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PROBLEMS OF NUTRITION IN INDIA

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Throughout the whole of India the staple article of diet of the masses is a cereal grain of one kind or another—wheat, barley, millet, maize, rice—sometimes a mixture of two or more of them. Most of these grains are eaten whole; these are not subjected to any milling or refining process before use. The outer layers of the grain and embryo, containing valuable dietary constituents, are thus consumed with endosperm. Rice is the single exception to this rule; though within recent years the use of white flour and white bread is spreading in the larger towns and cities. Rice is always subjected to some form of refining process. In country districts, distant from rice mills it is pounded by the villagers in large mortars; a process which removes some, but not all of the external layers. In towns it is milled and polished in the raw state or after par-boiling or curing. As is well known these processes reduce its nutritive value to a greater or a lesser degree. Biological tests in this laboratory have shown that these cereals differ in nutritive value; whole wheat being the most, and whole rice the least, nutritious. The other cereals occupy an intermediate position between these two extremes. All are deficient in certain food essentials—suitable proteins, calcium, sodium, iron, phosphorus and certain vitamins. These deficiencies are greatest in whole rice; and as rice is always subjected to refining processes, always washed before cooking, and always consumed after prolonged boiling, this cereal is, generally speaking, of much lower nutritive value than any of the others.

The nutritive value of some of these cereals may, and often does, vary in different localities; amongst rices grown in different parts of India, this variation may be considerable; the same is true of millets. Thus certain millets grown in the south of India have been found to be surprisingly low in vitamin B, an observation which has a bearing on the not infrequent occurrence of beri-beri in millet-eaters resident in endemic areas of this disease. It has been found, too, that groundnuts and split peas (*dhal*) grown in certain localities in South India, are unexpectedly low in this factor. Observations of this kind have led to the suspicion that the nutritive value of certain cereal grains, legumes and nuts, in common use in India, may depend to some extent on conditions of soil, manure and irrigation under which they are grown. A considerable amount of evidence in support of this supposition has been obtained in this laboratory. Thus, it seems certain that rice grown under conditions of natural rainfall, or of watering designed to stimulate natural rainfall contains more vitamin B than the same rice when grown in standing water. The former practice is generally followed in the south-west of India where beri-beri is not endemic; the latter in the south-east where it is. Biological tests appear also to indicate that manurial conditions influence the nutritive value of cereal grains; and it seems likely that the almost universal practice of utilising cow-dung for fuel purposes instead of returning it as manure, to the soil, is one that has a bearing on the nutritive value of Indian food crops. Thus agricultural practice appears to have a definite relation to problems of nutrition in this country.

The varied conditions of climate, rainfall, irrigation, and soil prevailing throughout the Indian Peninsula makes some part of it more suited to the cultivation of one cereal than of another. The cereal or cereals grown in any particular locality are those that enter into the dietaries of the inhabitants of that locality. In the north of India—North-west Frontier Provinces, Punjab, Beluchistan and United Provinces—wheat is the principal cereal grown; though some rice, barley, maize or millet are also grown. Generally speaking, the races resident

in these areas—Pathans, (Afridis, Waziris, Bajauris), Punjabis, Sikhs, Baluchis, Rajputs and Paharis—are wheat eaters. Wheat is the staple article of their dietaries; the other cereals mentioned being merely adjuncts to it. A large amount of wheat is also grown in parts of Central India, Bombay and the Deccan; but in general the races resident in these localities such as the Mahrattas, use a diet of mixed cereals—usually wheat and rice. Towards the East, through Bihar to the Coast of Bengal all down the east and west coasts and throughout the Madras Presidency rice is the principal cereal grown; though in parts of these regions millet is also a considerable crop. But, for the most part, the races resident in these areas are rice-eaters. Throughout the rest of India millet is the chief crop, that forms the staple article of diet of races—such as, the Kanarese—resident therein, who commonly use rice as a supplement to it. In parts of Travancore the staple article of diet is the tapioca root supplemented with rice.

As we pass from the north to the east, south-east, south west and south of India there is thus a gradual fall in the nutritive value of food grains forming the staples of the national diets, this fall reaching its lowest limit among the rice eaters of the east and south. There is also a gradual fall in the amount of animal protein, animal fats and vitamins entering into these diets. The races of the north are either milk users or meat eaters or both; while those of the south and east use both meat and milk sparingly and sometimes not at all. Thus the Pathans are meat eaters; the flesh and fat of goats and sheep forming a principal constituent of their dietaries. They also use milk freely, chiefly in the form of butter-milk, curds and butter and ghee. The Sikhs are large users of milk and the products of milk; milk being only an occasional addition to their diet. The Mahrattas also make free use of milk and milk-products, an additional source of animal protein being eggs and fish. The Bengalis, Kanarese and Madrasis, on the other hand, are for the most part vegetarians; and although some of them do eat mutton or fish, millions do not, while milk and milk products are, in general, less extensively used by them than by northern races. It so happens therefore, that as the nutritive values of cereal grains diminish there is also a dimunition in the amount of animal protein ingested and in the level of protein metabolism attained by the races concerned. There is, too, a precipitate fall in the amounts of vitamins A and B ingested by the races of the south as compared with those of the north. Legumes (*dhal*), vegetables and fruit enter into all the national dietaries of India; but it is only among the better classes that a sufficiency of these is eaten. Accompanying the gradual fall in the nutritive values of the national diets there is a gradual decline in the stature, body weight, stamina and efficiency of the people. McCay was the first to draw pointed attention to this association, which my own observations have confirmed. In his book—"The Protein Element in Nutrition" (1912)—he emphasizes the "all important influence exerted by food, and particularly protein in determining the degree of muscular development, the general physical endowment, the power of endurance and resistance to disease, and the most important of all the place a tribe or race has won for itself in manliness, courage and soldierly instincts." Indeed, nothing could be more striking than the contrast between the manly, stalwart and resolute races of the north—the Pathans, Baluchis, Sikhs, Punjabis, Rajputs and Maharattas—and the poorly developed toneless and supine peoples of the east and south; Bengalis, Madrasis, Kanarese and Travancorians. McCay's work was done before the days of vitamins; and while he rightly emphazized the important part played by the protein element of food in bringing about this result, we now know that other factors—vitamin and mineral elements—are concerned in it also. Inherited factors, climate, customs, caste, religion and endemic diseases no doubt contribute their share to the production of this result; but food is the paramount factor concerned. This is shown to be so by an experiment carried out some

years ago (1926) in this laboratory. Groups of youug rats—20 in each—were fed on certain national diets of India; care being taken to stimulate in every detail the culinary practices of the races concerned. The animals were obtained from the same stock, an unusually healthy one. The experiment was so conducted that factors such as climate, atmospheric temperature, rainfall, age, body weight, sex distribution, caging, housing and hygiene were the same in all groups. It was found that the nutritive values of these diets—as determined by the average body weight of each group at the conclusion of the experiment—ranged themselves in the following order:—

Diet.		Average Body-weight of group.
Sikh,	...	235 grams.
Pathan,	...	230 ,,
Maharatta,	...	225 ,,
Kanarese,	...	185 ,,
Bengali	...	180 ,,
Madrassi	...	155 ,,

The "Sikh Diet"—the most nutritious of those examined—was made up of freshly ground whole wheat made into cakes of unleavened bread (*Chapatis*), milk, and the products of milk—butter, ghee, curds, butter milk—*dhal* (legume), vegetables (fresh carrots and cabbage) tomatoes, root vegetables, fresh meat with bone and fat once a week and water. The "Madrassi diet"—the least nutritious of those examined—was made up of washed polished rice, *dhal*, (legume) fresh vegetables, condiments, vegetable oil, coffee with sugar and a little milk, a little butter milk, ghee (sparingly), coconut, betel nut and water. The respects in which these two diets differ are obvious.

Further evidence of the health-giving properties of the Sikh diet is afforded by the following experience; my stock rats are fed on this diet. The average daily strength of these is round about 1000; sometimes more, sometimes less. The animals live under conditions of perfect hygiene and are exposed daily to sun's rays. During the past three years there has been no case of illness amongst them, no death from natural causes (the older animals are killed off when no longer of use for breeding purposes) and no infantile mortality other than an occasional accidental death. Large numbers of them (1189) at all ages upto 2 years, have been killed and subjected to post-mortem examination without revealing any microscopical evidence of disease except an occasional cyst (tapeworm) in the liver. Disease has been almost completely excluded by attention to three things; cleanliness, comfort and food. These experiences illustrate the great importance of food in relation to the physical efficiency and well being of animals and man; the importance also of a proper balance of the national diets of India with respect to animal protein, animal fat, vitamins and mineral elements; and the great value, as a health promoting agency, of the lacto-vegetarian diet used by the people of North India amongst whom are some of the finest physical specimens of mankind.

Our first problem of nutrition in India—"What diet is most likely to maintain physical efficiency and health?" has thus been solved. It is a diet composed of any whole cereal grain or a mixture of cereal grains, milk, the products of milk—butter, curds and butter milk—legumes, green leafy vegetables, root vegetables fruit and water with meat occasionally. I notice that "Oslo Breakfast"*

* A breakfast served free to School Children and consisting of half a litre of milk, wholemeal bread with butter, wholemeal rusks, a raw carrot, an apple or orange and whey cheese.—Ed.

which is reputed to be having such remarkable beneficial effects in Norwegian children is of this order. To the tribes of our Indian frontier this is "an old accustomed feast".

One further fact in regard to the national diet of India is here deserving of note—it introduces another element into the complexities surrounding problems of nutrition in this country—that of high atmospheric temperature and drought. It was observed in this laboratory, about 10 years ago, that the milk of cows subsisting on the parched pasture available during the hot months of the year contained less vitamin A than that of cows feeding on the green pasture that spring up after the rains. Generally speaking it is safe to say that the vitamin A content of the milk of the ill fed and of ten semi-starved Indian cow is relatively low; a circumstance which is not withoutits effect on the well being of the people into whose dietaries milk and milk products enter.

It is not to be supposed that the national diets of India are invariably used in their completest form by every member of the races concerned. It is only those in better class circumstances who can afford to do so. The poorer classes, according to the degree of their poverty, drop out, in part or in whole, the more expensive or less easily obtainable items; meat, milk, milk-products, animal fats legumes, fruit and vegetables. So that as the people are poorer and poorer their dietaries are more and more cereal in character, more and more unbalanced, more and more depleted of animal protein, animal fats. vitamins and essential mineral elements. Lower down the social scale a stage may be reached when the diet consists mainly of cereals. and lower still it may not provide even enough of these; under nutrition is then added to faulty nutrition—a state in which millions of Indian people exist for the greater part of every year of their lives. "Throughout his daily work the powerful influence of this condition of chronic semi-starvation, not only in the poor Indian himself, but throughout his whole race and generation, is constantly obtruding itself upon the physician, who says, 'This man's constitutional malady is mal-nutrition anaemia, asthenia, complicated with fever, dysentry or what not'. Consequently, the first indication for treatment is a proper and nourishing diet". (Norman Chevers, 1886).

Our next problem of nutrition in India has, therefore, been this "What are the effects, on the people using them. of diets composed of cereals?" This problem may be approached in two ways, and for its proper solution it should be approached in both ways: by an epidemiological survey of diseases with special reference to dietary conditions (an undertaking so great as to be outside the resources of this laboratory) and by animal experimentation. The latter is the way I have followed.

In India we have to deal with combination of food-faults rather than with single food-faults. There is, for instance, no diet in common use in India which while lacking in any single element or complex necessary for normal nutrition, is not at the same time faulty in other regards. It may indeed be doubted whether any deficiency is ever complete; deficiency of vitamin C is the most likely one to be complete. It is with "insufficiency" rather than with complete want of certain food factors that we have to deal: and with a combination of such insufficiencies. Associated with them, there is, as a rule an imbalance of the diet with respect to proximate principles such imbalance usually takes the form of excessive richness of the food in carbohydrates. It is true that one insufficiency or another may be dominant; as for example, an insufficiency of vitamin B in rice eaters. But upon the effects of the dominant insufficiency there are often super-imposed those of other associated insufficiencies, of the imbalance of the food in other regards, or of actual under-nutrition. Our problem in India is not so much of the effects of this or that faulty diet. What then

are the effects on the animal organism of a diet composed wholly or almost wholly of rice? What are those of a diet composed wholly or almost wholly of wheat? And to what extent do these effects, as observed in animals, enable us to account for ill-health in man?

To begin with rice. This cereal has many deficiencies prominent among them being that of vitamin B. In India rice is the poorest of all cereals in this complex. The effects of rice on the animal organism, either alone or in combination with other food materials in common use by rice eaters, were studied in the pigeons and monkeys. It was found that the more highly the rice was polished and the more it was washed, the more rapid was the onset of symptoms; and these symptoms were usually of the same kind polyneuritic. But no man lives on rice alone. No matter how great his poverty may be he makes some addition to his rice—a little dhal (legume) a little vegetable or a little of both. These additions raise the nutritive and vitamin B value of the diet to some extent; and it is when animals are kept on a diet of this kind—a diet in which vitamin B is not wholly lacking though insufficient for normal metabolism—that we begin to see signs and symptoms of ill health which are of the greatest importance in relation to the origin of maladies prevailing amongst rice eaters. These signs and symptoms are poor appetite, loss of appetite or (in monkeys) depraved appetite, failure to increase in body weight or actual loss of body weight, vomiting (in monkeys) diarrhoea, dysentery (specific and non-specific), colitis, slowing of the respiratory rate lowering of body temperature, cardio-vascular depression, progressive asthenia, anaemia, disorders of the skin, oedema, nervous irritability, symptoms referable to mal-nutrition of the nervous systems, and intercurrent infections. The last may lend wide variety to the symptomatology; and it is here that chance comes into play in determining the kind of infection from which the animals suffer. Thus one batch of pigeons, imported for experimental use into this laboratory, had amongst them carriers of the invisible virus of *Epithelioma contagiosum*. The birds fed on rice diet suffered much from this condition, while well fed controls did not. Another batch happened to have amongst them carriers of B. suipestifer; the birds fed on the rice diets suffered much from this infection—itself capable of causing neuritis—the well fed controls did not. A batch of monkeys happened to have amongst them carriers of Entamoeba histolytica; dysentery appeared amongst the ill fed animals, while the well fed—amongst whom were also carriers—remained free from it. Thus did faulty nutrition favour infection by invisible virus, bacillus and amoeba.

It was found also that a number of other factors—age, sex, warmth, cold damp, chill, balance of the food, previous food conditions and above all, individual idiosyncrasy—influenced the onset of symptoms either in the direction of precipitating or of retarding them. Those that precipitated symptoms were such as placed additional burdens on the metabolic resources of the body: those that retarded them were such as conserved these resources. Thus, an addition of an excess of fats to the rice diet hastened the death of both birds and monkeys, while exposure to cold and damp precipitated the onset of oedema—an observation of significance in regard to malnutritional oedema and beri-beri. Associated with these symptoms of ill-health profound changes were found throughout the organs and tissues of the body; these were observable even by the naked eye and the relatively crude method of histological examination. Of these changes the most conspicuous were those in the gasto-intestinal tract, the circulatory system, the endocrine organs and the nervous system. They are now-a-days so well known that little further reference need be made to them; by analytical methods of experimentation many of them have since been traced to particular deficiencies in the diet.

In these observations a parallel is to be found in the poor stamina, muscular development and physical endowment of rice-eating races, and in low powers of endurance and resistance to infection of the poorer classes amongst the rice eaters. A parallel is also presented in the frequent occurrence amongst them of respiratory diseases, gastro-intestinal diseases (diarrhoea, dysentery, cholera, colitis) malnutritional oedema, anaemia, skin diseases and beri-beri. Interest in the last named has, because of its occurrence amongst rice eaters, over-shadowed the vastly more important and more general effects of the rice-eater's diet. For, considering the millions whose staple article of diet is rice, beri-beri is relatively an uncommon disease in India. Its distribution is very limited; it is confined, as an endemic, to certain coastal areas of the north-east of Madras and Bengal. In Madras it is rarely seen at a distance of more than 50 miles inland. It is practically unknown on the West Coast of Madras and Bombay where as much rice per capita is eaten as in localities where it is endemic. Occasional small outbreaks (epidemics) occur in other parts of India, but, for the most part, these are in persons who have emigrated from endemic areas. In India endemic beri-beri is very definitely a "place disease". I do not here speak of "epidemic dropsy" which some in India, consider to be a form of beri-beri. Much of the confusion in regard to the causation of beri-beri has arisen from the fact that par-boiled rice and rice which is not highly milled and polished are supposed to contain "plenty of vitam B". They do not. In this laboratory true beri-beri has been produced in pigeons fed exclusively on diets of undermilled or home-pounded rice or of washed par-boiled rice. A second source of confusion has been the assumption that *polyneuritis columbarum* is the same condition as beri-beri. It is an analagous condition certainly, but not the same condition; though it may arise under precisely the same dietary conditions as true beri-beri does. Thus if pigeons be fed on a diet simulating that in use by human beri-beries—washed polished rice plus 0·8 gram of dhal per bird daily, the latter administered artificially—some will develop no signs either of polyneuritis or of beri-beri, though they may suffer from other maladies within a period of 100 days; others will develop polyneuritis, columbarum others beri-beri columbarum; others again, a condition intermediate between these two states. The individual indiosyncrasy of the bird is the final factor determining which condition it will suffer from or whether it will suffer from either.

These two conditions differ from each other as follows:— the former is a state of polyneuritis and cardiac atrophy with or without oedema; it is most readily and most regularly produced when the rice diet is very deficient in vitamin B. The latter is a state of polyneuritis, cardiac, hypertrophy and degeneration with (usually) or without (rarely) oedema; it arises when the diet contains an insufficiency of, but is not wholly lacking in, vitamin B. It is to this latter condition that the term "true beri-beri" can alone be accurately applied. Statistical examination of my experimental data has shown that it is due to an unknown positive factor acting in association with insufficiency of vitamin B. This positive factor is produced in the bodies of birds themselves, and is either a metabolic or a microbic poison. True beri-beri is an intoxication. It is still thought by some that the beri-beri poison can be produced in deteriorated rice outside the body. No evidence in support of this view has so far been forthcoming in the course of work in this laboratory.

There are, thus, a number of polyneuritis states which can arise in pigeons fed on rice-diets; infective polyneuritis due to a microbe such as the B. suipestifer; nutritional polyneuritis due solely to avitaminosis; true beri-beri, due to avitaminosis plus an unknown positive agent arising in the bodies of the birds in consequence of the avitaminosis; and intermediate states between nutritional polyneuritis on the one hand and true beri-beri on the other. If there be this

diversiiy of " beri-beri-like " maladies in birds fed on rice diets it is reasonable to suppose that a similar diversity of these maladies will be found in human beings who subsist mainly on rice. All these forms of neuritis are preventable in birds by the same means; the addition to the rice—whether it be from deteriorated stock in use by human beri-beries or not—of a sufficiency of food materials (wheat, tomatoes, legumes, etc.) rich in vitamin B. Human beri-beri as it occurs in India, is also preventable by the same means and has been so prevented in jails where it is endemic for years. The prescription of ancient Indian Hakims—" stop eating rice and take a diet of wheat and milk ", can hardly be bettered.

So much then for the rice-eater's diet. What of the wheat-eaters ?. If animals (rats) be fed on an exclusive diet of whole wheat the mortality amongst them is very high. Pulmonary infection is the chief cause of death. If to the diet of whole wheat some good olive or sesame oil—which are poor but not wholly lacking in vitamin A—be added, together with a salt mixture to make up for certain mineral defects in the wheat, the animals live longer and afford greater opportunity for the study of the effects of diets comparable in composition to that used by the poorer class of wheat-eaters. The main deficiency of this diet is one of fat soluble vitamins. Its effects are exhibited as metaplasia of epithelia, throughout the body—a change now recognised as characteristic of vitamin A insufficiency. Infections of the eye, the nasal sinuses the lungs, are common; urinary calculus is frequent; the goitre is occasionally met with.

In the course of experimental work in this laboratory many variations of deficient diets, having one or other cereal grain or cereal product or a mixture of such as their basis have been used with results which manifest themselves, for the most part, as " it is's " of various kinds and locations. These need not be enumerated but some reference may be made to three conditions—" Stone ", goitre, and peptic ulcer ", which in India are problems of moment.

The distribution of " Stone " is peculiar; it occurs, for the most part, in the north of India and is relatively rare in the south. It is a disease of wheat eaters rather than of rice eaters. Experimental work in this laboratory has shown that the cereal grains in common use in India vary in their stone-producing potency, wheat having the highest, the rice the lowest potency, in this regard, while the other cereals occupy an intermediate position between these two extremes. The distribution of stone is therefore related to the distribution of cereal crops. The stone-producing potency of white flour is relatively low; and as white flour contains no more vitamin A than whole wheat flour it is obvious that in the process of milling some substance favourable to stone production is removed from the whole grain. There are two classes of factors (apart from infection and foreign bodies in the urinary tract) concerned in the causation of stone; negative ones—vitamin A deficiency and phosphate deficiency; and positive ones—an unknown substance existing in different amounts in different cereals, and excess of lime in the diet. Cattle stones are, in India, almost invariably composed of calcium carbonate. The dietary conditions under which they arise in nature or are produced under experimental conditions in the laboratory are the same: deficiency of vitamin A and deficiency of phosphates relative to the amount of lime in the diet. Work in this laboratory has convinced that, in India, urinary calculus is usually a disease of faulty nutrition.

The distribution of " goitre " is also peculiar: it occurs chiefly in Himalayan regions. In these the iodine content of the soil is low and no doubt also that of the food materials grown upon it. But the iodine content of the urine is not significantly higher in non-goitrous than in goitrous persons in these regions; and while admitting that iodine deficiency may favour the development of certain kinds of goitre, such deficiency is not regarded as the essential cause of the disease. With the possible exception of the adrenal glands and thymus, no organ

or tissue of the body is more sensitive to food conditions than the thyroid. The iodine content, the fat content, the lime content the phosphate content, the vitamin content of the food—all these influence its size; as do certain unknown substances in food materials such as cabbage, and groundnuts. Its size also is influenced in certain circumstances by insanitary conditions of life. Iodine is by no means the be-all and the end-all of goitre. Four etiologically distinct types of goitre have been produced in this laboratory—the hyperplastic, the hypertrophic, the colloid and the lymph adenoid—but all have this in common: they are preventable by the same reasons. This means the provision of a perfectly balanced diet such as the lacto-vegetarian one previously described. Thus, insanitary condition—a positive goitrogenic agency—will not cause goitre when the animals are properly fed; it will cause goitre when they are not. Goitre is, in the main, a disease of faulty nutrition; but, like beri-beri and like urinary calculus, both negative and positive factors are concerned in its causation.

"Peptic ulcer" has also a peculiar distribution. It is very common in the south of India—particularly in Travancore. It has been shown in this laboratory that the tapioca diet of the poorer class Travancorian will cause this condition in 27 per cent. of albino rats fed upon it: that of the poorer class Madrassi, 11 per cent.; while the lacto-vegetarian diet of the Sikhs affords the animals complete protection against it. Some 10 years ago it was observed, in this laboratory, that deficiency of vitamin C was capable of causing duodenal ulcer in guinea-pigs.

A pernicious type of anaemia may occur in albino rats when they are fed on a diet of oatmeal, linseed meal and patent flour. It is due to rat-house-borne organism: Bartonella muris. As is well-known this organism gives rise in these animals to a profound anaemia on removal of the spleen It is of significance, in regard to such maladies as malaria, typhus, relapsing fever and Kala-azar—all widely prevalent in India and favoured in their course and development by famine conditions—that the protective resources of the spleen can be injured by faulty nutrition in a way comparable to that brought about by splenectomy.

Other diseases of faulty nutrition—keratomalacia, night-blindness, rickets, osteomalacia, tetany, dental caries, scurvy, pellagra, anaemia of pregnancy, lathyrism—all concern us, to a greater or lesser extent in India; and many other conditions, such, for instance, as cataract and sprue, may have a malnutritional basis of the nature of which we as yet know but little Keratomolacia is common, and is the chief cause of preventable blindness (Wright 1931). It occurs in undernourished, poverty stricken persons, whose diets are not only deficient in vitamin A but in other vitamins as well. "In all probability it requires an initial multiple vitamin deficiency, with a secondary multiple disfunction of glandular structures to account for the whole picture of degeneration, loss of function, wasting, necrosis, secondary infection and death which we see in kerotomalacia." (Wright 1931). Night blindness is also common—well known to ancient Hakims in India who treated by the administration of liver. It is frequently associated with lathyrism in localities where the latter condition prevails (McCombie Young, 1927). "In Northern India and Kashmir rickets in its various forms, osteomalacia, late rickets and infantile rickets, tend to occur in any race or caste wherever there is deficiency of sun light or diet, or more frequently where there is a relative deficiency in both these factors." (Wilson, 1930, 1931). It is of a greater severity amongst those who observe purdha couditions of life. Osteomalacia accounts for much maternal mortality in child birth (Vaughn). Tetany is frequently associated with rickets; it is endemic in certain valleys of the Himalayas (McCarrison 1910). Dental caries and hypo-plasia are widespread amongst Indians whose diets are composed mainly of cereals and are deficient in fat soluble vitamins and vitamin C. If deficiency of vitamin D be the chief

cause of dental caries it is obvious that tropical sunlight does not provide enough for its prevention. Scurvy, usually in minor form, is wide spread throughout the whole of India; and pyorrhea alveolaris is frequently to be found in persons whose diets contain far too little fresh vegetable foods. Pellagra appears to be relatively rare. The anaemias of pregnancy are common; they are malnutritional in nature, occurring in women whose diets are both quantitatively and qualitatively deficient (Wills: 1928–31). Epidemiological investigations carried out by McCombie Young (1927) from this laboratory, have shown that lathyrism is associated not only with the predominance of lathyrus sativus in the diet but with undernutrition and deficiency of fat soluble A.

The problem in connection with all these diseases is no longer one of lack of knowledge of their nature, nor of their means of prevention; but one of the improvements of conditions of living and of food supply of the people. Indeed, the greatest of all problems in India at the present time is the adjustment of the population to its food supply. It is one that is capable of solution only by the people themselves; by the exercise of self-help; by the jettisoning of old habits and customs unsuited to modern economic conditions; by improvements in methods of agriculture, animal husbandry and industry; and above all by restraint in re-production.

Recently (1931) I had occasion to contrast the incidence of disease in 2243 improperly fed albino rats with that in the well fed stock rats in this laboratory. It was shown that while the former exhibited a large proportion of the maladies included in the calendar of human ailments, the latter were remarkably free from disease of any kind. The only significant difference in their conditions of life was the improper feeding of the one "Universe" and the proper feeding of the other. It seems to me that, however deeply we may delve into the minutiae of the relationship of faulty nutrition to disease, the essence of the whole matter will be found to lie in this; the use of a properly constituted diet is a sure means to the attainment of physical efficiency and health. Such a diet is the lacto-vegetarian one in use by certain vigorous and resolute races of Northern India. *(From "Nutrition Abstracts & Reviews", Vol. II, No. 2. July 1932).*

Notes and Comments.

Potato Breeding. The appointment, with the help of a grant from the Imperial Council of Agricultural Research, of an officer of the Department, to carry on breeding work on potatoes at the Nanjanad Agricultural Research Station, Ootacamund, marks yet another step forward in the march of agricultural science in the Presidency. The breeding work done in the earlier years, on major crops like sugarcane, paddy, cotton and the millets, has resulted in valuable strains being evolved and distributed over the country; the appointment of the Oil Seeds Specialist two years ago has similarly satisfied the growing need for improving the several oilseed crops, and the appointment of an officer to breed superior varieties of potatoes, will therefore be hailed with satisfaction by all those interested in agriculture, especially as in modern days the tendency has been to depend not merely on any one crop, but on as many suitable ones as possible to make agriculture more paying.