OFFICE OF THE REGISTRAR OF BOOKS
25 JUN 1928
MADRAS

THE LATE DOCTOR RAO BAHADUR
K. MADHAVA MENON.

(146)

IN MEMORIUM.

It is with deep regret that we have to record the rather sudden death of Rao Bahadur Dr. K. Madhava Menon, V.H.A.S., at his residence in Purasawalkam at 9 p.m. on the 12th May 1928. The late Dr. Madhava Menon entered the Madras Provincial Medical Service as a temporary Assistant Surgeon on 17th September 1897. He was employed at the Government Hospital for Women and Children, Madras, where his work was much appreciated by such a stern disciplinarian and a famous obstetrician like Col. A. J. Sturmer, I.M.S. In 1903 he was transferred to Coimbatore where he was the Assistant to the District Medical and Sanitary Officer for nearly ten years. It was at this place he established his reputation as a skillful Physician and Surgeon and sympathetic Medical Officer and the excellent work that he did in connection with the plague epidemic in that city was appreciated by the Government who conferred on him the title of "Rao Sahib". To him belongs the unique honour of being selected as the Medical Officer-in-charge of the Madras Provincial Camp in the Delhi Coronation Durbar during 1911-12. After that he was promoted as Civil Surgeon and then to the Selection Grade on the 12th December 1923. He was later on selected to hold the important appointment as the Personal Assistant to the Surgeon-General with the Government of Madras in February 1925. He was appointed as Honorary Assistant Surgeon to H. E. the Viceroy on 12th May 1925. In recognition of his very valuable services for nearly 30 years the Government were pleased to confer on him the

title of " Rao Bahadur " in 1927. Dr. Madhava Menon was an Officer loved and respected by all alike. The Madras Medical Association owes a great debt of gratitude to him for all the good work that he did in connection with the service. As the Personal Assistant he discharged his duties so efficiently that many members of the service felt that they had in him a sympathetic Officer and one who always gave wise counsel to all alike who had the privilege of consulting him. The service has sustained irreparable loss through the untimely demise of one of its best members. We can only hope that the Giver of all good will but offer to his family that consolation which no human heart can adequately satisfy.

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THE EFFECT OF GOLD-SALTS IN PULMONARY TUBERCULOSIS.

By Rao Bahadur M. KESAVA PAI, M.D.,

Superintendent, Tuberculosis Hospital, Madras,

AND

P. K. GUNASAGARAM, L.M.P.

Gold has been used empirically in the treatment of consumption in the ancient systems of medicine in India and elsewhere for centuries, but the rational application of gold in the chemo-therapy of tuberculosis is of comparatively recent origin. As a catalytic agent, under the name of Triphal, Krysolgan, etc., it has been in use in Europe for several years but the therapeutic application of gold-salts based on systematic experimental research owes its inception to Moellgaard who by his experiments on guinea pigs and calves first advocated the use of Sanocrysin as a chemo-therapeutic agent in pulmonary tuberculosis.

That Sanocrysin has practically no bactericidal effect on the tubercle bacillus in vitro has been repeatedly proved by Wright,[1] Sweaney and Max Evanoff,[2] Sweany and Wasich,[3] and others though their work seems to show that a definite inhibitive effect is evident in cultures containing Sanocrysin, but even here the concentration of gold necessary for inhibition is much greater than can ever be safely induced in the human subject during treatment.

Moellgaard,[4] McClusky and Eichelberger[5] and others have proved that Sanocrysin in doses of 1 to 4 cgr.

per kilo of body weight has no effect on the healthy animal, but in ⅓ of these doses or even less the drug has a toxic effect on tuberculous animals. They have also shown that Sanocrysin has no selective action on tuberculous tissues, as most of it is excreted by the kidneys and the concentration of gold in the tuberculous lung after intravenous administration is less than in other healthy tissues. Moellgaard's work seems to prove that the effect of Sanocrysin in tuberculosis depends on its power of splitting up the bacilli in the tissues with liberation of their toxins and the subsequent development in the body of the anti-toxins by natural processes. In favour of this view, Moellgaard adduces an experimental observation that the serum of calves affected with chronic tuberculosis has the power of counteracting 'Sanocrysin Shock' in tuberculous calves injected with Sanocrysin. Basing his views on this observation Moellgaard advocated the use of the anti-toxic serum prepared from horses injected with defatted antigen, in the Sanocrysin shock of human beings under Sanocrysin treatment.

Le Blanc,[6] Jessen [7] and others disagreeing with Moellgaard consider that the action of Sanocrysin is entirely due to the chemical action of the gold on the tissues. They consider that Sanocrysin has no specific effect on the tubercle bacillus or on the disease. Cummins and Acland,[8] Madsen and Morch [9] and others have, however, shown by experiments on rabbits that the drug has a markedly favourable effect on infected rabbits. Cummins did not see any evidence of Sanocrysin shock in the few animals he experimented with and could not say whether its effect was purely chemical or biological as well.

The results of Sanocrysin treatment in pulmonary tuberculosis since its advocacy by Moellgaard in 1923, have varied considerably in the hands of different workers. The Danish hospitals and Sanatoria reported remarkably good results in selected cases. Thus Faber [10] obtained good results in 25 out of 40 cases and gave the statistics of 250 cases treated in the Danish Sanatoria up to 18th June 1925 with 52% successes, 35% becoming bacillus negative.

Gravesen [11 & 12] reported in 1925 the results of 80 cases with 60% successes. Of these 44 cases were treated by himself with positive results in 22.

Frimodt Moller [13] obtained good results in 19 out of 27 cases at Arogyavaram in South India.

Burrell,[14] in his report to the British Medical Research Council in 1926, gave a synopsis of treatment of 20 cases of which 18 improved and 7 became bacillus negative. Of these 10 cases were having artificial pneumothorax treatment as well.

Cummins,[15] Poix,[16] Klemperer,[17] Freidmann,[18] Koch,[19] Jessen, Stachelin,[20] Morland and Zimmerli [21] and others have obtained more or less satisfactory results from Sanocrysin treatment, whilst French workers like Bernard,[22] Rist,[23] Sergent, Bordet, Durand and Kourilsky [24] and Bacmeister [25] and others in Germany reported the results either as indifferent or as unsatisfactory.

The large variations in the results obtained are apparently due to one or more of several causes.

1. The method of selection of cases has not been uniform. Whilst some have treated the early and exudative types of cases, others have chosen the more advanced and proliferative types.

2. The dosage and the intervals between successive doses have varied in different hands.

3. Artificial pneumothorax and other lines of treatment have been simultaneously adopted in many cases and the results as reported are therefore not quite as accurate as they would have been if Sanocrysin alone had been used.

4. The pathological classification of the cases has not been identical with different workers.

5. The standard of judging the results has differed with different persons.

That is why the subjoined table shows such a variety of results :—

WORKER.	No. of cases treated.	No. of cases benefited.	REMARKS.
Le Blanc	18	6	4 died and 8 unaffected.
Friedmann, Kinasniewski and Deicher	54	19	Exudative cases improved more than proliferative.
Koch	10	10	Details of result not given.
Jessen	20	11	2 got worse and 2 died.
Danish Sanatoria (1924).	136	55	21 died, 19 got worse and 41 were uninfluenced.
Faber (1925)	40	25	6 got worse, 9 were unchanged and 16 became T. B. negative.
Burrell (1926)	20	18	2 got worse.

WORKER.	No. of cases treated.	No. of cases benefited.	REMARKS.
Wurtzen (1926)	100	64	Small doses reported more beneficial.
Bernard	23	4	19 failed to respond.
Faber (Statistics of all Danish Sanatoria up to 1-6-1925)	250	130	35% became T. B. negative.
Gravesen (1925)	8	48	Some cases had pneumothorax treatment as well.
Sergent, Bordet, Durand and Kouritsky.	13	4	4 died, 4 became worse and 1 developed diarrhœa.
Frimodt Moller	27	19	50% cases improved in stage III and 84% in stage I.
Ours	43	31	19 arrested or much improved and 12 improved.

The Doses of Sanocrysin and Krysolgan.—The dosage of Sanocrysin has been different in the practice of different clinicians. Moellgaard judging from the effect on his animals advocated the higher doses for the human subject, *viz.* 50 cgr. rising to 100 cgr. intravenously at comparatively shorter intervals, the idea being to have the Sanocrysin in sufficient concentration in the blood to produce the desired bacteriolytical effect. To provide against a 'Sanocrysin' shock, which he attributed to the liberation of the tubercle toxin he advocated his anti-toxic serum. Later workers have discovered that Sanocrysin produces equally good if not better results with smaller doses and the induction of reactions is quite unnecessary.

Thus Poix commenced with 5 to 10 cgr. and ended with 80 to 100 cgr. Klemperer, Wurtzen [26] and others have advocated the smaller doses, whilst Gravesen and other Danish workers as also several clinicians in England and on the continent have used the comparatively larger doses. In our work we began with 10 cgr. as we found rather severe reactions with higher commencing doses. Our maximum dose has been as a rule to 50 cgr. but in more tolerating cases, we have given up to 80 cgr. The maximum total quantity of Sanocrysin given to any case in one course has been 8½ grammes.

Krysolgan has been used intravenously in much smaller doses than Sanocrysin being employed for its catalytic action and not for its chemical effect as in the case of Sanocrysin. The initial dose was ·0001 gramme and subsequent doses of ·001, ·005, etc. up to a maximum of ·1 gramme have been given, the intervals and increase of dosage being based on the reactions resulting from each dose. The maximum total quantity administered in any case was ·34 gramme which is far lower than the corresponding dose of Sanocrysin in our series.

The Nature of Cases suitable for Sanocrysin and for Krysolgan Treatment.—It is recognized by Moellgaard, Gravesen, Friedmann, Clarke [27 & 28] and others that the exudative types are more responsive to Sanocrysin than the proliferative, though a few persons like Klemperer consider that either type benefits and no criteria can be laid down regarding the suitability or otherwise of a case for the treatment. The action of Sanocrysin being primarily chemical it can be understood why the acute cases with no fibrous tissue formulation wherein the Sanocrysin gets easier access to the bacilli should be more favourably influenced than the chronic proliferative cases where the bacilli are comparatively inaccessible to the drug. Of the

43 cases of our series 10 only were of the exudative type, whilst 33 were mostly of the fibro-caseous type, no true fibroid case having been placed under the treatment. The figures are too small to draw conclusions from. The percentage of exudative cases that benefited, *viz.*, 87% as against 66% in the fibro-caseous types cannot be considered as a reliable figure, as, in the usual course, one would expect better results in the former type of cases which belong mostly to stages I and II than in the latter type of stage III cases. The results of any treatment in III stage cases must be less beneficial than in I and II stage cases.

As regards Krysolgan it has been generally believed by Rickmann [29] and others that its action being catalytic it is more beneficial in the fibrosing cases than in the acute exudative ones.

Our figures cannot be said to be sufficiently large to enable us to judge the relative value of Krysolgan and Sanocrysin in pulmonary tuberculosis of the two types. Whilst Sanocrysin has given us better results on the whole than Krysolgan with less untoward results, our experience so far seems to confirm the view that whilst Sanocrysin is more effective in the exudative types, Krysolgan has given better results in the chronic fibrosing cases; for whilst 85% and 61% of the exudative and fibro-caseous types respectively benefited with Sanocrysin, the reverse was the case with Krysolgan *i.e.*, 52% and 56% in the exudative and fibrosing cases respectively.

Reactions and Complications in the course of Sanocrysin and Krysolgan Treatment.—Most of the signs and symptoms characterizing Sanocrysin and Krysolgan reactions were noticed during the course of the treatment and have been tabulated below :—

TABLE II.

Reactions.	Sanocrysin cases Total 52	Krysolgan cases Total 41
Slight febrile reactions ...	10 cases.	4 cases.
Severe and prolonged febrile reaction ...	4 „	7 „
Rigors and Chills ...	1 „	...
Transient and slight albuminuria....	6 „	...
Prolonged albuminuria ...	2 „	...
Slight hæmoptysis ...	2 „	13 „
Severe hæmoptysis ...	8 „	6 „
Nausea and vomiting ...	7 „	2 „
Abdominal pain ...	6 „	6 „
Enteritis ...	6 „	3 „
Exanthemata ...	1 „	...
Stomatitis ...	3 „	...
Marked focal reaction with general disturbance ...	3 „	6 „
Vague symptoms like burning sensations, giddiness, sleeplessness, pain in the chest, weakness, etc. ...	7 „	5 „
Initial loss of weight ...	3 „	1 „
Prolonged and persistent loss of weight ...	3 „	6 „

Slight febrile reaction on the day of the injection and lasting a few hours only was very common but a prolonged febrile reaction with severe constitutional symptoms could be observed in 9% of the Sanocrysin series and in 17% of the Krysolgan cases. Severe rigors were never met with, chills having been seen in one Sanocrysin case only. The so called Sanocrysin shock was never noted in the series and there was no occasion to administer Moellgaard's antitoxic serum.

This is apparently due to the smaller doses that were administered. This also accounts for the comparative rarity of Albuminuria. Of 52 cases in which Sanocrysin treatment was attempted 4 had to be given up on account of marked and persistent albuminuira following the initial doses, 2 had mild and transient albuminuria and 2 prolonged albuminuria during treatment. The smaller Krysolgan doses had apparently no irritant action on the kidney. The hæmoptysis that occurred in the course of the treatment could not always be directly attributed to the Sanocrysin or Krysolgan but was no doubt more frequent than under normal conditions. The great frequency of hæmoptysis in the Krysolgan series is a characteristic feature and seems to show that this drug is more apt to produce focal reactions than Sanocrysin even in the much smaller doses that are administered. It was present in 50% per cent of the Krysolgan cases but in less than 25% of the Sanocrysin series.

Abdominal pains were particularly severe and persistent in many cases under Krysolgan though present in both series. Enteritis though apparently more frequent after Sanocrysin was of a more obstinate type after Krysolgan, blood and mucus having occasionally been passed in the stools.

Stomatitis with ulceration of the tongue especially near the frænum was present in a few cases and was persistent for several days after each injection. Nausea and vomiting were frequent after the larger doses of Sanocrysin.

Vague nervous symptoms including giddiness, burning sensations in the chest and other parts of the body, sleeplessness and general weakness were present in a fairly large number of cases but never gave serious trouble.

An initial loss of weight was observed in a large number of the cases, but a prolonged and persistent loss

characterized the Krysolgan more frequently than the Sanocrysin series.

SUMMARY AND CONCLUSIONS.

Of the two salts of gold, Sanocrysin and Krysolgan the former was found more effective than the latter, 77% cases being benefited with Sanocrysin and 53% with Krysolgan.

2. Neither drug could be said to have a specific effect in tuberculosis. Whilst Sanocrysin in the usual doses of 10 cgr. and upwards produce a chemo-therapeutic effect, Krysolgan in the small doses of ·0001 gramme to ·1 gr. has a catalytic effect.

3. Sanocrysin in moderate doses produces no severe reactions whilst Krysolgan even in much smaller doses produces unpleasant effects.

4. Sanocrysin is of greater value in the exudative cases and Krysolgan in the proliferative cases.

5. Whilst they are useful adjuncts to other forms of treatment neither of the drugs can produce the decisive effects of pneumothorax therapy.

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VITAMINS: THEIR PAST, PRESENT AND FUTURE, AND THEIR RELATION TO DEFICIENCY DISEASES—(*Continued*).*

By Dr. K. MADHAVA NAYAK., L.M. & S.

Assistant District Medical Officer, Vellore.

VITAMIN—C.

It has been previously mentioned that one of the earliest observations that were made to indicate the existence of these accessory food factors was the fact that sailors who had been deprived of fresh vegetables and fruits would develop scurvy. Subsequent study proved that it was the absence of vitamin C, and for this reason this food factor is popularly known as the antiscorbutic vitamin. Scurvy develops after four months upon a diet lacking in vitamin C. Since the realisation that it was so easy to prevent and cure scurvy this disease has not been so prevalent, but during the war it is said that thousands of cases occurred both among the troops and the civilian population because of the economic conditions incidental to the war. During the war the campaign in Mesopotamia furnished, on a large scale, adequate proof of the absolute necessity of a sufficient supply of vitamins in the dietary. In 1916 the Indian troops in Mesopotamia, though given a dietary entirely adequate from chemical standpoint, and calorie system but which, owing to the enforced absence of fresh foods, was deficient in antiscorbutic vitamin "C," developed scurvy to such an extent that 20,000 cases occurred. Their dietary was adequate as regards vitamin B, because the flour

* Lecture delivered before the North Arcot District Medical Association on 14th November 1927.

with which they were supplied was a wholemeal flour known as atta, and no cases of beri-beri occurred.

On the other hand, the British troops also given a dietary quite adequate from a chemical standpoint, developed a number of cases of beri-beri. The reason being that their dietary was deficient in vitamin B, owing to the flour from which their bread and biscuits were made being deprived in its preparation of the vitamin constituents.

Scurvy was almost entirely absent from the British troops owing to their allowance of fresh meat, of which the Indian troops, by reason of caste prejudice, were unable to avail themselves. The best sources of vitamin C are lemons, oranges, grape fruit, tomatoes, lettuce, cabbage, spinach, green beans, green peas and turnips. Meats, grains and seeds contain little if any of this vitamin. Oysters, sprouted seeds and grains are considered good sources. Milk may or may not contain it, depending largely on the food that the cow receives. It is not difficult from the foregoing to see how scurvy exists to a greater extent during the winter months than early spring. In the light of the present day knowledge the administration of orange juice to young infants whether they are on breast milk or artificial food is generally accepted. Before definite symptoms of scurvy appear there is a period of ill-health characterised by certain symptoms which may also be looked for in those who habitually take too little vitamin C, though they get enough to prevent acute scurvy. These symptoms are a sallow, muddy complexion, loss of energy, fleeting pains in the joints and limbs, especially in the legs, usually mistaken for rheumatism. So-called rheumatism in infants and young children has often proved to be due to insufficient vitamin C, and is really scurvy, which in its severer form is known as

Barlow's disease or as scurvy-Rickets. The most complete series of experiments upon quantitative vitamin requirements are those with vitamin C carried out by Dr. Harriette Chick and her colleagues at the Lister Institute. The guinea-pig was used as the experimental animal but in some cases monkeys were also used. A large number of fruits and vegetables were also tested, as well as the effect of heat, drying and the influence of chemicals. The experiments were designed to be of a practical nature. Many were made during the war to find out the most suitable anti-scorbutic for armies operating far from the base. Others were devised to ascertain the effect upon the vitamin C in milk of the various commercial and domestic processes to which it is subjected. The data obtained with guinea-pigs may be thought inapplicable to man, but they can be compared with an old naval test on sailors. On long voyages scurvy was not prevented by an allowance of 2/3 oz. of lemon juice per day, but no cases were observed with an allowance of 1 oz. This figure makes it possible to recalculate the data obtained with guinea-pigs in terms of man's requirement.

VITAMIN—D.

It has been previously mentioned in this paper that any shortage of vitamin A in the young animal invariably results in the development of rickets. While this is true, the vitamin D has earned the title of the antirachitic vitamin because of the fact that it is such an important factor in the metabolism of Calcium and Phosphorus. Moreover it has been definitely shown that rickets can be produced experimentally in animals by depriving them either of vitamin D, lime or phosphorus. Little is known of the general distribution of vitamin D than any of the others, and the only substance which is known to

contain it constantly is cod-liver oil. It is found at times in egg-yolk and milk. The preparation called "Ostelin", which is sold in the market, contains it in abundance to serve our purpose.

In recent studies, many of which must have been already reviewed by you, there is little doubt but that a strong relationship exists between the vitamin D, sun light and ultra-violet ray irradiation. The activation of certain food stuffs by irradiation with the ultra-violet ray, from direct sun-shine or the mercury quartz lamp is another outstanding achievement, which has marked the progress of the study of vitamins which can no longer be regarded as being in the experimental stage. For example, substances like lettuce, spinach, milk, pure cholestrol and some vegetable oils which ordinarily do not possess antirachitic properties, become actively protective against or curative for rickets when they are irradiated. Moreover many of these foods retain these properties for quite a long time, thereby indicating that the vitamin D is a very stable product. This observation may be regarded as the culmination of several distinct lines of research carried out by different investigators. On the one hand these led to the realisation that McCollum's "fat-solubles" vitamin was a mixture of at least two distinct principles—the growth-promoting and anti-xerophthalmic vitamin A, and the antirachitic and, to a minor extent, also growth-promoting vitamin D. These differ in their resistance to oxidation and in their distribution in the animal and vegetable kingdoms, but both agree in passing into the unsaponifiable fraction when the fat in which they occur is hydrolysed, and in being readily separable from the cholestrol of this fraction. On the other hand, the beneficial results in rickets of exposure to ultra-violet light led to the interesting discovery, made

almost simultaneously by Hess and Steenbook in America, that many food materials, and among them fat, acquire antirachitic properties when they are exposed to ultra-violet radiation. It was then discovered, independently by several workers, that the carriers of these newly acquired properties were the sterols of the fats and that these substances in the purified condition acquired antirachitic properties under the same treatment. This fact has now been repeatedly confirmed, and the use of irradiated cholestrol as a source of antirachitic vitamin in a diet has been adopted as a routine procedure in some laboratories.

Rickets both in rats and in man is favourably influenced by cod-liver oil and by ultra-violet rays; it is sufficient, however, if instead of irradiating the patient we expose the food to the rays. It is evident that antirachitic vitamin is built up in the food under the influence of the radiation, from some pre-existing substance or pro-vitamine. A similar process must take place in the radiation of the skin, since if rachitic rats are fed on animals whose skin has been exposed to ultra-violet rays, an obvious improvement takes place in the disease. The vitamin appears to be ready formed in cod-liver oil, whilst in most other foods the inactive pro-vitamine is only present. Originally it was believed that the pro-vitamine was a cholesterine like substance. Oxygen, however, takes no part in the activation of cholesterine, since it can be activated by irradiation in an Oxygen-free medium. Moreover, the products of the oxidation of cholesterine have no action whatever. Windaus, therefore, took the view that exposure to ultra-violet rays converted the ordinary cholesterine into an active isomer. However, none of the cholesterine isomers so far produced have proved themselves in any way antirachitic, whether irradiated or not; indeed, further investigations showed that chemically pure cholesterine is

quite inactive. Therefore cholesterine could not possibly be the pro-vitamine—the pro-vitamines must be present in the cholesterine impurities. Optical methods led to the easy separation of cholesterine from pro-vitamine. It was, on the contrary, a very difficult matter to isolate pro-vitamine from cholesterine. Windaus finally discovered that the pro-vitamine was contained in the most insoluble portions of cholesterine. After ten recrystallisations of the cholesterine in acetic ether, the pro-vitamine was concentrated three-fold, and it was then brought to a nine-fold concentration by distillation in vacuo. Further chemical reactions, in particular precipitation by digitonin, showed that the pro-vitamine was closely related to cholesterine, and that it fell into the group of sterins. The pro-vitamine is unsaturated, and if the pro-vitamine containing cholesterine is hydrolysed it loses all its physiological action. Pro-vitamine is more sensitive to oxidising agents, oxygen and ozone, than cholesterine, and it tends to absorb ultra violet light of longer wave lengths. It has also more colour than cholesterine.

Windaus concludes from these researches that pro-vitamine is a less highly saturated sterin than cholesterine—a dehydro-cholesterine. Pro-vitamine gives the same colour reactions as Ergosterin, and it is conceivable that the two are identical. Cholesterine contains 1/60 per cent. of pro-vitamine. Windaus therefore mixed chemically pure cholesterine with 1/60 per cent. of ergosterin, and he obtained a product which could not be differentiated from cholesterine either in crystalline form or in powder, either in its effects on polarised light or in its analytical constitution. Their optical identity is thereby proved, but it is too early to say as much for their chemical identity. In rachitic rats, definite curative effects were

noted from such minute doses as 1/500 or 1/1000 mg. of irradiated ergosterin. Multiplying the dose 1,000 times had not the slightest harmful effect. Ergosterin therefore represents the pro-vitamine, and an isomer of ergosterin is the Vitamin D.—Hence, Baly's interesting suggestion, that Vitamins are energyzed forms of ordinary materials, to which they revert by loss of the extra energy, has no foundation whatsoever; or, is there any experimental evidence till now in support of the same. The foregoing is certainly one of the most important and far-reaching observations made on the chemistry of the vitamins, and its further development cannot fail to be of surpassing interest. The discovery that irradiated ergosterol provides Vitamin D in a high state of concentration has already been applied to clinical practice in the treatment of rickets, late rickets, and osteomalacia. In most cases the dose given daily was from 2-4 mg., but in one case as much as 10 mg. was given without any detrimental results. It has been found out that in the rat it does no harm to give a dose many times greater than minimal effective dose, and this evidently true for human beings. It is usually administered as a solution in olive oil, but cocoa-butter pastilles and sugar-coated tablets also give satisfactory results. Hottinger reports that he cured a child under one year with 1 mg. daily, and children over a year with 2-3 mg. Falkenheim has remarkable success with doses of 3-5 mg. in treating ricketty children with severe complications such as broncho-pneumonia. He received the impression that the prognosis of the complications was greatly improved when the rickets was thus treated. It is believed that the substance has a great future as a prophylactic. Another great advantage is that it has not got the nauseating qualities attributed to cod-liver oil. The group of papers in connection with this substance is a valuable instalment of clinical

experience from Germany and Switzerland and goes some way to demonstrate that irradiated ergosterol is as reliable an antirachitic agent as ultra-violet light or cod-liver oil, and in many ways a most convenient one. Talking of irradiation, and the effect of irradiation of certain food-stuffs, such as milk and cod-liver oil, in increasing their antirachitic properties, *i.e.*, Vitamin D, a note of warning has been sounded in the Editorial Columns of the Journal of American Medical Association for May 7th, in which it points out the danger of rashly irradiating foods in order to increase their content of Vitamin D. The danger is a real one and is of practical importance where milk is concerned. It is true that the antirachitic value of milk can be significantly improved by exposing it, in the liquid or dry state, to the action of ultra-violet light and rickets can be cured in children by the administration of such directly irradiated milk. As a vehicle for the administration of Vitamin D, irradiated milk might in certain cases find a use, but as a complete food for infants its employment is undesirable. Apart from the unpleasant taste which irradiation imparts to the milk, there is no security that certain of the vitamins which it contains may not have been destroyed. As long ago as 1919, S. S. Zilva investigated the action of ultra-violet light on the Vitamins A, B, and C. The two last he found were little, if at all, damaged, but Vitamin A in butter, for instance, was completely destroyed under the conditions of the experiments, owing to the formation of Ozone by the ultra-violet light waves. Conditions might be so arranged commercially that the destruction of Vitamin D did not take place, but many safe-guards and tests would first be necessary before the product could be safely used. Meanwhile direct irradiation of the cow or feeding her with cod-liver oil seem safer methods to use, for at any rate the milk is not

thereby, as far as we know, robbed of anything, nor is it rendered unpalatable. The case is different in regard to older members of the community, who consume a mixed diet in which the Vitamin A is obtained from a variety of different sources; in countries with long sun-less periods, for example, there might be scope for some irradiated source of article of diet to supplement the Vitamin D in the ordinary dietary. Our information about the vitamins of milk and their relations to children's diet goes on increasing splendidly. It is now universally recognised that there are two Vitamins A and D (possibly more) which are associated with fats and have to do with growth; A, which promotes growth and prevents xerophthalmia and the keratinisation of mucous membranes; D, which promotes growth and prevents rickets, and for which exposure to ultra-violet light is a tolerable substitute. The differentiation of these two factors has naturally invalidated a good deal of earlier work in which they were confused and it has complicated the technique of experimental titration; at the same time it seems to afford a basis for the reconciliation of clinical and experimental results which seemed inconsistent. The dissection and measurement of the two factors in cow's milk has lately been achieved in a very interesting way by Dr. Harriette Chick and Miss M. H. Roscoe at the Lister Institute, in an elaboration of Miss E. M. Luce's work on the effects of diet and sun-light on the vitamin content of milk. Without going into the detail of the technique, the whole sums up to the conclusion that the content of the milk in Vitamin A depends on the food of the cow, and is not influenced by the exposure of the animal to sun-light, while its content in Vitamin D is determined mainly by the degree of insolation. Fresh green food given in a dark stall results in milk with a maximum amount of A,

which is not increased by turning the animal into pasture; A is at its minimum on a diet of cereals and roots. But the power of the milk to prevent rickets depends on whether the cow was in-doors or outside, though green good appeared also to have some beneficial effect. The best milk, therefore, is obtained when the cow is pasture-fed in summer, and the virtues of such milk may be preserved by making it into butter and keeping it in cold store. The results are another illustration of how the modern knowledge of accessory food-factors explains the empirical methods of common human experience, and of how necessary this knowledge is to correct the ingenuity which devises methods of intensive milk production by stall-fed cattle and such like "Scientific" plans.

At this stage, I don't think it will be out of place if I mention something about the spontaneous discovery that irradiation of milk, while activating and increasing the amount of Vitamin D actually unsettles and practically destroys all the available amount of Vitamin A from the milk. This is rather an unfortunate happening, but it does really happen. The investigations of Peacock, Willimot and Wokes prove it beyond doubt that in irradiating milk to produce Vitamin D, there is simultaneous destruction of Vitamin A, as was first shown to occur in butter by Zilva in 1919. At the outset of their investigation they hoped to overcome this difficulty by cutting down the period of irradiation to a point at which Vitamin D would be produced. but no significant amount of Vitamin A would be destroyed. Unfortunately this hope had to be abandoned when they discovered that after a Vitamin A containing substance such as cod-liver oil had been exposed to ultra-violet light even for a few minutes only, there was produced in the oil some substance, possibly of the nature of an organic peroxide, which continued to

cause the destruction of Vitamin A. An initial loss of about 3 per cent. of the vitamin had increased in three months' time to about 25 per cent., and after 6 months there was very little of the vitamin left.

Even in spite of experimental evidence of a precise nature there still seems to be some confusion about the antirachitic value of green food, although the results of recent work on the subject are quite clear. The confusion is undoubtedly a legacy from the time before the fat-soluble vitamins were differentiated. It was believed at that time that Vitamin A and the antirachitic Vitamin D were identical, and tests which revealed the presence of Vitamin A were held to be an index of antirachitic potency also. In this way green vegetables, which are undoubtedly rich in Vitamin A, were deemed to be also rich in Vitamin D, later work has shown that they do not commonly possess this value in any marked degree. Chick and Roscoe, following up the work of Luce, found that the power of pasturage to raise the antirachitic value of cow's milk is due more to the sun-light which the cows enjoy out of doors than to the green food which they consume. In tests on rats Hess and Weinstock found no antirachitic value in fresh lettuce leaves; Goldblatt, Zilva, Zucker and Barnett found none in spinach leaves, and Chick and Roscoe exhaustively examined spinach leaves and found no antirachitic value in them, under any conditions, except at the height of summer, when a very slight antirachitic effect was observed. But they found, as did Hess and Weinstock with lettuce leaves, that the spinach leaves when exposed to an artificial source of ultra-violet light became potently antirachitic. The reason for the apparent non-activation of the leaves exposed to sun-light remains a mystery, but the possibility exists that the overwhelming preponderence of Vitamin A in green

leaves, under the conditions of the experiment, somehow masks the presence of a small amount of Vitamin D, perhaps because the growth produced in the experimental animals, receiving the green leaves, is much greater than the growth of the controls. A small degree of antirachitic activity has been detected in green alfalfa by Steenbock and co-workers. It must, however, be concluded that the antirachitic value of green food is usually very slight, and in no way comparable with its richness in Vitamin A, as was at one time supposed.

The same misconception as applies to terrestrial green food also exists with regard to the green food of the sea. It used to be held that the cod fish obtains the Vitamin D, in which its liveroil is so rich, from its food and that the ultimate source of Vitamin D for all organisms in the ocean is in the green algae and the diatoms that inhabit the sea. These, it was believed, form their Vitamin B under the influence of direct insolation. It had been shown by Jameson, Drummond and others that the marine diatom, Nitzschia Closterium, is a rich source of Vitamin A, and confusion as to its antirachitic power came about in the same way as happened with terrestrial green food. In a paper published this year Leigh-Clare has disposed of this comfortable theory of the origin of Vitamin D in the sea and has shown that Nitzschia Clesterium, grown with conditions of maximum insolation, has no antirachitic power. So we are still left in doubt as to which organisms provide the vehicle by which Vitamin D is supplied to the inhabitants of the sea. Since the green ones are not responsible, possibly the surface-baskers among the animals play a more important part than had been supposed, or possibly even as Bills suggests, Vitamin D can be elaborated in the body of some marine animals, without the intervention of light. Unfortunately, however, there is still

no definite answer to the oft repeated question: "Where does the Cod get its Vitamin D from?".....

Well, the whole question of foodstuffs, and the property which sun's rays or the mercurial quartz lamp possesses of irradiating them, and thereby activating them in their Vitamin D content, is an extremely fascinating one, and at the same time gives room for some interesting suggestions. I, for one, would like to make the suggestion, that in Western countries direct sun's rays fall in irradiating green foodstuffs, because the wave lengths of the sun's rays in the cold countries are of shorter duration than they are in the tropical countries like India. Rickets, the arch enemy of straight limbed childhood, is a very rare disease in Tropical India, but is extremely common in cold countries. The rays of the Tropical Sun while irradiating the foodsuffs activates them to a great extent in their Vitamin D content and also imparts antirachitic value to the skin of the people in the tropical countries. This has given rise to the comfortable theory that vitamins are nothing but stored 'Sun-light.'

Another interesting point is the property possessed by heat of activation and inactivation. This property has been extremely made use of in 'Serology.' The complement Fixation Test and to a certain extent the 'Wasserman Test' are based on the principle of inactivation or the de-complementing action of heat on blood serum. Heating Blood serum to 55°C inactivates or decomplements it. The consideration of all these points makes the subject so interesting and opens a vast field for investigation, where the explorer has to dive deep into the mysteries of 'Nature.'

This observation raises serious difficulties in the commercial application of irradiation methods to foodstuffs on a large scale. These experimental results have consider-

ably raised the interest of investigators in the close connection between Vitamins A and D especially in regard to the action of light under different conditions. It has also brought to light the different action of light either those present in sun-light or those artificially produced by the mercury quartz lamp, in living and in dead tissues. In living plant tissues Vitamin A is accelerated by ultra-violet light, whereas it is destroyed in dead spinach leaves. Many interesting and important questions arise from these observations, if they are confirmed; Is the wave length of the rays which destroys Vitamin A, the same as that of the rays which produces Vitamin D? Are Vitamins A and D derived from the same parent substance? Do the pigments in the living plant, say for example chlorophil, play a part in selecting the particular rays which produce Vitamin D? These and other questions suggest themselves at once for consideration in future applications of ultra-violet light both to food materials and in actino-therapy. Now to tell you a word about the work of the commercial activities of the people. The British Drug Houses, Ltd., London, have put in the market a drug called, Radiostol, which is the name given to Ergosterol, which has been subjected to, and has been activated by ultra-violet irradiation, thereby producing a substance producing antirachitic activity many thousand times that of a similar quantity of cod-liver oil. The substance resulting from the irradiation is now generally accepted to be Vitamin D. Radiostol is issued in solution and, combined with calcium glycerophosphate, in the form of tablets. The solution is given in doses of 3 or 4 drops on a lump of sugar, or added to other food 2 or 3 times a day. The solution is sold in bottles containing half an ounce at 2*s.* 6*d.* per bottle, and the tablets in bottles of 50 at 2*s.* 6*d.* per bottle. This much for the information of those of you who are anxious to make use of the drug.

VITAMIN—E.

The substance of a fifth vitamin was realised for a long time before all of its properties were known. About two years ago an observation was made that rats reared on synthetic food mixture containing proteins, carbohydrates, fats, mineral salts and the Vitamins A and B grew normally and were apparently vigorous and healthy. But, both the males and females were, however, sterile. Further observation indicated that this sterility could be prevented as it had appeared in a given time by the addition to the diet of such foods as lettuce, meat, wholemeat, wheatgerm, rolledoats, large quantites of milk and dried alfalfa. The conclusion reached was that these foods must be rich in what was formerly known as the Vitamin X, but is now known as Vitamin E. Further studies will have to be made on this latest vitamin but it has been considered important enough to add to this list.

Now, coming to the consideration of the shortage of all the vitamins, as distinct from absence, we find that in England, and other European countries, the definite deficiency diseases—beri-beri, scurvy and pellagra—are prevented by the ordinary mixed diet. This does not mean that their diet approximates to the standard of "squarreness", nor that they escape the consequences of their errors in diet. Larger and smaller errors in various directions obscure the clear-cut picture of any one deficiency disease, but cause a host of small ailments and many cases of chronic disease. Experiment has shown that greater the shortage of any vitamin the sooner does the deficiency disease arise. With slight shortages of the various vitamins characteristic symptoms take a long time in appearing. In most cases the first sign of illness is loss of appetite, followed by digestive

disturbance. Animals may have stoppage of the gut, gastric or duodenal ulcer, or die of appendicitis or other troubles before the typical symptoms of the deficiency disease are known. During the war the slow healing of the wounds was found to be associated with shortage of Vitamin C. Heart and digestive troubles are caused by shortage of Vitamin B. Under all variations of vitamin shortage experimental animals are more susceptible to infections of all kinds. Animals fed on vitamin poor diets have succumbed to epidemics of infectious disease which have not attacked other animals kept side by side with them, but fed on food containing enough of all the vitamins. Details of these experiments cannot be entered into here, but they all prove how intimately health depends upon a food supply containing plenty of all the vitamins. Lack of cleanliness, bad housing, and confinement do not produce disease in properly fed animals. Two common types of deficient diets may be picked out for special consideration, namely, the rich man's and the poor man's. The type of wrong diet common amongst the richer classes shows an excess of fat, sugar and protein, and of Vitamin A. The use of white bread, white flour, and other white cereals, and of too much sugar, upset the balance of Vitamin B. This diet is constipating, and, there is reason to believe Cancer producing.

Contrasted with this type is the type of diet common amongst the poorer classes. In this type dholl and green vegetable are practically the only sources of Vitamins B and C. The food consists of a large quantity of carbohydrate, a little meat and fish and a certain amount of sugar. There is an excess of carbohydrate and shortage of all the vitamins. The protein supply is fairly good except amongst the very poor. This diet is also constipating; it lowers the resistance to infections such as tubercle, influenza, pneumonia, etc.

The preponderance of carboydrate unbalanced by Vitamin B, is a fault common to the food of both rich and poor, and may have some connection with the occurrence of diabetes. Glycosuria proper, or diabetes mellitus, is a melody very common in Madras. It is due, as McCay has shown, to indolence and ease combined with the excessive ingestion of starchy food and sweetmeats. It never occurs among the labouring classes, but only in those whose exercise is confined to their jaw muscles. Chronic deficiency of Vitamin B, whether absolute or relative to the excessive ingestion of carbohydrates, no doubt helps to cause it by bringing about atrophic changes in the islands of Langerhans. Here is a very good example of a melody caused by over-feeding with some essentials combined with under-feeding in others plus lack of exercise.

A number of other maladies might be referred to, the origin of which is directly or indirectly connected with faulty nutrition, but the examples already given will suffice to indicate the prominent part played by well balanced and non-deteriorated diet in maintaining the physical efficiency and well being of Indian races, and if it plays this part in India, it does also play in Europe and other countries.

Another important question which naturally arises is the quantity of vitamins needed. In the absence of chemical knowledge of the vitamins there are consequently no exact data of the amounts of each of the vitamins in the various foodstuffs, nor of the amounts required by the body for the maintenance of health. A great deal of work has, however, been carried out to

ascertain how much of the several vitamins, as reckoned in terms of foodstuffs, must be taken to prevent the characteristic deficiency diseases. The amounts thus determined are the minimal, and it is likely that they may be larger since the experiments were of comparatively short duration. In all cases the quantities were larger than might be expected, especially as some of the original experiments gave the idea that only very small quantities were needed. It is commonly believed that the ordinary mixed diet must provide plenty of vitamins, but this is incorrect.

Having gone so far a word about how the vitamins get destroyed and thus lost, will not be out of place. Vitamins are lost from the food by the various processes used in its preparation. Each vitamin gets lost or destroyed in a different way. Vitamin A is very sensitive to oxidation, especially at high temperatures. Thus Vitamin A in milk withstands sterilisation in closed vessels, but it would be destroyed in fat used for frying, as it is then exposed to heat and air. It is also destroyed by hydrogenation, the process used to harden oils for margarine.

Vitamin B is stable to heat except at high pressure, as in canning meat, etc. Through its solubility it is washed away from vegetables cooked in an excess of water. It is therefore better to steam vegetables. The most serious loss of Vitamin B occurs in the preparation of white cereals. The whole meal contains ample of Vitamin B. With practically the whole of the nation's food consisting of rice alone, it is difficult to see how this loss of Vitamin B can be made good by anything else in the shape of diet, as few foods contain Vitamin B to balance the deficiency in white cereals.

Vitamin C is the most easily destroyed. The antiscorbutic properties of fruits and vegetables are lost by drying, heating, oxidation, such as occur in the ordinary domestic and commercial processes. The quantity in cabbage and potato is diminished by boiling for twenty minutes, and altogether lost by long, slow stewing. Heating twice is also totally destructive, in the boiling of already pasteurised milk. Vitamin C is quickly destroyed by alkali as in the cooking of vegetables with soda to preserve their green colour. Infantile scurvy has been caused by the use of citrated milk. Sodium bicarbonate is equally injurious.

A Word or Two Regarding the Chemistry of these Wonderful Things.

Ever since the discovery of their existence and importance, efforts have been made to isolate them and ascertain their chemical nature. Failure has so far been the result, and these mysterious substances must be relegated to the realm of the large group of Bio-chemical agents, comprising among its members the enzymes and most of the hormones, which although producing the most obvious and vitally important results in animal and vegetable organisms, have persistently defied chemical identification.

There have not been wanting alarms and excursions in the form of announcements of the isolation of this or that vitamin, but none of theseproducts has so far emerged as refined gold from the critical furnace.

The present position with regard to this interesting question is that the Vitamins A, B, and C have been obtained in highly concentrated form—from 100 to 900 times more potent than in their most active natural sources.

Moreover, this concentration has been effected without any very serious loss. This is notably the case with Vitamin C. There is, therefore, up to this stage, no question of the potency disappearing under the hands of the investigator, whether from inherent instability of the compound, or from the removal of adjuvants during the process of purification. As I have already told you once before, there is as yet no experimental evidence in favour of Baly's interesting suggestion that vitamins are energysed forms of ordinary materials, to which they revert by loss of the extra energy. The difficulties of further advance lie in the vanishingly small absolute amounts of the vitamins which are present in natural sources and in the complication of the mixture of substances with which they are associated. Neither of these should prove insuperable to modern methods of investigation.

From animal experimentation, and from clinical entities in the human being, there is little doubt that a deficiency of vitamin will produce what is now popularly called a deficiency disease. It has also been proven that other nutritional factors are most important. It might be a debatable question in the minds of many how far one is justified in applying the conclusions drawn from these animal experiments. Scurvy, beri-beri, rickets, xerophthalmia and pellagra can be experimentally duplicated in experimental animals by the utilisation of certain foodstuffs deficient in the same essentials that produce the disease in man. This will indicate that little doubt can be entertained against the food factors now called vitamins. It is true, of course, that the popularity of vitamins has been grasped by many whose practices cannot be spoken of as altogether ethical, but the fact remains that the vitamin problem is of far greater importance than is generally realised. Much harm has

been done in the past by disregarding these essential food-factors, and even at the present time they do not seem to be fully appreciated by many whose duties are to plan and provide diets for infants and young children. Pediatrists agree at the present time, regardless of their particular opinion of just how the milk should be modified, that every infant regardless of whether it is on artificial or breast milk, should be given about a coffee spoonful of cod-liver oil that is known to possess antirachitic properties by biologic control, twice a day and a teaspoonful of orange juice morning and evening. If the infant is breast fed the same care should be exercised in seeing that the mother takes foods that are rich in vitamins as is exercised in the feeding of a cow whose milk is expected to be rich in vitamins. For the last eight years, it is my usual practice, nay, it has become almost a habit with me, that whenever an underfed or marasmic child is brought to me, I advice the parents, as a routine, to give the child a teaspoonful of cod-liver oil, a tea-spoonful of orange or lemon juice, with 10 drops of honey. Honey is a very fruitful source of vitamins. A little more care in this connection will reduce the incidence of deficiency disease and a better foundation will be laid for a sound constitution. These are points of National importance and we, Medical men and women have to do our duties as Medical Missionaries, in the interest of the nation. Of course the feeding of the young infant is perhaps more important. From the stand-point of vitamins, more attention should be given to these factors through the whole period of growth. In fact with our present day habits of eating so many refined and preserved foods diligence in this connection should not be relaxed at any age.

Now we come to the last part of our subject, the last but not the least in importance—*The future of our friends the vitamins*—Allowing events to take their own natural course and in the natural sequence of the Alphabet, and finding that there are 21 more letters in the alphabet to complete the natural sequence, and hoping that the remaining 21 vitamins would be reinstated within the next 10 or 15 years, the whole subject of the future of the vitamins seems to me to be one with a host of possibilities and a very bright future. Research workers are not wanting at present there are medical men all over the universe, who are working day and night, with their heart and soul, and who are prepared to spill their very life blood for the cause of science and suffering humanity. Such being the case, we can safely predict a very brilliant future for our friends the vitamins. At this stage I ask you the natural question, whether "*we could ever conquer disease.*" Last year I spoke to you on the important subject of "*Vaccine Therapy.*" This year I just now spoke to you on the subject of our friends "*the vitamins.*" Next year, if I happen to be here, I propose to speak to you on the other important subject of our relatives "*the Endocrines.*" You know fully well, that barring accidents and other traumatic lesions, and with the exception of a few surgical complaints, including birth palsies and developmental defects, almost all the diseases are brought on by our foes the bacteria. Bacteria give rise to most of the infectious diseases and other septic processes connected with them. These are diseases brought on by our foes, the bacteria, the foreigners. Deficiency diseases are brought on by the absence in the food of the accessory food-factors, from an external

source. Endocrines give rise also to a type of deficiency diseases on account of the absence of the internal secretions from an internal source. Bacteria are our foes, the foreigners and the powerful weapons, in our armamentarium to fight out bacterial diseases, are the vaccines and the sera. Vitamins are our powerful allies and they are planting the milestones on the roadway to conquer disease. Endocrines are our own kith and kin.

So when our powerful allies, the vitamins, have planted all the 26 milestones in the field of battle, and our own relations the Endocrines work more harmoniously in a regular team-work, the healthy growth of the harmony which we all recognise is so necessary for the successful process of our warfare on the road to conquer disease, and with the help of our powerful weapons of warfare, the vaccines and sera, I give you my solid assurance, upon my word of honour, that we can, we must and we shall certainly be able to conquer disease.

After having completely finished writing on the above subject, I happened to be in possession of the latest issue of the "Indian Journal of Medical Research" for October 1927 in which appears an original article on Lathyrism by Lt.-Col. T. C. Mc Combie Young., I.M.S. "Lathyrism is pure and simple a deficiency disease, though various theories were formulated as to its causation, none seem to have received universal acceptance, and all present day evidence is in agreeable conformity with the original observations of Buchanan made as far back as 1904." Lathyrism is extremely common in Bengal, Central India and some of the North of India. It is not uncommon in this province, not to speak of Vellore, but we do not speak about it, because we refuse to recognise a case of Lathyrism, when

we see patients before our eyes in the streets of Vellore. Every beggar we see in the streets with partially paralysed legs, with knock-knee gait and scissor-leg deformity and walking with the aid of sticks, is a typical case of Lathyrism. Lathyrism is pre-eminently a famine year phenomenon, it is one of the pains and penalties of poverty and malnutrition, and the mechanism of its production is due to the fact that the poorer classes and especially beggars are ill-fed and half starved. The varied and cheap variety of cereal they eat are defective and wanting in Vitamin A. They can't afford to eat green vegetables and much less costly stuffs like milk and ghee which are rich in this vitamin. Three months of complete stoppage brings on lathyrism. A partial stoppage, or in other words a shortage brings on a condition of night-blindness or keratomalacia, as we have already termed it, and a little more graver cases bring on a condition of Epidemic Dropsy, or Hunger Oedema or War Oedema, which all mean the same thing, namely, deficiency of Vitamin A. The ultimate causes of lathyrism are economic. Who suffer most from the effects of economy? Certainly the poor and primarily the beggars. The poor and the beggars are certainly passing through the days of Eternal Famine. Hence, if at all, any should suffer from lathyrism it must be the beggars.

Col. McCombie Young was deputed under the Indian Research Fund Association in November 1926, to examine in the field the Epidemiological and clinical aspects of lathyrism. He conducted the enquiry quite independently, and as far as possible, he has not covered ground already traversed by earlier observers, like Buchanan, McCarrison, McCollum and Acton.—He sums up as follows :—

1. When the legume, lathyrus sativus, predominates in the diet, lathyrism may result.

2. When the general population is suffering from starvation and avitaminosis in a famine year, lathyrism is more common than in normal years, when these conditions are absent.

3. A community suffering from lathyrism is also in a state of marked nutritional instability, due to lack of the protective food substances, notably those containing fat-soluble A.

4. In an area in which lathyrism is particularly prevalent, the deficiency disease, 'night blindness', is also notoriously prevalent.

5. In a Mahomedan village using as much lathyrus sativus as their Hindu neighbours but supplementing their diet by substances, which tend to restore the dietary balance, lathyrism is unknown.

6. There are some significant resemblances in the etiology of deficiency diseases and lathyrism.

It may be tentatively suggested for experimental verification that lathyrism may to some extent be a deficiency disease which is produced in persons living in a state of nutritional instability on a diet noticeably lacking in Vitamin A, by a prolonged ingestion of a legume, the amino-acids of whose proteins are unsuitable as a diet and perhaps specially harmful, which is itself deficient in fat-soluble A. Further experimental work producing as far as possible in animals the pre-lathyrism avitaminosis as seen in men, would, therefore, seem to be desirable. If successful, the results of such work would yield deductions of considerable practical value.

A FEW OBSERVATIONS ON PUERPERAL FEVER. *

By Dr. M. B. Prabhu, M. B. B. S.,

Govt. Hospital for Women and Children, Madras.

I am going to read a few words on some problems of Puerperal fever. When I was asked to read a paper on any subject I naturally chose the above one as it seems to me one full of interest. I have already contributed a fairly long article on Puerperal fever in one of our Association Journals and it may cause some surprise and annoyance why the same subject is once again inflicted on you. I would like to point out that I want to place before you some of the problems confronting us during our work so that some of you also may take up this work and solve the problems.

Though puerperal fever has been known from the time of Hippocrates, the last word on the subject has yet to be said. Dr. Kœhlar of Vienna in his latest book on Obstetrics, is of opinion that a rational therapy of puerperal fever we have still to seek. Bonny says that while with the advance of antiseptic measures brilliant results were obtained in general surgery, it is puzzling as well as disappointing that very little improvement is noticeable in the morbidity or mortality from this fever. The disease remains with us not greatly diminished in frequency for the last 50 years. This is the outstanding fact, the failure to explain which, keeps the professional interest in the subject always simmering.

Its aetiology has not been perfectly understood whether it is exogenous or endogenous or both. The

* A lecture delivered at a meeting of the Madras Medical Association on 24th March 1928.

organisms causing the fever have been studied with a certain amount of care only during this decade and books only copied or repeated the names of organisms causing septic condition elsewhere in the body.

We in India are apt to think, that identical conditions exist in England, America and here and if any western investigator makes any observations, we are likely to take them as such without considering, if there are any modifying factors here, or whether there are any differences in the aspects of the fever here and in the West. Treatment of puerperal fever is still considered unsatisfactory. During the British Congress of Obstetrics and Gynæcology in April 1925 about sixty different methods were advocated and there was an idea to try the different lines of treatment in different hospitals and then to crystallize the results.

Then again it is not uncommon for any one of us to meet with cases of puerperal fever which come round with ordinary amount of care and any line of treatment, whereas now and then crop up a case or two which baffle our best efforts and make us pause and consider whether after all it is not the patient's luck that determines the fatality of the case.

Then again the mortality from sepsis has not diminished to a great extent during the recent years, so much so it makes one ponder if the old lines of treatment advocated were not the best. Gentlemen, I would like to speak a few words on these aspects of the problem and invite your attention to some of the puzzling features of the case.

About the Causation of Puerperal Fever.

The cause of septic fever during puerperium is accepted on all hands as invasion of the person by septic

organisms. Whether these organisms were introduced from without or were already present in the body cannot be satisfactorily explained in *every* case. It is safe to say that in the large majority of cases, extrinsic infection is the rule and that the organisms were introduced from without either before labour or during labour. In a few cases it is intrinsic. Here these organisms are already present in the patient either in the vagina or at the external orifice of the cervix or they have migrated to the raw placental site from other foci of infection in the throat, nose, intestines or elsewhere in the body. Streptococci are said to be normally present in the Vagina in the pregnant women, and Fitzgibbon found streptococci in the vagina in 54 % cases of pregnant women. Lockhart found streptococci in 48 % of women. Whitridge Williams found strepto in 55 to 75 % of pregnant women. I do not know if streptococci are present to the same extent in pregnant women in India. Out of 21 women examined at full term in the Government Maternity Hospital, Madras, Streptococcus was present only in one case, in other cases there were yeast diptheriods, staphylococci, and undifferentiated Saprophytes.

Another feature why the same variety of organism causes disease in one person while it is not pathogenic in another can be explained by the fact that individuals have different degrees of resistance to disease. At present very little is known about the inherent resisting powers of the individual towards the different varieties of pathogenic organisms.

Attention has been largely focussed round the central idea that Streptococci are primarily responsible for severe cases of infection and that the Hæmolytic variety is more responsible than the non-Hæmolytic and of the Hæmolytic that the streptococcus pyogenes is *the organism of puer-*

peral septicæmia. While recent investigations of Lockhart, Fitzgibbons, Bigger and more recently of Burkwhite and Armstrong throw considerable light on the role played by Streptococcus, Hæmolytic as well as non-Hæmolytic, it is surprising that so far as I know except for the observations of Whitridge Williams and more recently for some work in the Government Maternity Hospital, Madras, nobody else has recently cared to find or confirm if other organisms like B. Coli or Pneumococci can be equally responsible for these severe types and whether the association of these with Strepto. increases or decreases the severity of the disease.

Now a few words about sepsis and anti-natal care.

It is undoubtedly true that women who had anti-natal care do not become so readily septic as those who come under the doctor's eye in labour or often late in labour. But at present most of us are confronted with the problem in actual practice, only when a woman has become septic after labour. I shall not deal with the details of the anti-natal care except with the short remark that coitus in the last few weeks of pregnancy may be the cause of introduction of undesirable organisms from outside.

As regards the curative side of puerperal fever the key to the whole problem is in the hands of the bacteriologist. Some cases recover with scanty care on our part, some fail to respond to treatment until a particular line is adopted and some succumb in spite of all our treatment and this is because the organisms associated with these conditions are different in different cases, and *therein lies the clue to this puzzling aspect of puerperal fever.* Here I shall give you a few observations of my own which I hope you will verify in your practice and thus confirm or correct them as the case may be.

Cases may be classified as Sapræmia and septicæmia. Sapræmic cases are those where the local lesions can sufficiently account for the disturbance in temperature and pulse, septicæmic cases are those where the local measures affect the course of fever slightly. These Sapræmia cases are those that we generally meet in practice and almost all cases *should* recover by general measures like rest, nourishing diet, Hydrotherapy and local measures like vaginal douches or application of local antiseptics to the parts. If the vaginal and uterine swabs are taken, Strepto are generally absent from the uterine swabs though they may be present in vagina, and Staphylococci are present either alone or in conjunction with streptococci. Now and then a case of sapræmia dies and it is where the patient has been subjected to very prolonged labour and where the perineum and vulva and vagina are gangrenous and sloughing. The absorption of septic material tells upon the patient and though by energetic local treatment the sloughs may all be removed and the part be healing, the patient dies of exhaustion or some intercurrent disease.

It is the case of Septicæmia, that is responsible for the larger number of deaths from sepsis and if we tackle the problem of Septicæmia we have solved the problem of puerperal sepsis. In this case, there is severe constitutional disturbance and little local lesions. Beyond vaginal douches local treatment is not of much avail and constitutional treatment is the deciding factor. A certain percentage (40 to 60 %) recover on stimulating mixtures, sera, vaccines, injection of Iodine, Hexamine or mercurochrome, whereas about 40 % die in spite of all the measures known. Why is that? There are three factors. Among the fatal cases, there are three varieties. (1) The Moribund cases where the disease has so

far progressed that treatment is of no avail. You are bound to meet with such cases for which nothing can be done. (2) Next come the cases where though the patient is not moribund she is so bad that you can at once prophesy that there is little chance for her. These are pale, waxy looking, yellowish, anæmic patients with puffy face and general anasarca. Albumin may be moderate or marked. The mucous membranes are pale, white or blanched. Hæmoglobin index may be anywhere between 20 to 30 % or even less. They are breathless and vomit their food or retain it with difficulty. They have frequent motions, greenish, watery, offensive and almost everything that is given disagrees with them. It is in such conditions where Sepsis supervenes very little can be done. The patient is snatched away before your measures take effect. In these type of cases I do not see how to reduce the mortality or in the words of Whitridge Williams 'a certain number of women are foredoomed to death whether we look at her, pray for her or give her any drug we like'. (3) Then come the third type about which I would like to draw your particular attention. These are among patients whose general condition is not bad. Temperature might have commenced on the first day or might have commenced later on. Pulse may be ranging anywhere from 120 to 160 per min. Temperature ranges between 100° and 104° or 105° F. Delivery may be natural or instrumental and there is very often a history of prolonged labour. These cases may have been examined by barber midwife or not.

It is in these types of cases that a fair number recover on proper treatment and a certain number get progressively worse day by day and ultimately die. What is it here that determines the recovery of the patient or otherwise? As regards the resistance of the patient, from the

general appearance one who is poorly nourished may come round after a severe and prolonged attack, whereas another looking fitter at first sight, may not respond to treatment at all. It is because, in the cases I had occasion to study, the organisms in the uterus were different. Where Streptococci were found the cases were more amenable to treatment. Two or three cases with B. Coli in the uterus either alone or with other organisms all died. These observations are at variance with those of Whitridge Williams who found B. Coli either alone or in combination in 7 cases and all recovered. He had streptococcal infection, Hæmolytic as well as Non-Hæmolytic in 28 cases and all recovered. In short all his 75 cases where uterine cultures were taken recovered. One with Strepto. and Pneumo. died in spite of all we could. In two cases where the general condition at the outset was fair, we got the report that uterus contained B. Coli. Every effort was made from the beginning to save the patient. Hexamin was given by mouth and afterwards intravenously. Antiseptics were tried intravenously. Stimulants like glucose, brandy, and injections of pituitrin and digalin were given to support the patient in their struggle. All in vain. They became progressively worse and were taken home in very low condition. Herein lies the cause of mortality in these cases where all treatment seems futile. If in future a line of treatment can be elaborated for this kind of infection I can picture to myself the day when we can say that the mortality from Septicæmia is not 40 to 50% but 5 to 10%.

Though we have not been able to reduce the mortality very much, the morbidity has been reduced to a great extent. The result from Antistreptococcus serum and vaccine in our hands has been bright if not brilliant. Cases with prolonged labour or after difficult instrumental delivery or those badly handled outside, in short, all those where you expect Sepsis are given either sera or vaccine as soon as possible. This is repeated if necessary. The result is very encouraging. The patient develops very slight sepsis and is fit to go home in a shorter period.

VACCINES.

Opinion has been sharply divided on the use of vaccines in puerperal fever. Vaccines were tried in 1925 and 1926 with indifferent results. Late in 1926 we prepared a vaccine from the strain of organisms isolated from the uterine discharges of the septic cases. Two vaccines were prepared, Puerperal polyvalent streptococcal, and puerperal polyvalent B. Coli vaccine. This vaccine has given very good results; it should be given early in the case and not after the patient begins to get high temperature. Vaccines have superseded Sera as a prophylactic and experience with vaccine since the end of 1926 has only increased our faith in the vaccine. It was probably the question of finding the right key to unlock the problem. As a result of sera and vaccines given early in the disease we rarely get severe types of cases. Only last month we had 4 cases one with extended breech, arms in the nuchal position and forceps to the aftercoming head. 2. Forceps, cord prolapsed and perforation. 3. Transverse, prolapsed left arm—Internal podalic version and perforation of the after coming head. 4. One of high forceps in Walcher's position; and all of them went home after slight sepsis in a fortnight. The use of serum and vaccine used early in the disease has definitely minimised the incidence and severity of the disease. I have placed before you some of the salient features of this fever. If you will remember this in your practice and

correct or confirm my observations by your experience, we have made a definite advance in the treatment of Puerperal fever which is in the words of the Lancet ' one of the most illusive diseases which have confronted the Medical profession '.

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ASSOCIATION NOTES.

Minutes of an Executive Committee meeting convened on 13th February 1928 and adjourned for want of a Quorum to the 1st March 1928 at 5-30 p. m. at the President's house.

PRESENT :—Dr. M. Kesava Pai, *President*; Dr. A Lakshmanaswami Mudaliar, *Vice President*; Drs. G. Sreenivasamurthi; P. V. Cherian; P. Venkatagiri; and K. Koman Nayar.

(1) Resolved that Dr. A. Lakshmanaswami Mudaliar be elected as a Vice-President of the Association in place of Dr. K. Madhava Menon, resigned and that Dr. P. Venkatagiri be elected as a member of the Executive Committee.

(2) Read letter from Dr. M. Narasinga Rao regarding a memorial to be sent up to the Government requesting that the past military services of members of the Madras Medical Service may count towards service for pension.

Resolved that all available information and orders on the subject may be collected before drafting a memorial.

(3) Read letter from Dr. P. Krishnaswami Ayyar regarding the courses of study at the Medical College.

Resolved that as final orders have been passed on the subject by the Madras University, Dr. Krishnaswami may be informed that arrangements may be made to get similar changes effected by the Andhra University.

(4) Read letter from Dr. Mannadi Nayar regarding recruitment for Professorship of Physiology at Medical College.

Resolved that a memorial may be drawn up regarding recruitment for special posts.

(5) Read letter from the Registrar of Joint Stock Companies regarding the change of rules of the Association, etc.

Resolved that, as the general meeting at which the changes in the rules were passed was not convened according to the rules of the Indian Companies Act and confirmed at a later meeting as required by the Act, these new resolutions have become invalid and that the Registrar may be informed that the changes may be considered as having been dropped for the present.

(6) Resolved that the members may be circularised to kindly remit their subscriptions and that non-members may be requested to join the Association.

Minutes of an emergency meeting of the Executive Committee held on 9th March 1928 at the President's house.

PRESENT :—Dr. M. Kesava Pai, *President*; Drs. A. Lakshmanaswami Mudaliar, *Vice-President*; Drs. M. R. Guruswami Mudaliar; P. Venkatagiri; P. V. Cherian; and K. Koman Nayar.

Read memorandum of the Executive Committee members of the Association resident at Vizagapatam regarding recruitment to special posts in the Madras Medical Service.

Resolved that the members who have sent the above memorandum be informed that the Committee do not agree to several of the statements made therein and that they cannot therefore forward the memorandum to the Government in its present form or based on the different views and statements made therein.

Minutes of meeting of the General Body of the Association held on 24th March 1928 at the Medical College, Madras, with the President Rao Bahadur Dr. M. Kesava Pai, M. D., in the chair.

The proceedings commenced with an "At Home" in honour of the following members of the Madras Medical Service,

16537

who returned from study leave abroad after specialising in different subjects :—

Drs. N. Mangesh Rao, M.B.C.M., D.L.O., F.R.F.P.S., F.R.C.S.; E. Achutha Menon, L.M.S., L.R.C.P. & S., F.R.C.S.; A. R. Parasuraman, M.B.B.S., T.D.D.; R. Krishna Rao, F.R.C.S.; G. R. Parasuraman, L.M.S., M.R.C.P., etc., K. P. Padmanabha Menon, L.R.C.P. & S., etc., K. Raman Menon, M.B.B.S., F.R.C.S.; and R. Sanjeeva Rao, M.B.B.S., D.T.M.

The President welcomed the guests of the evening in a long speech, referring to the high distinctions attained by the guests of the evening and wished them all success in their future career. It was regretted two of the guests could not be present at the function.

The next item on the Agenda was the very thoughtful and interesting paper read by Dr. M. B. Prabhu on "A few Observations on Puerperal Fever" illustrated by several charts. (This paper is published in the current issue of our journal.) An interesting discussion followed in which Drs. A. Lakshmanaswami Mudaliar, P. Venkatagiri, E. Achutha Menon, K. Raman Menon and a few others joined.

Minutes of meeting of the Executive Committee held on 13th April 1928 at 5-30 P.M. at the residence of the President Rao Bahadur Dr. M. Kesava Pai, M.D.

PRESENT :—Dr. M. Kesava Pai, *President*; Drs. A. Lakshmanaswami Mudaliar, M. R. Guruswami Mudaliar, T. S. Tirumurthi, P. Krishnaswami, K. Koman Nayar, G. Sreenivasan, S. Swaminathan, P. V. Cherian, G. R. Dinker Rao, and [illegible].

Read the modified memorandum sent in by the Executive Committee members at Vizagapatam regarding recruitment to special posts in the Provincial Medical Service.

The following resolutions were passed and the President was authorised to communicate the same to the Surgeon-General for his consideration.

1. Resolved that as a large number of members of our service are now desirous of proceeding to foreign countries for additional qualifications and specialisation, the Association feels that it would be in the interests of the service and of the department if the Surgeon-General would make known to the members of the service, as occasions arise, the particular subject or subjects in which specialisation is needed from the point of view of service conditions, so that when the members return after such specialisation their services could be better utilised for the benefit of the department.

2. Resolved that in the formation of the Anatomy and Physiology cadres the pay fixed for the Professors is low compared to the scale adopted in other provinces. For example in Lucknow, the pay for Professors in Anatomy and Physiology ranges from Rs. 1,450 to Rs. 1,600 whereas in this province it is Rs. 700 to Rs. 1,200. The pay should therefore be raised to the scale of Lucknow at least for full time appointments.

(The following reply has been received from the Personal Assistant to the Surgeon-General :—

"Ref. No. 989-1-E, dated 1st April 1928. I am directed by the Surgeon-General to acknowledge receipt of your letter No. 14 of 1928 dated 14-4-28 communicating the resolutions of the executive Committee of the Association and to inform you that the matter will receive the consideration of the Surgeon-General.")

The following resolution passed by the Executive Committee of the Madras Medical Association was sent to Mrs. Madhava Menon.

That the Executive Committee of the Madras Medical Association do place on record their sense of profound sorrow and irreparable loss at the untimely demise of Rao Bahadur Dr. K. Madhava Menon, V. H. A. S., who was for many years a very devoted, helpful and zealous member of the Association as also a most distinguished member of the Madras Medical Service ; and beg to convey their most heartfelt condolences and sympathy to his wife and the other members of the family in their great bereavement.

The following summary of the proceedings of the Bombay Medical Council held on the 6th February 1928 is published in the Medical Press for information.

1. The Council resumed consideration of the case of Dr. N. A. Cooper, M.D., B.Hy., judgment in which had been suspended on the two charges proved against him to the satisfaction of the Council, *viz.*,

I. That in breach of rule 22 of the Code of Medical Ethics issued by the Bombay Medical Council he displays outside the premises in which he carries on practice on Hornby Road, Bombay, signboards exhibiting the following words :—

(1) Laboratory and Vaccine Institute, Blood, Sugar-Test and Examination of Urine, Sputum, Blood, etc.,

(2) 606 Clinic,

thereby advertising that he adopts in the treatment of certain diseases special lines of treatment ;

II. That in breach of rule 22 of the Code of Medical Ethics issued by the Bombay Medical Council he displays outside the said premises three signboards,

The Council resolved to further postpone their judgment till the next meeting.

2. The Council considered the case of Charles Charity Raymond de Souza, M.B.B.S. (Bombay), who had been summoned to appear before the Council on the following charges :—

(*a*) That in or about May 1925 in Africa he advertised by means of visiting cards upon which he described himself as " Dr.C. C. Raymond, Director, the Neucuro Propaganda for Africa."

(*b*) That in or about May 1925 in Africa he acted as Agent for a patent medicine called Neucuro and distributed literature or pamphlets extolling the virtues of the said patent medicine.

The Council judged Charles Charity Raymond de Souza to have been guilty of infamous conduct in a professional respect

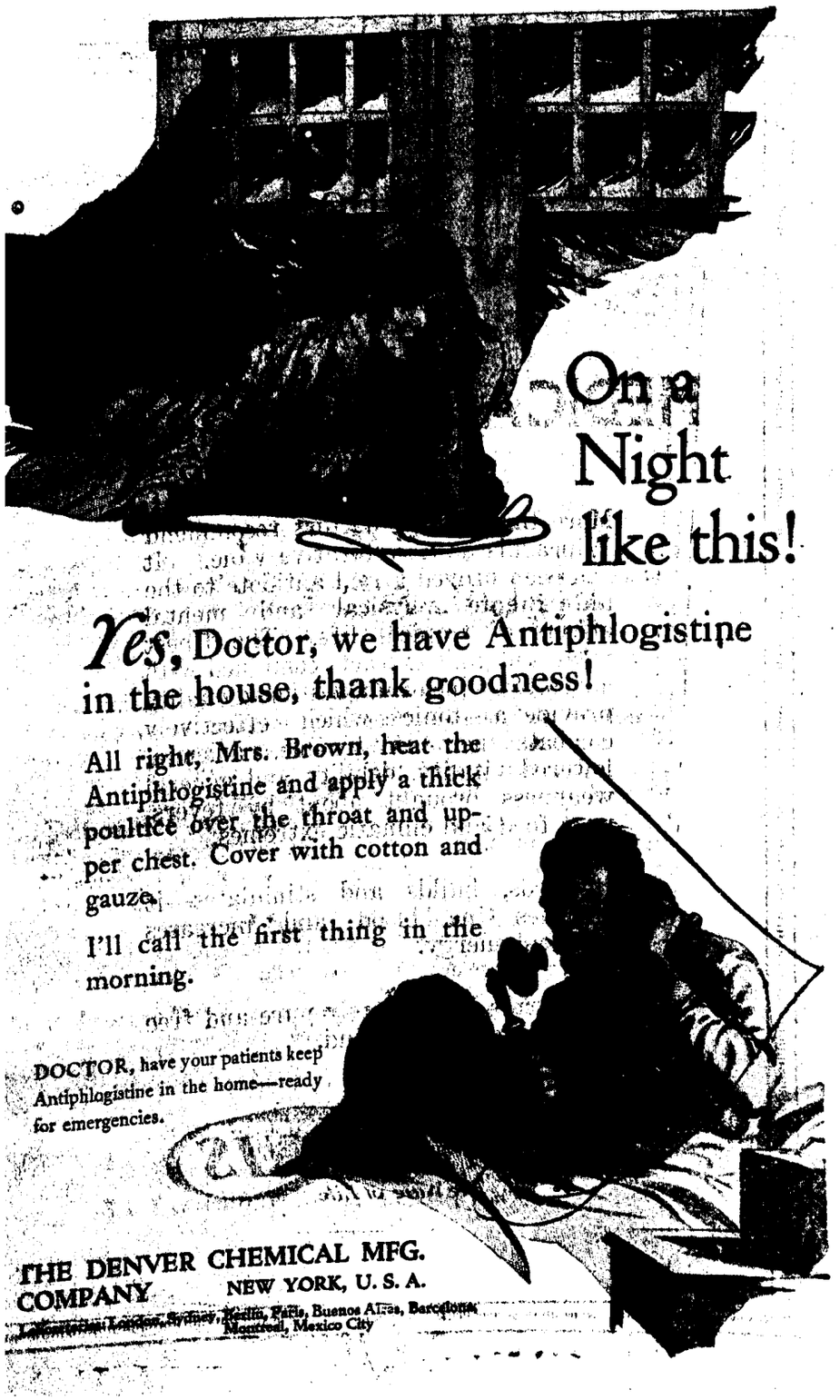
and directed the Registrar to erase his name from the Bombay Medical Register.

3. The Council considered an application from Dr. V. S. Gupte, M.D. of the University of Minnesota, U. S. America, and other papers and corespondence relating to the same. It was resolved "that the curricula of the M.B.B.S. of the Bombay University and of the Membership of the College of Physicians and Surgeons of Bombay should be communicated to the Medical Board of the United States of America (through the American Consul in Bombay) with a request that they will state if the Medical Board of the United States of America will permit Graduates and Members of the above two Institutions to appear directly for the State Examinations to practise, on the same terms as those who have obtained their degrees from the "A" class Allopathic Institutions of the U. S. A., to enable the Bombay Medical Council to consider the application for registration from a M. D. of the University of Minnesota and other 'A' class Universities and the question of reciprocity between the Bombay Medical Council and such Universities."

4. The Council considered a reference from the Surgeon-General with the Government of Bombay forwarding, for the remarks of the Council, a memorandum from the Commissioner in Sind in which the question is raised as to the maximum dose of Morphia that a medical practitioner should prescribe. The Council resolved to inform the Surgeon-General that the Council discourage large doses of Morphia being prescribed by medical practitioners but that in special cases they are allowed to exercise their judgment for the welfare of the patients; that any case of abuse of the drug by a registered medical practitioner can be dealt with by the Council if a complaint is lodged in the matter; and that under the circumstances it is not necessary to impose any limitation under the rules.

5. The following six members were elected as members of the Executive Committee for the year 1928:—

Mr. Y. G. Nadgir.
Mr. D. M. Gagrat.
Lt.-Col. W. M. Houston, I.M.S.
Sir Temulji Nariman, Kt.
Lt.-Col. R. Row, O.B.E.
Khah Bahadur Dr. N. H. Choksy, C.I.E.



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