NUTRITION AND THE FUTURE

J. T. IRVING,† M.A., Ph.D., M.D., Department of Experimental Odontology, University of the Witwatersrand, Johannesburg

POPULATION GROWTH AND FOOD PRODUCTION

Population Growth

Malthus many years ago promulgated a 'law of population', that the number of persons tends to grow faster than the food supply, and he suggested various 'positive' and 'preventive' checks as the only way this could be controlled—'positive', by such things as war, disease and famine, 'preventive', a restriction in the growth of the population. Recently Julian Huxley1 has commented on the sudden increase in the world of the land as an explosive process, and without example in history. Prof. K. Davis, of the UN Population Commission, has stated: 'This explosive human multiplication cannot continue indefinitely. How this growth is eventually stopped, and when, will play a tremendous role in human destiny'.

The dietary problems of affairs has created have led to several thoughtful articles. Harrar3 has analysed the position and comes to a hopeful conclusion, but the solution is entirely in our own hands. I remember Sir Stanley Davidson saying to me that A.P.C. for the Newer Knowledge of Nutrition had been solved, and that the problem now boiled down to distribution and economic aspects. The following facts show that this assessment of the position is indeed wide of the mark, and would still be so even if everybody could afford to buy all the food he wanted.

In 1700 the world population was 500 million, in 1900 1.25 thousand million, and in 1950 2.5 thousand million. It will probably double over the next 40 years and by 2050, if the population growth continues at the present rate, it will be nearly 13 thousand million. At this rate of expansion, the outlook is indeed frightening, since the increase in food production in the world is not at present even 2% per year. One group of scientists seems to regard the future as chaos, and presumably expect that some catastrophe will drastically reduce the population. Others hope that a solution will be found, and not far off, whereby food production can be increased by improvements in technology and similar means.

World Food Production

Even at present food production is inadequate and does not amount to 3,000 calories on an average per head per day. Harrar estimates that only 25% of the world population get more than 2,750 Cal., while 55% get less than 2,200 Cal. per day. The way things are going, those with the highest standards of living will probably find themselves in a situation when the luxuries of 1940 and 1950 are sad memories. This will not benefit anyone—the decrease in living standards of this group merely representing a contribution to the increased number of people in the world, the rich getting poorer, and the poorer, poorer still. I do not want to deal with the question of population control but, as can readily be seen, it is a fundamental problem in our survival.

There are a number of factors aggravating this food shortage, some of which we could improve. One is the difference in efficiency in different countries, due to natural barriers to efficient crop production, public-health difficulties, poor natural resources and education. What can happen when these difficulties are overcome has been shown by the Mexican Agricultural Programme.4 This was undertaken jointly by the Mexican Ministry of Agriculture and the Rockefeller Foundation, and as a result wheat production in certain areas has been increased to a phenomenal degree, and as will be admitted by all South Africans, the use of the soil has been in the past little short of disastrous, and all over the world millions of acres have been rendered useless, or will take a long time to recover. It is clear that many millions of acres in the USA have been so over-planted and over-worked that it is reducing this acreage. Besides this, the use of land for other purposes, urban and industrial, is eating away the available land, with no substitution. One cannot but hope that in many parts of the...
cultivation. We must in the meantime improve the plants we have ever been used for food, only 300 are now at all widely grown, cannot expect much more increase in production from this source.

40 years is due to an increased use of mechanization. In the future, compounds. As regards the sea, it is clear from our experience in holes, and where crop production is most successful, while the farmer is at the mercy of the rainfall, he will be quite unable to estimate what such a protein source is nutritionally useful.

It remains that of soya beans, the most productive crop now grown. It remains to be seen if such a protein source is nutritionally useful. One would hope that such surpluses would mean a more equitable distribution of food throughout the world, but so far this has happened only to a small degree. Lord Boyd-Orr once said that he was not sure if prosperity and their possible many properties to meet various conditions at critical periods to improve crop production. Even the humble gardener knows how to manipulate his soil to alter the colour of his hydrangeas. The carrying ability of agricultural soils has been increased to an amazing degree. In addition, the microbiology of the soil, which seems to have been largely neglected, is now becoming as complete a science as soil chemistry. The microbiology of the soil plays an important role in the decomposition of crop residues, in making available nitrogen and phosphorus, and in regulating the pH.

There is an aspect of this that has always interested me, viz. the apparent complete waste of drainage, which ought to be immediate-ly, with the exceptions of nitrogen, phosphorus and other nutrients. I calculate that Johannesburg, with a population of 800,000, produces 25 tons of urea per day. An accountant accustomed to balancing credit and debit would be horrified to see such rich assets thrown away. I suppose that wiser heads than mine have gone into this matter, but it would appear on the face of it that a much more widespread use of sewage farms would give us a rich source of vegetables at a trifling cost. During the war farm animals were fed with urea as a partial source of nitrogen, and I see recently that it has been claimed that urea may furnish as much as 1/3rd of the protein needs of cattle, and that corn cobs and other roughage may be used with urea as a source of protein.

The use of fertilizers has undoubtedly done as much as mechanization to increase crop yields. The experiments at the Morrow Plots at the University of Illinois are illustrative of the value of fertilizers. These plots had been put under maize every year since 1876 without the addition of any plant food. In 1935, full fertilizers were for the first time used. This great increase in production, as the decomposition of crop residues, in making available nitrogen and phosphorus, and in regulating the pH.

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the conversion of sea water into fresh water and its transport to distant areas, cheaper power for use on farms, and factories for processing food. Coal and petroleum products have been exploited by us to as full an extent as will ever be achieved, and they will in the end be exhausted, but the more pelerees released by nuclear power, if they are as promising as they sound, and if we do not let the misuse of them destroy us, should solve many of our problems.

But by the time this consumption has arrived we shall be sitting in the completely artificial world from which there is now no escape—an artificial soil, enriched by artificial fertilizers, pepped-up plants, controlled water supply, and energy from a source which can only be described as 'unnatural'. A breakdown in any of these— and they all seem to me to be unreliable to some extent—would mean a catastrophic disaster which would wipe out the majority of mankind. Life on the moon might seem no more hazardous, and possibly one solution will be space immigration.

One final point before I leave this aspect. Even if we can produce enough food to feed everybody properly, some economical readjustment must take place whereby everybody can buy or be supplied with what he needs.

**DIET AND HEALTH**

Before blithely planning that everyone should have enough to eat, we must consider very carefully what this should be. I suppose we consider that the Western form of diet is the best, and presumably wish to elevate the under-privileged elsewhere to a diet of that type. However it is becoming abundantly clear that the Western type of diet is killing off more and more people from coronary heart disease, and also that it is very bad for the teeth. I do not need to discuss coronary arterial disease here, but I should like to draw attention to some war-time studies which from the nutritional point of view are interesting and apparently show that these two processes are reversible.

Biörck has given an analysis of the incidence of arteriosclerotic heart disease in Scandinavia before, during and after World War II. Owing to enemy occupation, or to rationing, the consumption of fat fell very considerably in Norway and Denmark. It was also reduced in Finland and to a lesser degree in Sweden. This was accompanied by a reduction in the total death rate in Finland, Sweden and Norway, but not in Denmark. Denmark usually exports butter and eggs in large amounts and, since this was no longer possible, the consumption of eggs and much more so of butter increased considerably. The inference was drawn that the change in food habits was one of the factors responsible for the fall in death rate, and evidence from other sources supports the concept that the reduction in fat intake was responsible. One fact that Biörck points out was the intimate connection between the fat consumption decrease and the decline in mortality from arteriosclerosis, there being practically no time lag. With the end of the war the diet 'improved' both in calories and fat content, and the death rate immediately rose again in Norway. Sweden and Denmark.

In Sweden the percentage of fat per total calories rose from 33.5 in 1948 to 36.6 in 1953.

The other condition which improved greatly during the occupation was dental caries. During the war it was found that the incidence of caries in occupied countries fell considerably. Bransby and Knowles investigated the teeth of a similar group had been taken to England before the German occupation, and 2 years later. When the islands were liberated it was found that 51% of the children in the age-group 3—7 were caries-free. A similar group had been taken to England before the German occupation and 2 years later. When the islands were liberated it was found that 51% of the children in the age-group 3—7 were caries-free.

The reduction in caries in occupied countries fell considerably during the war, when the sugar consumption fell from 87 to 30 g. per day per person and sweets were unobtainable. Collett, who reported these findings, said that the relationship of caries to food was quite plain, and quoted Gœthe: 'It irritates people that truth is so simple'.

In this connection, Sognnaes made an analysis of the timing. The reduction in caries had a definite time lag after the change in diet. He attributed the improvement, not to a change in the oral environment, but to the different fatty acids. He brought up here an ingredient of the teeth. He has produced much other evidence in favour of the thesis that factors operating on the teeth during their development affect their caries resistance.

I have mentioned these two rather different pathologies to show that there is no doubt that a poor diet is not all bad. If we are going into the situation to improve the diet of the Bantu, we must bring it into line with our own, shall we then submit them to the danger of cardiovascular disease, from which they are now infrequent sufferers? We already know at the Dental Hospital that the urbanized Bantu has caries which approaches that of the white man in severity.

Here is a tremendous responsibility for nutritionists of the future. Any improvement of the world food supply must avoid the tragic example of the Western world, where we seem to be killing ourselves off with eating. About the only consoling fact is that these conditions appear to be readily checked and are reversible.

**The Value and the Use of Dietary Standards**

I cannot but feel that a lot of our trouble about these problems is our ignorance of dietary standards—how these should be determined and how applied. We cannot estimate a world requirement for food unless our standards are accurate. The experimental method of putting animals on to diets 'adequate' in all respects but one, and then altering the intake of the item under investigation is obviously open to question. In the first place we are not sure of the adequacy of the diet, and secondly, as is well known, the interpretation of this apparently simple finding has varied widely. Furthermore it is obvious that while every constituent of the diet has a proper level of intake, these listed are only the ones which may be in short supply, such as vitamins, some minerals, protein, etc., the purpose of the table being to ensure that enough of them are provided.

There must be standards for the intake of carbohydrate, sodium and other inorganic constituents. The在美国 and in Europe. During our deliberations, we wrote to some of these people asking for further information on points not clear to us, and found to our surprise that these points were also not clear to them. We felt that the functions of a table of dietary standards could be laid down at most as follows: 'The standards proposed ... should be regarded as adequate for the maintenance of health without allowing for a safety margin for ill health, or for great individual differences in absorption and metabolism.' Furthermore it is obvious that while every constituent of the diet has a proper level of intake, these listed are only the ones which may be in short supply, such as vitamins, some minerals, protein, etc., the purpose of the table being to ensure that enough of them are provided. There must be standards for the intake of carbohydrate, sodium and other inorganic constituents. The United States Government Council on Nutrition, and our own National Nutrition Council have put out tables. I do not wish to comment on all these findings, but to say that the caloric levels are also supposed to apply in physiology. This is not an all helpful to the person actually drawing up a diet; the absolute amount of fat to be consumed at various calorie levels, and also the kinds of fat that should or should not be eaten ought to be listed.

The first tables to be officially issued were put out by the League of Nations in 1935. Since then the Food and Nutrition Board of the National Research Council of the USA, the Committee on Nutrition of the BMA, the Dutch Nutrition Council, the Canadian Council on Nutrition, and our own National Nutrition Council have put out tables. I do not wish to comment on all these findings, but to say that the caloric levels are also supposed to apply in physiology. This is not an all helpful to the person actually drawing up a diet; the absolute amount of fat to be consumed at various calorie levels, and also the kinds of fat that should or should not be eaten ought to be listed.

Calculations about the future of the world food supply depend in large measure on our dietary standards, and it behoves us to study these critically to ensure that our calculations are all right. Since we have few data with which to test the standards, let us apply them in physiology. This is not an all helpful to the person actually drawing up a diet; the absolute amount of fat to be consumed at various calorie levels, and also the kinds of fat that should or should not be eaten ought to be listed.
the effects of excess or deficit are immediately seen. Protein
far more quantitative basis than the old pious hope that of the
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and that some reductions can be made, going back to the stand­
amino-acid balance, has been stressed. This is a particularly
practical aspect of protein mixtures, to give a final satisfactory
point of Chittenden half a century ago. In addition, the important
It now appears that our protein requirements were set too high
acid, are probably of the right order, though recently the American
taking experiments, are of the same order as those found in
leaders, who have studied the effects of vitamin deficiencies and
should like to emphasize the fine work of Horwitt and his col­
Food and Drug Administration have proposed a daily require­
of Fox and Dangerfield in 1940, who showed that Natives on the
any role in the economy of the adult.
The full-term foetus contains about 25 g. of calcium, and thus is
McCance and Widdowson studied various people, including
special calipers. This method is obviously not particularly accurate,
also the body composition which that weight represented.
In addition, errors creep in from the air in the respiratory passages
In the case of children, methods of body analysis were applied.
Mixtures for various age groups are calculated from the following
for children and adults. The accepted weight for normal children
was part of the weight regained was water, not fat. Cowgill comments
the data for children varied from specific gravities
2.2 2 4 5. Newborn babies
needed would preclude its use by all but the best-equipped clinics.
However, indirect methods for estimating body composition
can be used. As one example of how this can be done one can
quote McCance and Widdowson, who measured the extra­
cellular space by the thiocyanate method, corrected for water
in the red cells, determined total body water by the urea technique,
and calculated the cell mass and fat of the body. The differences
between total body water and the volume of extracellular fluid
was considered to be cell water, the cells being 67% water by
weight. The fat-free body contained 7.5% minerals by weight.
The fat was then calculated as the body weight minus the
weights of extracellular fluid, cell mass and minerals. Using this method
McCance and Widdowson studied various people, including
newborn babies, and had calculated fat contents of 12-16%, which agreed well with
actual analyses. The data for children varied from specific gravities
of 1.10 for tall boys and 1.08 for abnormally thin boys to 1.066
for fat boys. The formula was applied to the prisoners investi­
gated by McCance and Widdowson, and had the limitation of
over-estimating the fat in these individuals. As stated above,
power of the weight regained was water, not fat. Cowgill comments
that it would be interesting to know how long the period of rehabili­
tation must be in order to restore not only the person's weight,
but also the body composition which that weight represented.
We are thus developing useful and accurate methods for the determination of the nutritional status. If we are going to improve the diets of peoples in the future, it is only by methods such as these that we can determine if we have succeeded or not.

THE FUTURE

It may appear that I have given a very gloomy prognosis for the future of world nutrition—a rapidly expanding world population, a far too slow development in food production, and a general lowering of standards to ensure our survival.

The answer is an ’artificial’ type of life, dependent on many factors which are themselves unreliable. But are we not there now? When the electricity fails in my house, we cannot cook, food deteriorates in the refrigerator, and we have no light, no heat and no radio—what more artificial than that? In nutrition we shall have to rely on fertilizers, mechanized production, irrigation schemes, atomic power; because of the way we have chosen to evolve, such developments are inevitable.

But we can at least exploit the resources which have lain fallow in the world since man began to live in it. All these facilities were there but they were not used. I think the future is one of challenge and promise. We know the problem and we know the answers. With the potentialities that we possess and the techniques now available, it is our responsibility to utilize them to the utmost of our ability and knowledge.

An examination of recent statistical data reveals clearly that before the turn of the present century cancer will become—if other things remain equal—the biggest killer in the communities of the world. It has been estimated that 50,000,000 people in the United States and 4,000,000 people in the Union of South Africa, now alive, will develop cancer in their lifetime. These figures give cause for public alarm and stand as a challenge to our medical science; and if in every latitude the piercing cry is heard, ’What is being done to combat the evil in our midst?’ then we would say that the answer is being constantly given by an organization which was founded in South Africa as far back as 1931 by a group of men whose names now belong to medical history, and which included Drs. M. des Ligneris, J. H. Harvey Pirie, E. B. Woolf, D. Horwich, P. J. Olivier, A. J. Orenstein and Louis G. M. Van Rensburg, Sir Spenser Lister and Messrs. Hugh R. M. Swinner, A. E. Kark, and Prof. O. S. Heyns in collaboration with Dr. M. H. Schwartz, and Dr. M. H. Silk, Prof. D. Crichton, Prof. A. E. Kark, and Prof. O. S. Heyns in collaboration with Dr. S. Shippe.

(e) Exhibits at medical congresses. The first exhibit was presented at the 41st South African Medical Congress, Durban 1957.

2. The Education of the Lay Public

(a) Literature. The NCASA, with the permission of the American Cancer Society, distributed 200,000 copies each of pamphlets entitled, ’How your doctor detects cancer’, and ’Breast cancer’ to the personnel of insurance companies, banks, building societies, chambers of commerce and industry, mines, the S.A. Railways, the S.A. Police and all Departments of the Public Service.

(b) Educational films, purchased by NCASA from the American Cancer Society, are loaned for exhibition to many organizations in the Union.

(c) A mobile cinematographic unit visits every town in the country, presenting a programme consisting of (i) a cancer exhibition, (ii) a talk on the activities of the Association; (iii) a general talk on cancer; (iv) a film show for the general public; and (v) a medical lecture and a film on ’Breast self-examination’.

(d) Exhibitions and shows to combat the undesirable practices of cancer quacks are held annually at agricultural and industrial shows.

3. The Care of the Cancer Patient

One of the objectives of the NCASA is the establishment of services aimed at alleviating the suffering of cancer patients, provided that these services are supplementary to, or fall outside the scope of, local or government authorities. In addition, the Association undertakes to act as agent for the cancer sufferer in helping him to get from the authorities such relief as he is legally entitled to but perhaps, through ignorance or incompetence, is unable to claim. In the furtherance of this work other organizations are rallying to the Association’s aid. Thus (i) the South African Red Cross Society provides domiciliary aids for stricken cancer families, the aids being paid for their services by the Association; (ii) The St. John Ambulance Association provides assistance to medical libraries. The NCASA provides the libraries of medical schools with publications relating to cancer which, owing to lack of funds, they are unable to purchase.


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(d) Grants for post graduate study and research. The NCASA has made it financially possible for research workers at our medical