intrinsic factor' that is essential to the blood and the nervous system.

These experiments open up the theoretical possibility that under certain circumstances pernicious anæmia may be due to an isolated atrophy or inactivity of the pyloric-gland organ without a simultaneous atrophy or inactivity of the fundus-gland organ, i.e., without simultaneous apepsia or achlorhydria ('dissociated achylia') although judging from present clinical experience this possibility does not appear to be of much practical importance.

It has been shown by Loewi that the vagus nerve inhibits or checks the activity of the heart by the liberation of a chemical substance which directly influences the myocardium. This is a find of great importance, as there is increasing evidence that the activity of all nerves may take place through the agency of similar chemical substances. Cannon and co-workers believe that they are capable of appearing in two forms of combination, one producing only the augmentor and the other only the inhibitory effects of sympathetic nerves.

Extensive investigation as to the nature of the process by which nerve impulses influence the effectors has been carried out by Dale and it seems fairly established that all efferent messages eventually produce the desired effect by the liberation of either acetylcholine or of a substance like adrenalin. Dale distinguishes such nerve fibres as 'cholinergic' or 'adrenergic' according to the nature of the active substance liberated. The preganglionic fibres of the autonomic system, the motor nerves, and the post-ganglionic fibres of the parasympathetic belong to the 'cholinergic' category while the post-ganglionic fibres of the sympathetic usually fall under the 'adrenergic' group. It has been pointed out by him that Langley and Anderson's evidence, long available, as to the kinds of peripheral

efferent fibres which can replace one another in regeneration, can be expressed by the statement, that cholinergic fibres can replace cholinergic fibres, and that adrenergic fibres can replace adrenergic fibres, but that nerve fibres of different chemical functions cannot replace one another. This discovery has no doubt an important evidence on our new conceptions of the mode of action of 'neuromimetic' drugs.

Certain recent experimental studies tend to show that living tissues may be the seat of radiation able to produce effects at a distance, and that certain activities in one cell of a tissue may influence activities in a neighbouring cell and that chemical reaction may be accompanied by radiations, and events in one cell may thus influence other cells without material transmission.

The Endocrine glands. The glands of destiny. The Pituitary. It has been held that the ductless glands are the 'glands of our destiny' and that 'these potent overlords of our bodies are dictators of our minds and personalities'. It may be possible that the future may reveal that genius, intelligence, beauty, character morality, and other human characteristics are dependent upon diverse combinations of the secretions of these bodies, just as their deficiency or excess may give rise to disease.

Insulin has completely changed the prospect of the treatment of diabetes. The discovery that parathyroid extract mobilizes the calcium of the bones has revolutionized the treatment of diseases due to calcium derangement. Our knowledge of the interaction of endocrines has increased in recent times. I would just mention a remarkable fact that, as shown by Houssay and co-workers, there is no glycosuria when both the pituitary and the pancreas are removed, and further that the injection of extract of the anterior pituitary is followed by the appearance of glycosuria.

May I end this portion of my address by making a little more reference to the pituitary, which seems to have a multiplicity of functions. It may be regarded as the headquarters for the hormones or the chemical messengers which control most of the other endocrine glands and thereby probably almost every cell of the body. The chemistry of the pituitary is by no means closed and it may be that the most important discoveries in the pituitary chapter have yet to be written. It has been held that the integration of the endocrine system is based on the influence of the diencephalon upon the anterior pituitary, which through complex hormones acts on the other endocrine glands, stimulating or inhibiting the production of simpler hormones in them. These hormones are closely related chemically to other substances concerned in normal activities, such as, the growth of the embryo, the growth of bone and calcium metabolism, as well as abnormal activities such as malignant growths. Further, 'in general we can see a division of labour between nervous and hormonal events,

and accordingly between the respective regulators, the central nervous system and the anterior pituitary lobe. The central nervous system regulates principally the specific, acute functions; therefore it also influences those neurogenic endocrine organs, the adrenal medulla and the posterior pituitary lobe, the hormones of which cause acute changes. The regulator of the non-neurogenic hormonal system, the anterior pituitary lobe, regulates mainly the development and state, and partly also the secretion, of the remaining endocrine organs, the hormones of which bring about longer lasting changes of the conditions of many other organs' (Loewi).

In studying the developmental history of the remarkable endocrine gland, the pituitary, one finds that by the seventh week of embryonic life, as the base of the skull is being laid down between the roof of the pharynx and the floor of the forebrain, the stalk of the Rathke's pouch which forms the anterior and intermediate lobes of the pituitary body is drawn out and lies at the posterior border of the nasal septum. Usually some fragments of the pituitary stalk persist in the mucous membrane of the roof of the nasopharynx. Cases have been observed in which the whole pituitary body lies in the posterior part of the nasal septum. By the ninth week the stalk usually disappears, but occasionally a canal in the body of the sphenoid bone of the adult—the craniopharyngeal canal—marks the site of the embryonic stalk. Herring, very recently, has referred to the functions attributed by the ancients to the pituitary. We may make here a reference to the remarkable claims made by the ancient Yogis of India who practised what is known as *Khechari Mudra*. They elongated the tongue slowly by practice and manipulation aided by cutting its fraenum, if necessary, and carefully introduced it into the nasopharynx. The Yogis claimed to have developed remarkable powers of their body and mind in this way. Did they conceive that the tongue mechanically stimulated the secretion of the glandular structures in the nasopharynx (pituitary?) which might be subsequently absorbed into the system, in the same way as adrenalin is absorbed when put under the tongue, and interact with the secretions of other endocrine glands? Will some future investigator test the validity of the above claims?

Tissue culture. May I now say a very few words about tissue culture? 'Tissues cultivated *in vitro* show two types of growth, which are sometimes termed "somatic" and "uncontrolled" respectively.

'In somatic growth, which is usually seen best in cultures of early embryonic tissues, the explanted fragment behaves to some extent as if it were still part of the body. It may increase in size by any or all of the three methods observed *in vivo*, viz., by the multiplication of cells, by the enlargement of cells and by the formation of intercellular material, and if removed from an embryo at an early stage of development often continues to differentiate during

cultivation. For example, undifferentiated skeletogenous mesoderm will form cartilage and bone *in vitro*, explants of the undifferentiated retina give rise to nerve cells and rods and cones, and in cultures of the early mesonephros typical kidney tubules may develop.

'The second type of growth—uncontrolled growth, is perhaps more characteristic of tissues cultivated *in vitro*. Its main features are the progressive simplification of the original histological structure of the explant correlated with a diffuse outgrowth of the cells into the medium, and an increase in volume by cell multiplication only. Even in uncontrolled growth, however, cells never wholly depart from their original type, and epithelial and connective tissue cells remain distinguishable as such even after prolonged cultivation' (Fell and Willmer).

The Carrel strain of fibroblasts is the oldest set of cultures in existence, but there is evidence that certain types of epithelium and various forms of malignant tissue can also be made to live and multiply indefinitely *in vitro*. These results suggest that at least some types of vertebrate cells may be potentially immortal, just as certain types of protozoa or the flat worm may be kept indefinitely alive. It has been claimed by Wells and co-writers that 'if Dr. Strangeways had lived in the time of Julius Caesar and set a series of sub-cultures growing from a scrap of him, fragments of that eminent personage might, for all we know to the contrary, be living now.'

The recent invention in the Rockefeller Institute for Medical Research jointly by Carrel and Lindbergh, of a 'Life Chamber', a sort of artificial body of 'heart, lungs and bloodstream', has enabled scientists for the first time to keep the organs alive, functioning and even growing for a long period outside the body. The method of Carrel-Lindbergh consists of the transplantation of an organ or of any part of the body into a sterile chamber and its artificial feeding with a nutrient fluid through the arteries. In this way the thyroids and ovaries of animals have been artificially cultured, and made to grow. The perfusion fluid consists of protein hydrolytic products, haemin, cysteine, insulin, thyroxin, glutathione, vitamins A and C, blood serum and other substances according to the necessities of the particular organ to be perfused. There is no doubt that tissue culture is likely to be of immense importance in the study of the human body and in the preventive and curative treatment of diseases.

I have briefly outlined how the sciences of biochemistry and physiology have been laid under contribution in the recent progress of medicine. There are, no doubt, various other facts worthy of note in their application to medicine, but I have refrained from mentioning them for want of space and time.

It is pleasing to know that many of the investigators whose names I have just mentioned have been Nobel-laureates for researches in the subject group of physiology and medicine.

GENETICS.

I hope it will not be regarded as transgression of the ambit of my subject if I pay a passing tribute to the recent activities in the field of genetics.

The account of Mendel's epoch-making experiments in his cloister garden, on the crossing of varieties of the common pea, somehow or other sank into oblivion for thirty-five years. But such was the potentiality of his work that, when rediscovered, it not only laid the foundation but also gave a new impetus to the study of the science of heredity. In recent times Mendel's theory of what were called by him *factors* (now known as *genes*) has received confirmation in the hands of Morgan and others. Their physical existence in the chromosomes has been proved and it is now known that the chromosomes are indeed the bearers of the hereditary units and that to their very reliable mechanism we owe the regular behaviour of the inheritance of characteristics from parents to children. Heredity is really a most remarkable phenomenon. The production, generation after generation, of offsprings identical in all but minor peculiarities with their parents is indeed one of the great mysteries of life, and it is by the orderly division of the chromosomes and their contained genes life can be maintained. It is becoming more and more established that 'the general laws laid down by Mendel have as wide a validity for genetics as have Dalton's for chemistry.'

The practical outcome of the application of the principles of genetics as demonstrated by the magnificent work in research laboratories such as those at Cambridge, Edinburgh, Aberystwyth and Aberdeen, has been of immense value in improving crops and livestock. The boundless possibilities in heredity revealed by the science of genetics have placed great power in the hands of breeders of plants and animals and they can now tell with approximate accuracy what to expect from matings. This knowledge has revolutionized breeding in all directions, and resulted in the production of bigger and better plants and animals used for food, clothing or pleasure. In the course of time man may be able to replace the natural selection of more fertile mediocrity and the artificial sterility of high-grade parents by human selection and the artificial fertility of high-grade parents. Sooner or later the frequency of the latter would increase in geometrical progression and control and guide the qualities of mankind in any way it desires for the good of man. The future trend of creative evolution, including man's own destiny, depends on his response to the new knowledge and on his intelligent application of genetical discoveries, in the near as well as distant future (Hurst). Genetics aided by better environments may also be able to prevent the transmission of hereditary weakness and hereditary diseases, some of which are sex-linked. In this way it may lead to the production of better type of men, free from diseases of the

mind and body that are propagated from father or mother to their children and thus the difficult task of medicine for averting or curing hereditary diseases or diathesis will be reduced to a minimum.

CHEMISTRY.

It has been recently remarked by Lord Moynihan that perhaps in the relation of physics and chemistry to medicine, we stand on the very threshold. Let us see what advances have been made at this threshold in recent times.

I begin with the recent contributions in therapeutics due to the application of chemistry. If I were to attempt to enumerate the various compounds that are brought every day to the notice of the medical profession in recent times, as hypnotics, anaesthetics, analgesics, antipyretics, antiseptics, or for other therapeutic purposes, then their number will be legion and my task may be impossible. I shall therefore refer briefly to a very few principal therapeutic chemicals of recent times.

How complicated is the mechanism of chemotherapy is shown by the fact that a slight alteration in the constitution of a compound may bring about a complete change in its physiological properties. This is well-exemplified in the preparation of the various amino-quinoline derivatives for antimalarial purposes. A slight change in the constitution of these compounds leads to a complete disappearance of these properties. Six-amino-quinoline and 8-amino-quinoline have no action on paramoecia in strength of 1:4000. The introduction of OH into 8-amino-quinoline and quinoline-8-glycine-amide raises their toxic action on paramoecia to a remarkable degree and the methylation of 6-oxy-8-amino-quinoline by replacement of H of OH by CH₃ reduces its action on paramoecia to nil (Brahmachari and co-workers). Diethylmonosulphone is without hypnotic action, while both dimethylsulphonedimethylmethane and the isomeric diethylsulphonedimethylmethane (sulphonal) are strongly hypnotic.

Anaesthetics and Hypnotics. Amongst the more interesting synthetic drugs introduced in recent times are those recommended for producing anaesthesia, when given by injection, preliminary to and partly replacing the use of volatile anaesthetics.

Though it may be held that inhalation anaesthesia seems to hold its own which is, to a great extent, due to the development of the gas and oxygen method, yet attempts are being made to introduce, in recent times, other synthetic compounds which may be used for anaesthesia.

The new basal anaesthetics include tribromoethyl alcohol (avertin), urethanes and some of the newer substituted barbituric acids. Most of them are sodium compounds, such as soneryl sodium, amyta sodium, evipan sodium, pernocton, and nembutal. Among the general anaesthetics that have been introduced in recent times may be mentioned evipan sodium, and cyclopropane and di-vinyl ether.

To one coming from Calcutta, the history of anæsthetics has a peculiar interest, because Waldie, who was one of the pioneers of chemical research in India and who lived in Calcutta, was associated with the discovery of the anæsthetic properties of chloroform in 1844. To his memory there is a tablet in the rooms of the Asiatic Society of Bengal. To all of you, the same must also be of great interest because the first chloroform commission was held in India.

There is no doubt that general anæsthetics have been conducive to the advance of all branches of medicine. 'The medical sciences, physiology, pharmacology, pathology and bacteriology would have remained inaccurate and incomplete hand-maidens of medicine, had it not been made possible by the aid of anæsthesia to critically examine, corroborate or disprove the claims, hypotheses and tenets of workers of all types.' (Stander.)

Synthetic chemistry has produced numerous local anæsthetics, better than cocaine. A new era has been opened to the operating surgeon. His visitations on the most delicate parts are performed, not only without agonizing screams he has been accustomed to hear, but sometimes with a state of perfect insensibility, and occasionally even with the expression of pleasure on the part of the patient. Who could have imagined that drawing the knife over the delicate skin of the face might produce a sensation of unmixed delight! That the turning and twisting of instruments in the most sensitive bladder might be accompanied by a beautiful dream! (Warran.)

We are steadily approaching the solution of a perfect analgesia for labour.

In recent times, much work has been done in the quest of a suitable hypnotic. The demand for a good hypnotic has grown more and more intense of late, because due to the stress and strain of modern life, many ask for an ideal draught or a tablet or a pill which would quickly put them in possession of 'tired nature's sweet restorer, balmy sleep'. From the hypnotics of olden times to recent ones, the chemist has travelled a long way, and he is still moving further and further in the search for better hypnotics.

The chief advances in our knowledge of hypnotic drugs in recent times have been (1) the discovery of many new derivatives of the barbituric acid series; (2) the introduction of a number of drugs other than alkaloids for purposes of basal anæsthesia.

The barbituric acid derivatives are perhaps the most commonly used hypnotics at the present day. Other recent hypnotics not derived from barbituric acid include avertin.

An ideal hypnotic should be free from any toxic effects, should be quickly excreted and should give a quiet natural sleep of normal duration in a short time. Such a hypnotic has yet to come. Further the same hypnotic is not suitable for all types of cases and sometimes

methods other than hypnotics are suitable for individual persons for relief of sleeplessness.

May I now refer to the hypnotic properties of the extracts from the root of *Rauwolfia Serpentina*. As early as March 1912 the speaker read a note on its alkaloidal principles and therapeutic properties in a meeting of the Asiatic Society of Bengal. The extracts have marked hypnotic properties and are specially indicated in certain forms of insanity. Since the above paper was read, much work has been done on the chemistry of the drug and many alkaloids have been extracted from the roots. Its hypnotic properties may be due to these alkaloids.

I now pass on to certain aspects of chemistry in its application to a few protozoal diseases as revealed by recent researches.

Organic arsenicals. The best known of trivalent organic arsenicals is salvarsan, for which the non-proprietary name arsphenamine is in common use in the British Empire and the United States. The drug is now generally used in the form of one of its two principal derivatives. The first of these is neo-arsphenamine, the second is sulph-arsphenamine. The first pentavalent organic arsenical used in the treatment of trypanosomiasis was atoxyl. An important derivative of atoxyl is tryparsamide. It has been found very successful in the treatment of trypanosomiasis. Other new therapeutic organic arsenicals include stovarsol, etharsanol, proparsanol and carbarsone.

Symmetrical ureas. The first and best known of the symmetrical urea group of trypanocidal drugs is Bayer 205 or germanin. In 1924 Fourneau and collaborators described the production of a symmetrical urea, which is now obtainable in France under the name Fourneau 309 (moranyl) and is identical with Bayer 205.

Quinoline and acridine antimalarial derivatives. Schulemann and his colleagues succeeded in increasing the antimalarial properties of methylene blue by replacing its short side chains by a longer chain. Investigation subsequently conducted with the quinoline nucleus led to the discovery of beprochin, afterwards named plasmochine or plasmoquine. Similar experiments were made later with other heterocyclic nuclei including acridine and this led finally to the discovery of atebirin. These compounds are of great therapeutic value in certain forms of malaria. In Calcutta a number of amino-quinoline compounds are being synthesized under the speaker's direction and their antimalarial properties tested. Some of them have already been reported to have a marked action upon paramecia.

Leishmanocidal organic antimonials. One of the most terrible of tropical diseases, so far as certain parts of India are concerned, is kala-azar. Antimony, which was once banned to such an extent that the graduates in medicine of the University of Heidelberg had to swear never to use it, has now been found to be its specific. By the

introduction of organic antimonials in its treatment, the mortality of this disease has been reduced from 99 per cent to about 1 or 2 per cent in uncomplicated cases. The terrible nature of this disease in its epidemic form when it ravaged Bengal in the seventies was well described by a contemporary writer as follows:—'The devastation of the epidemic has a very sad tale to tell. Countries that once smiled with peace, health and prosperity, have been turned into hot-beds of disease, misery, and death. Villages that once rang with the cheerful, merry tone of healthful infants, now resound with loud wailings and lamentations. Huts, which offered too little space for their occupants are left without a tenant. The skulls of human beings now strew the fields at every few yards' distance. The fell disease has mocked every human effort, and absorbed in its powerful grasp, day by day and inch by inch, every blessed spot which once used to be prized for its salubrity' (Roy).

It was doubtless a very great advance in the treatment of the disease from massive doses of quinine to tartar emetic which was the first antimony compound introduced by Rogers into India for the treatment of kala-azar. Soon after the introduction of the latter, the speaker conceived the idea of using sodium antimonyl tartrate (Plimmer's salt) and tartar emetic was soon replaced by this compound.

The next step in the treatment of the disease was the introduction by the speaker of the intravenous administration of metallic antimony in a state of fine sub-division, which was attended with remarkable benefit. It was observed that when injected intravenously the particles of antimony are picked up by the same cells in the spleen as those that harbour the parasites of kala-azar, that the two contending agents thus come in closest contact with each other in these tissue cells, and that the fight ends most remarkably in the complete destruction of the parasites in the speediest way.

The next further advance in the treatment of kala-azar was the introduction of certain organic compounds of antimony and the use of these compounds in kala-azar infection has been the subject of the speaker's research for many years, and in 1920 some of them were prepared for the first time in India in the Calcutta Campbell Hospital.

Early in 1921, the speaker discovered an urea antimony compound for the treatment of kala-azar. Its introduction and his other researches on antimonial compounds opened up a new vista in the treatment of the disease in India by means of therapeutic organic antimonials, just as the discovery of salvarsan led to the introduction of organic arsenicals in the treatment of spirochætal diseases. This urea compound was named 'urea stibamine'.

I shall not detain you here with the romance of urea stibamine, however interesting it may be. But I recall with joy the memorable night in the Calcutta Campbell Hospital at Sealdah when after a very hard day's work at about 10 p. m. in a little room with a smoky

dimly burning kerosine lamp, the speaker found that the experiments in the preparation of this compound were up to his expectations. The room still remains, but the signs of a laboratory in it have completely disappeared.

The first series of cases treated with this compound were published early in 1922. Soon after this, most remarkable results were obtained with it by Shortt in Shillong to whom the compound was sent for trial. The value of this compound was quickly recognized. It was introduced, soon after a preliminary experimental trial, by the Government of Assam for the treatment and prophylaxis of kala-azar.

To-day urea stibamine stands pre-eminent in the treatment of kala-azar in India and as a powerful prophylactic against the disease, and it is a matter of supreme satisfaction that this treatment has been the means of saving the lives of a vast population of suffering humanity.

The following remarks from the Annual Public Health Report of the Province of Assam for the year 1933 dated 23rd July, 1934, are worth quoting: 'It has to be borne in mind that, when no specific remedy was known for this disease, that 98 persons at least out of every 100 were doomed to certain death within a comparatively short space of time. Since 1923, when reliable figures for the disease first became available to the end of the year under report, no less than 328,591 persons have been brought under treatment. It is no exaggeration to say that approximately 3.25 lacs of valuable lives have been saved to the Province'.

Further advances have still to be made in the treatment of infections with leishmania donovani, as there are antimony-resistant cases, though fortunately few, and the treatment of that ugly skin infection which was first described by the speaker as a post-kala-azar condition and known as dermal leishmanoid is frequently unsatisfactory. Cases of this condition may be a menace to a community, as a possible reservoir of the parasite of kala-azar.

Chemical structure and physiological properties. Dealing with the relationship between chemical structure and physiological properties one meets with a remarkable series of compounds in recent times having a common nucleus but possessing varied physiological properties. I mean the compounds having the condensed benzene ring system or phenanthrene, as well as the reduced phenanthrene ring plus a fourth five-membered carbon ring or cholane. The cholane nucleus is found in bile acids, cholesterol and other sterols.

A structure of the cholane type is also found in the sex hormones which are responsible for the secondary sex characters of animals. These hormones are œstrone, luteosterone and the male testicular hormone or androsterone. They have close structural relationships with each other and with bile acids and cholesterol which probably contain their biological precursors.

The male sex hormone or androsterone has been artificially prepared. Friedmann has pointed out that the aromatic ring, corresponding to ring A of oestrin is not necessary for the development of the oestrogenetic effect as the benzene nucleus can be replaced by the furane ring, fural-pyruvic acid being even more active than benzal-pyruvic acid. Recent experiments suggest the possibility of getting oestrogenetic activity in ring-free compounds by arranging the carbon atoms 13, 14, 8, 9 of oestrin in a suitable way.

Synthetic hydrocarbons containing the phenanthrene nucleus, such as dibenzanthracene, are found to possess carcinogenic properties. The cancer-producing action of certain tars is due to the presence of a hydrocarbon allied to dibenzanthracene. It has been synthesized and the powerful carcinogenic action of the pure substance has been confirmed. It is, perhaps, the most potent carcinogenic substance so far discovered.

The aglucones, that is, the non-sugar parts of digitoxin, strophanthin and several other closely related substances are allied to the sterols as they embody structures of four carbon rings. Bufotoxin has a constitution closely allied to those of the cardiac aglucones and possess a characteristic action on the heart similar to that of digitalis preparations. The phenanthrene nucleus is present in some of the most powerful alkaloids, such as morphine and codeine of the opium group, and the corydalis alkaloids and in colchicine.

All hormones of the secondary types contain benzene rings. In some cases the ring is a simple one as in thyroxin, pituitrin and adrenalin. In others it is a complicated one, the condensed phenanthrene ring. The Needhams and Waddington have observed the most remarkable phenomena that the chemical organiser or, as they call it, the evocater which determines certain developments of the embryo, belongs to the same group.

Recent knowledge about the chemistry of vitamins and hormones. X-ray work on vitamin B₁, B₂ and C has been carried out in recent times and the structural formula of vitamin C as *l*-ascorbic acid has been established by a close collaboration of crystal analysis with the ordinary chemical methods.

The structure of carotene and vitamin A has also been established by X-ray analysis, as consisting of *cis*-polyene chain which is presumably the chain of polymerized rubber.

Vitamin B₁ possesses two ring systems, one a glyoxaline or pyrimidine and the other a pyrrole containing a substituted sulphur. It is not allied to flavins. Vitamin B₁ possesses antiberiberi properties. The crystalline specimens of Jansen and Donath are, according to most recent observations, the pure vitamin itself with the admixture only of a small and variable amount of inactivated vitamin.

Vitamin B₂ is a complex, containing flavin and another factor, the absence of the latter and not of flavin being considered responsible

for the symptoms of pellagra in rats. The flavin factor exerts a growth-promoting action. A substance identical with lacto-flavin of milk which is allied to vitamin B₂ has been isolated and synthesized. Examining the oxidation-reduction properties of flavin-cleavage products, Kuhn and Moruzzi were able to sum up the relationship of the flavin group by saying that the parent substance was a reductant; that combined with a ring system which contains a substituted amino group it produced a colour; that the addition of a carbohydrate side chain yielded a vitamin; and that the further addition of a protein group resulted in an enzyme (the yellow respiration ferment of Warburg).

Vitamin C is closely related to simpler carbohydrates and sugars. It is keto-hexonic lactone.

Vitamin D can be artificially prepared from irradiation by ultra-violet rays. It has been isolated from irradiated ergosterol in a crystalline and apparently pure form, the crystalline compound being known as calciferol. The production of vitamin D by the irradiation of the sterols of the skin by ultra-violet rays of the sun is a most interesting chapter in the history of medicine, reconciling, as it does, the dispute whether rickets is due to a deficiency in the diet or want of proper sunlight.

Rapid progress is being made to-day in the isolation of hormones in a chemically pure condition. The hormone thyroxine, the active principle of thyroid gland, the iodine-containing amino acid has been synthesized by Harington and his collaborator Barger from tyrosine from which it is probably formed in the animal body. Kendall of the Mayo Research Institute has succeeded in preparing what appears to be the hormone of the suprarenal cortex, which may be beneficial in the treatment of Addison's disease. Ephedrine and pseudo-ephedrine are alkaloids isolated from species of ephedra and are chemically allied to adrenalin. Physiologically ephedrine and adrenalin behave similarly in many respects. Epinine, a synthetic compound possesses, in a marked degree, the pharmacological action of adrenalin.

The specific carbohydrates. The discovery of type specific carbohydrates are among the most remarkable triumphs of chemistry in recent times. It has been observed that a derivative of gum arabic possesses properties resembling those of the specific polysaccharides of one of the types of pneumococcus serum. The value of polysaccharides possessing immunological functions, and the knowledge of their composition, properties and structure must be of great value in medicine. The polysaccharides of the cholera bacilli and of *B. dysenteriae* (Shiga) have been investigated.

Isotopes and heavy water in relation to life. Vernadsky has put forward a hypothesis that the living organisms possess a selective power between isotopes of an element. Among the plants, Loring and Druce have shown that in the potassium of potatoes isotope of

atomic weight 41 predominates, while in ordinary potassium the chief isotope is of atomic weight 39. In the case of man the future may reveal that isotopes of elements play an important part in the maintenance of health and that they may vary in disease.

Barnes has suggested that the polymerized molecules of water are of primary importance in physiological processes. The discovery of the hydrogen isotope (deuterium) of mass 2 and the isolation of quantities of 'heavy water' containing this isotope have opened a new field in the physiology of water. Gortner considers that the water in the Medusa is as much 'alive' as are the proteins, the fats, the lipides, or the carbohydrates. The water relations and different molecular forms of water in the living organism lie at the foundation of problems concerning both health and disease. It has been held by him and others that in lyophilic hydrosols and hydrogels the water may exist in two states, i.e., in the state of free water which is characteristic of water in bulk and in the state of bound water which is characteristic of the lyophilic system, and that the equilibrium between free and bound water is undoubtedly of major importance in vital phenomena. Two hypotheses have been presented as to the possible nature of bound water: (1) an oriented absorption of the water dipoles at the interface, and (2) an oriented absorption of hydrogen and hydroxyl ions. The effect of the substitution of the deuterium form of hydrogen in place of ordinary hydrogen and of the isotopes of other elements into organic molecules may have in the future an important application in biochemistry and medicine.

I have referred only to a very few achievements in medicine due to the application of chemistry in recent times. The advance has been so very great that even in snake venom has been found a therapeutic application for the relief of the terrible pain of inoperable cancer or as a systematic hæmostatic in uncontrollable hæmorrhage. The sex hormones are having therapeutic applications, and the pregnant mare's urine has been found useful in pituitary cachexia with disturbance of circulatory regulation and on the metabolism of carbohydrate and fat. Ovarian extracts have been used in the treatment of hæmophilia.

The relation between chemical constitution of compounds and their varied physiological and therapeutic properties, though at present consisting mostly of jumble of empirical facts may one day lead to generalization of vast importance. Therapeutics is moving to-day from merely qualitative to quantitative foundations. Some of you may live to see that remarkable results may be attained by chemistry in the treatment of diseases like tuberculosis or cancer for which chemical therapeutics has at present day only a limited application in gold or selenium and lead respectively. It may be mentioned in passing the interesting results obtained in Berlin by Fischer on cancerous rats. By keeping these animals in pure

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(To be continued)

Extracts

STAMMERING.

(Lancet. Jan. 25, 1936)

Any defect of speech is a serious handicap to a school leaver in search of employment. Stammering is by far the commonest of speech defects; about one child in a hundred stammers, four times as many boys as girls. The stammer differs from other speech defects in two respects: under certain conditions no stammer is apparent, and it does not respond to the usual speech training methods—suggesting that a stammer must be more than a mere defect of speech. Regarded as a speech defect, it is essentially an interference with the co-ordination of the muscular articulatory mechanism, associated with some disturbance of respiration, particularly of the synchronisation of thoracic and abdominal breathing. Its more obvious manifestations take usually one of two forms: the "clonic", popularly known as the stutter, in which the sound to be produced is repeated several times; and the "tonic" in which a silent period, long or short, precedes utterance of such sounds as give difficulty. The "tonic" form may be accompanied by spasmodic contractions of the muscles of the face, lips, larynx, or even limbs, which appear to take the place of the articulatory contractions of the stutter.

Many theories of causation have been advanced, but there is a growing convergence of opinion to-day towards the view that stammering is in essence a neuropathic condition and as such therefore may be attributable to many causes. Stammerers are usually nervous children. A special inquiry among Manchester school-children

revealed the frequency of neuropathic symptoms such as excitability, irritability, abnormal fears, enuresis, night terrors, nail-biting; 41 of 53 stammerers were of a very excitable type. These symptoms are not the result of the stammer, but are parts of the stammering syndrome. Stammering, then, is not merely a disorder of speech, but a disorder of personality, an emotional disturbance. Stammerers are one type of "difficult child". It is the child who lives in an "atmosphere of over-solicitude," whether through his place in the family, through illness, or other cause who, when some crisis (to him) occurs in his life—the arrival of a baby sister or brother, change of school or teacher, fright, loss of a parent, family disharmony—fails to adjust normally and may develop a stammer, just as he may develop asthma. There may, in addition, be some inherited neuropathic tendency, difficult often, however, to separate from the environmental influence of a neuropathic parent.

The methods of a child guidance clinic may have to be adopted in the treatment of stammering, in order to deal with possible maladjustments and to elucidate the subtle psychological factors, if such there be. The parent and the teacher may have a large part to play in the solution of these matters. The first essential is the production of self-confidence; its lack is characteristic of the stammerer and the inferiority complex is most manifest in the presence of strangers. This defect must be steadily overcome by the suggestion of the teacher. Next in importance to suggestion is relaxation from the tenseness of effort displayed by the stammerer in his struggles to speak. Natural speech should proceed in an easy flow. The act of speech should be more or less unconscious; there should be no sense of strain, no tensely contracted muscles. The habit of general muscular relaxation can be fostered by exercises alternating with short periods of complete rest. The careless habits of speech that many stammerers develop do justify some practice in correct speech training in the form of reading along with others, or reciting in dramatic form, conditions under which a stammer naturally tends to disappear. The older method of speech therapy involved a too intense concentration of effort on the production of sounds and contradicted the principle of relaxation, and so some authorities have dispensed with any specific speech training.

CYCLOPROPANE: A NEW AND VALUABLE GAS ANAESTHETIC.

(L.F. SISE, P.D. WOODBRIDGE, & U.H. EVERSOLE: *New Eng. J. Med.* 1935. ccxiii. 303.)

Cyclopropane is a hydrocarbon gas with the empirical formula C_3H_6 , which is isomeric with propylene. When mixed with certain proportions of air or oxygen it is inflammable and explosive. Its odour is characteristic but not disagreeable. When it is administered in toxic doses, breathing ceases well before the circulation. Its

metabolic effects are strikingly few. It produces a slight rise in the blood sugar. The hydrogen-ion concentration and carbon dioxide combining power are affected little. There is no effect on liver function. Cyclopropane is very expensive but as only very small quantities are required to produce surgical anaesthesia, the cost in individual cases is less than that of gas anaesthesia induced with the older agents and by the older methods. Considerable skill in the administration of the gas is necessary because of its great power, its rapidity of action, and the fact that drastic overdosage may take place in the presence of an abundant supply of oxygen. Recovery of consciousness is rapid. The chief fields for cyclopropane anaesthesia are the following:

1. Thoracic Surgery. The high oxygen supply which can be administered is of value, especially when the patient's vital capacity is low. Quiet respiration and rapid recovery of the cough reflex are other advantageous features.
2. Respiratory obstruction. Because of its high oxygen supply and the relaxation of the jaw and larynx it produces, cyclopropane is one of the best anaesthetics for intubation.
3. Marked anaemia. The advantage of a high oxygen supply in this condition is obvious.
4. Cardiac cases. A high oxygen supply is of value especially when decompensation is present. Since high concentrations of cyclopropane have a deleterious effect on the heart muscle, care is necessary in their administration. However, when very deep anaesthesia is not required the high oxygen supply, the quiet breathing, and the comparative lack of stimulation of the pulse and blood pressure more than compensate for the possibility of a deleterious effect.
5. States of debility and shock.
6. Short procedures requiring moderate relaxation.
7. Possibly in abdominal operations. The relaxation is superior to that afforded by nitrous oxide or ethylene, but less than that produced by spinal anaesthesia.
8. As an adjuvant to other anaesthetics.

Medical News and Notes

BEZWADA MEDICAL ASSOCIATION. The Association Day of this body was celebrated on the 16th February at Durga Vilas, with Major A. Krishnamurthy, B.A., M.B., C.M., A.I.R.O., District Medical Officer, in the chair. Dr. J. Dakshinamurthy, secretary, read the annual report, and an appeal was made to the public to help the association to start a nursing home. Dr. S. J. Eapen was re-elected president, and Drs. M. Venkateswara Rao and K. Sambasiva Rao were elected secretaries. Dr. Miss. K. Achamamba, L.R.C.P., M.R.C.S. (Eng.), L.M. (Rotunda) read a paper on medical studies in England.

Dr. D. S. Ramachandra Rao, M.A., M.D., spoke on the unsatisfactory state of medical education and medical research in this country.

CHITTOOR DISTRICT MEDICAL ASSOCIATION. A meeting of the above association was held at Tirupathi on the 22nd February with Dr. D. Krishnayya, District Medical Officer, in the chair. Dr. N. Srinivasa Rao read a paper on "cataract" Dr. M. Arjunan demonstrated a case of "beri-beri" and described its treatment. Dr. Arjunan was the host on the occasion.

BELLARY DISTRICT MEDICAL ASSOCIATION. This association met on the 22nd February at the Headquarters Hospital with Lt. Col. A. S. Leslie, M.D., I.M.S., District Medical Officer, in the chair. Dr. B. Dayananda Rao, L.R.C.P.S. (Edin.), D.T.M., L.M. (Rot.), Assistant District Medical Officer, delivered a lecture on "Plague". He said that prophylactic treatment consisted of destruction of rats and fleas by gas fumigation and that inoculation with Haffkine's plague vaccine protected one from infection for six months to one year. If the serum treatment was started within a day of the infection it should produce 100 per cent cures. After discussion the meeting terminated.

TANJORE DISTRICT MEDICAL ASSOCIATION. The first annual gathering of the above association was held at the Medical School Buildings, Tanjore, on the 23rd February, Capt. P. J. Kelly, I.M.S., District Medical Officer, presiding. The president welcomed the guests. Dr. E. K. Menon, secretary, read the annual report, which was adopted. It was unanimously resolved to affiliate the association to the Indian Medical Association. Dr. M. K. Sambasivan of Kumbakonam delivered a lecture on "gonorrhoea," Dr. C. S. Ganapathi Aiyar on "otorrhoea", and Dr. K. S. Ganesan on "experiences of Percain as a spinal anaesthetic". Capt. Kelly and Dr. S. T. Achar demonstrated cases of pulmonary tuberculosis.

TINNEVELLY DISTRICT MEDICAL ASSOCIATION. A meeting of this association was held on the 29th February at Nanguneri with Lt. Col. T. S. Shastri, I.M.S., District Medical Officer, in the chair. Interesting cases were shown. Dr. R. V. Padmanabhan described a scheme of present day treatment of Leprosy.

PUDUKOTTAH MEDICAL ASSOCIATION. This association met on the 28th February at the Town General Hospital under the presidency of Dr. F. Ysander, Superintendent of the Swedish Mission Hospital, Tirupattur. Dr. T.S. Shetty of the Kanadukathan Hospital gave a discourse on "diphtheria". Dr. V. Sadasiva Aiyar, R.M.O. of the Pudukottah Hospital, delivered a lecture on "aural suppuration".

THE UNEMPLOYMENT COMMITTEE'S REPORT. The report of the Unemployment Committee, appointed by the United Provinces Government and presided over by Sir Tej Bahadur Sapru, has recently seen the light of day and makes interesting reading. The following paragraphs thereof would interest medical men.

Medicine. (1) There is a considerable amount of unemployment prevailing in the medical profession in these provinces due to the tendency of the medical practitioners to congregate in big towns and cities where the remuneration is higher than in the rural areas though precise figures are not available.

(2) The system of medical relief in hospitals, maintained by Government or district boards or municipal boards, requires reorganisation and the strengthening of the staffs employed :

(3) It is necessary that medical men should be persuaded to settle down in rural areas in larger numbers, and for this purpose, it is necessary to subsidise them on a more generous scale than has hitherto been done ;

(4) Investigation should be made into the efficacy of the indigenous drugs according to the modern methods and after the recognition of such medicines by the medical profession and their standardisation, industries for the manufacture of such and other drugs should be started, and, if necessary, subsidised at the initial stages. If this is done, it should provide employment for a sufficiently large number of qualified medical men ;

(5) There is room for the complaint that the system under which a single man is appointed to treat patients, for all sorts of diseases, cannot be treated as a very modern or an up-to-date system. The attachment of private practitioners to hospitals, maintained by Government or local boards, should be encouraged so as to give the private practitioners a chance of becoming more efficient.

Public Health. (1) This department can provide scope for the employment of a fairly large number of educated men ;

(2) Posts of assistant superintendents of vaccination, which have hitherto been given to men who are not even Matriculates, should in future be given to men who possess some medical or scientific knowledge ;

(3) The number of medical officers employed in municipalities admits of an increase, and such municipalities as have not got medical officers of health of their own, should be asked to employ qualified men.

(4) New schemes of sanitary improvement, both in the towns and the villages, should be taken in hand, and qualified medical men, possessing some diploma or degree in Public Health, should be employed by district boards ;

(5) That more adequate provision should be made for medical inspection and treatment of school-going children in the province and for that purpose the strength of the medical staff should be increased ;

(6) If the district boards have not got sufficient funds to employ qualified medical officers, they should be helped, as far as possible, by Government with financial assistance, unless, by a rearrangement of their budget, or by fresh taxation specially for this purpose, it is possible for the district boards to find the necessary funds.

Subsidiary branches of Medicine. (1) The system which has been in vogue in these provinces, since January, 1928, for the training of compounders, appears to be wholly inadequate, and falls short of the standards suggested in Colonel Chopra's report;

(2) Provision should be made for the training of men in pharmacy, and the necessary qualifications should be prescribed by the rules and regulations, for those who may seek such education, and after an examination held by a duly constituted authority, the successful candidates should be granted a diploma;

(3) In future, Government should employ exclusively, in their hospitals, and dispensaries, such qualified men as pharmacists;

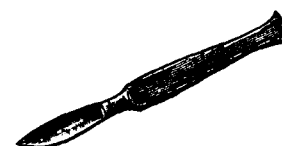
(4) Suitable legislation should be passed, organising this profession, providing for education examination, and the grant of diploma, and penalising the employment by private agencies of unqualified men.

Dentistry. A school of dentistry should be established at King George's Medical College, Lucknow, and suitable legislation modelled on the English Act of 1921, should be passed prohibiting, in future, the practice of dentistry by persons other than those on the dentists' register, kept by the Dental Board of those provinces, to be created by that Act.

LANDMARK IN NEUROLOGY. According to the *South African Medical Journal*, one of the most charming celebrations in the past weeks has been concerned with the jubilee of the first operation for the removal of a cerebral tumour. A commemorative lecture by Mr. Wilfred Trotter described the circumstances of the operation which occurred on November 25, 1884, when Sir Rickman Godlee, a nephew of Lister, successfully removed a glioma from the neighbourhood of the middle of the fissure of Rolando. The patient unfortunately succumbed some weeks later as a result of infection of the wound, but the operation proved that such surgery was possible.

OBITUARY. We regret to record the sad death on the 13th March of Sir Kedarnath Das, C.I.E., M.D., Principal and Professor of Midwifery, Carmichael Medical College, Calcutta, at the ripe age of 70. was highly respected in obstetric circles even in Britain and America and was a fellow of several societies of obstetricians and gynaecologists. He was one of the earliest M.D.'s of the Madras University. He is the author of a book on midwifery and the designer of an obstetric forceps (to suit the pelvis of Indian women) named after him. He dies full of honours. We offer our condolences to the bereaved family.

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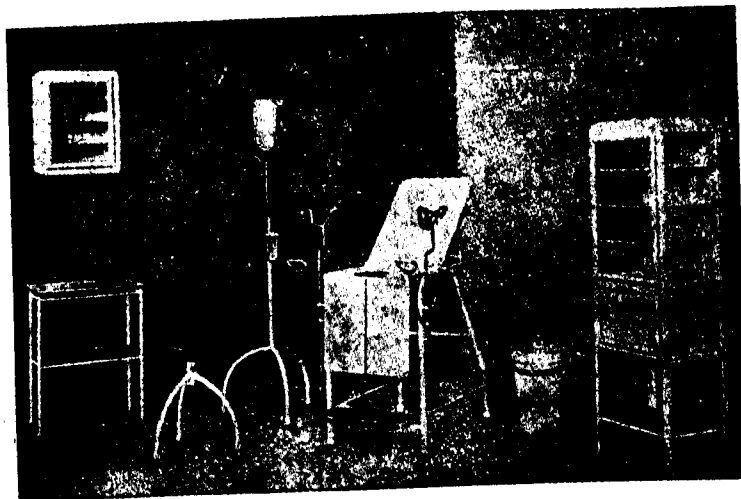
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