In 1974 at the World Food Conference in Rome it was stated that 500 million people in the world were underfed. That was probably an underestimate. Today the numbers are undoubtedly larger, in part because in the last decade the world's population has increased from a little under 4,000 million in 1974 to around 5,200 million people today, but also because the twin problems of poverty and inequity have worsened in many countries during this period. The increasingly wide gap between rich and poor nations and people, in one of the basic causes of hunger and malnutrition in the world.

There are no accurate figures on the global prevalence of malnutrition, and even good estimates are difficult to obtain. To some extent prevalence estimates of the malnourished and the underfed depend on definitions. Relatively minor changes, for example in anthropometric cutoff points used in assessment of protein-energy malnutrition (PEM) or in the recommended minimum requirements for energy or other nutrients, can change by millions the proportion of the malnourished in the world. We should be concerned not only about the numbers of persons who actually suffer from hunger and malnutrition in all countries, but also in the numbers at risk, which always greatly exceed those with the condition.

An attempt by the World Health Organization (WHO) to provide prevalence rates of the most important forms of malnutrition is shown in table 1. These figures are useful but they do constitute only educated guesses based on insufficient data from surveys and other sources. Table 1 suggests that PEM affects perhaps 500 million people, and that some 350 million women of childbearing age have iron-deficiency anaemia. The other two of the "big four" nutritional deficiency diseases are vitamin A deficiency which is a leading cause of childhood blindness, and iodine deficiency leading to endemic goitre and cretinism. . . .

The immediate causes of each of these four prevalent forms of malnutrition is a nutrient deficiency, but the solution involves social, economic, agricultural and political actions.

Economies at the roots of hunger

The decade began with a good deal of attention being directed to nutrition planning, including a systems approach and more nutrition-based development planning (2) and ended with a certain disillusionment with nutrition planning per se as a useful answer to the problem. But more attention is now being given to inclusion of nutritional concerns in overall development planning and to consideration of the nutritional impact of newly introduced programmes in different sections. This is all to the good.

But the underlying causes of hunger in many countries are their failures to weather the stormy seas of international economic disorder that has reigned in the world and the inappropriate development strategies that many of them have followed. For most non-industrialized, non-oil-producing nations the classical "growth and modernization" theory of development, even when modified to include "redistribution with growth," has failed to reduce inequity and hunger (3). A series
of alternative development theories offer a better hope and have influenced the policies of certain countries in different ways depending on their political ideology. The "basics needs" approach of the International Labour Organisation has been influential, and has drawn planners at least to consider matters such as food availability for the poor.

A major problem for non-oil producing, non-industrialized countries of the South is surely the current economic order or disorder. Quite simply the countries are not fairly paid for the primary products which they produce and export. If prices of coffee, tea, sugar, cocoa, sisal, bananas and cotton, and of certain minerals such as copper had been tied to the price of oil or even to the world price of automobiles, then few developing countries would need any foreign assistance at all. Not only do the countries of the South have to live with these unfair price structures, but they have absolutely no control over them. The prices are said to be a reflection of the free market system and questions of supply and demand. But the prices are manipulated by the industrialized countries and by the multinational corporations in a manner which usually depresses the prices of these primary products produced mainly by the developing countries.

If prices of these products were just and equitable, then the economy of most developing countries would not have to be in such disarray. But for this to benefit people, the better prices would have to accrue to the primary producers and not to the middlemen, the traders or the governments. It is simply unfair that a Tanzanian farmer, peasant producing coffee, tea, sugar, cocoa, sisal, bananas and cotton would be obtaining the same price as the producer of major world crops such as wheat and rice.

Table 1. Gross estimate of total number of persons affected by currently preventable malnutrition in the world today

<table>
<thead>
<tr>
<th>Morbidity due to Primary Cause</th>
<th>Morbidity per year</th>
<th>Mortality per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein and energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stunted growth</td>
<td>500 million</td>
<td>10 million</td>
</tr>
<tr>
<td>Clinical cases of kwashiorkor and marasmus</td>
<td>1 million</td>
<td>1-4</td>
</tr>
<tr>
<td>Iron</td>
<td>350 million</td>
<td>Women 18-45</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>8 million</td>
<td>All ages</td>
</tr>
<tr>
<td>Iodine</td>
<td>200 million</td>
<td>750,000</td>
</tr>
</tbody>
</table>

1. The estimates are gross and do not express the significant variations occurring not only from country to country but within countries.
2. Stunted growth defined by weight below the 3.0th percentile of the WHO growth standards. This figure includes mild malnutrition and is therefore higher than the usual estimate of 200 million of moderate to severe malnutrition.
3. Of those due to diarrhea as private causes of death, 30% of cases of death by diarrhea (at 3-5 of 4 years of age) are associated with starting and weaning.
4. Of the 7.5 million cases per year of kwashiorkor and marasmus, most die. Of these many die with diarrhea.
5. Of these women have high fertility rates below the 15th percentile of the WHO standards, i.e., 33% of women aged 18-45 years are amenorrheic.
6. This is an underestimate of persons affected because it includes only those cases in Southeast Asia. This area does not have the highest prevalence in the world, but it is a high prevalence area. Of the 7.5 million cases of kwashiorkor per year, 25% survive that year, so there are 250,000 new survivors each year. These probably have another 40 years of mean life span, resulting in a prevalence of 6 million.
7. 200 million estimated in 1969. We estimate successful campaigns against goiter have reduced the prevalence so that about 150 million suffer from goiter today.
8. In goitrous populations 5.5% of the children born have severe mental and physical retardation (cretinism). 750 million people live in goitrous areas (overall prevalence of 20% goiter in such areas). Thus about 250,000 cases are born a year in these areas. Even if their life span is half that of noncretins, a million persons bring today people eternally disabled because of maternal iodine deficiency.
9. The first manifestation of retinitis appears at birth, defied by low birth weight for gestational age. A rough estimate has been made of 32 million newborns born low-weight infants, equivalent to 1% of total number of births. If 40% of these cases are due to other factors, there are at least 14 million newborns related, thus about 250,000 children are born each year. Some evidence suggests a higher mortality for these babies than for bigger babies.

Source: M.C. Lathan, 1984, reference (1)
Agricultural commodities are vulnerable to market price fluctuations, which do not leave their producers with secure income levels. It is also to be recognized that modernization, industrialization and certain development projects have had negative as well as positive consequences for health and nutrition in poor countries. Examples of this include: the spread of the bottle and of infant formula as a cause of serious problems resulting from a decline in breastfeeding; the move from food crops for home consumption to cash crops to earn money; the use of a highly milled cereal in place of lightly milled or home-pounded grains sometimes accompanied by a loss of jobs; the "green revolution" with its benefits and problems; the spread of bottled sugary beverages, sweet foods and cigarette smoking and their effects on health; the role of new drugs in increasing the prevalence of certain tropical diseases; and certain adverse effects of other aspects of development. It is important that the possible negative consequences be considered.

The "big four" deficiencies and poverty

There is wide agreement that the four most important forms of malnutrition in the developing countries today are PEM, xerophthalmia due to vitamin A deficiency, iron deficiency anaemia and endemic goitre and cretinism due to iodine deficiency. The first two of these conditions are largely confined to the poor segments of the population. Therefore "macro" policies that will improve food intakes and reduce poverty can be expected to reduce greatly the incidence both of PEM and xerophthalmia. Nutritional anaemias, while considerably more prevalent in poor countries, are not uncommon in industrialized countries. Endemic goitre is mainly related to low intakes of iodine, which in turn are determined principally by the iodine content of the soil in which the crops are grown. For this reason there are many areas in the world where poverty is extreme but where endemic goitre is not prevalent. But now, because better-off people often consume a good deal of food imported into their areas of residence, they avoid developing goitre, whereas their poorer neighbors subsisting on locally grown crops remain iodine deficient.

All four forms of malnutrition are therefore more prevalent among the poor, but the reduction of poverty can be expected to have a different impact on the incidence of each disease.

The abandonment of home pounding of grains and the adoption of the bottle for feeding infants are among the double-edged results of economic modernization. PEM remains the most important form of malnutrition in almost all developing countries. There appears to have been a reduction in the overall incidence of the severe clinical forms of PEM -- kwashiorkor, marasmus and marasmus-kwashiorkor. However, nutritional anaemias in many countries in recent years. But there does not seem to have been an equal decrease in mild or moderate PEM world-wide, and with the marked increase in the world population the total numbers of children involved is almost certainly higher in 1984 than in 1974.

The literature on PEM is now enormous, and each year brings a plethora of articles on this topic. No attempt is made here to review this extensive literature. Instead three topics related to PEM and which have important policy implications are briefly and separately discussed. These are the fairly recent appreciation that PEM is due mainly to food and...
More cases of nutritional marasmus are seen today than a decade ago.

Energy deficits rather than to a protein problem: the appropriate use of anthropometry and monitoring of growth and the control of parasitic infections and the use of oral rehydration for diarrhoea as tools to reduce malnutrition.

Although there is little doubt that kwashiorkor is due mainly to grossly inadequate intake of protein and energy often accompanied by infections, there remains some scientific doubt about why certain children develop kwashiorkor while others develop nutritional rickets. Different theories have been postulated (18)(11).

In recent years Hendrichse et al. (12) have suggested that aflatoxin poisoning in children may be an important cause of kwashiorkor. Their work from the Sudan shows an association between high aflatoxin levels in children with kwashiorkor when compared with levels in children who do not suffer from kwashiorkor. But these associations need not be causal. Despite the extension of these aflatoxin studies to animals, it seems very unlikely that aflatoxin is the main aetiological agent in kwashiorkor.

Protein problem exaggerated

In the early 1970s a series of important articles drew attention to the fact that the protein problem had been exaggerated, that protein deficiencies were less prevalent than energy deficiencies, and that major efforts to increase the consumption of protein-rich foods would have a rather small impact on the prevalence of PEM (13)(14)(15).

The protein debate has subsided but not ended. It has left a fair measure of agreement and a few unresolved questions. But the outcome has had very important implications for food and nutrition policy. There is now agreement that much more emphasis needs to be given to the energy rather than the protein content of diets: that the PEM problem relates to food intakes and not protein intakes; and that in general when commonly consumed cereal-based diets meet energy needs, they usually meet protein needs as well.

Better solutions now known

No one should question that protein is an essential nutrient, that the protein requirements of children are proportionately higher than those of adults, and that infections result in increased urinary nitrogen losses which raise protein needs. It is also recognized that diets based on some non-cereal staple foods such as cassava, plantain and sugar are more deficient in protein than are cereal-legume-based diets.

But there is little doubt that in the post-1970s stress was placed on protein deficiency rather than food deficiencies, and on distribution and consumption of high-protein foods and too little on energy-dense foods. Simple evidence from developing countries suggests that most children with PEM are consuming diets deficient in both energy and protein, but that if intakes of existing foods are increased to satisfy energy requirements, the diets would usually more than satisfy protein requirements as well.

Although most nutritionists in academic centres and in the international agencies now accept this evidence it is regrettable that this new knowledge has not been fully appreciated by the majority of agriculturalists in colleges of agriculture in research stations and in extension. Also many economists, food scientists and politicians do not appear to be familiar with the new knowledge about protein or its policy implications.

But in general this new knowledge has led to major changes in our thinking and in policy directed towards the control of PEM. We no longer see kwashiorkor as being caused by amino acid fortification of cereals or single-cell protein or fish protein concentrate or high-protein weaning foods, nor on the consumption of meat, fish and eggs. Instead we see more efforts to protect and promote
breastfeeding; to increase consumption of cereals, legumes and other locally produced foods for weaning; to control infections and parasitic diseases; to increase meal frequency for growing children; and to encourage a higher consumption of oil, fat, and other items that reduce bulk and increase the energy density of foods fed to children at risk.

These measures are all of considerable importance in controlling PEM. They are likely to have more impact if they are accompanied by growth monitoring, immunizations, oral rehydration for diarrhoea, early treatment of other diseases, and also with attention to the underlying causes of malnutrition such as poverty and inequity. Some of these measures may be implemented as part of primary health care.

**Anthropometric measurements and growth monitoring**

During the 1950s and 1960s weight for age including the use of the Gomez Classification was the main method used in assessment of nutritional status (16) both for the individual child and for community diagnosis. In 1971 Seoane and Latham (17) suggested that it was important to distinguish three different categories or types of malnutrition using weight and height measurements of children. These categories were:

(a) Acute, current, short duration malnutrition where weight for age and weight for height are low, but height for age is normal.

(b) Past chronic malnutrition where weight for age and height for age are low, but weight for height is normal.

(c) Acute on chronic, or current long-duration malnutrition, where weight for age, height for age and weight for height are low.

This new classification was discussed by Waterlow in an important paper in 1972 (18). He agreed that these distinctions had worked advantages over the use of weight for age alone, and suggested that acute malnutrition be termed "wasting", that chronic malnutrition be termed "stunting" and that the combined condition of acute on chronic malnutrition be labeled "wasting and stunting." Although there has been no firm agreement either on the terms to be used or on the cut-off points for low weight and low height, nevertheless the general three-category classification is now almost universally used.

The new classification allows a distinction to be made between current and past influences on nutritional status, it helps the examiner assess the likelihood that supplementary feeding will markedly improve the nutritional status of the child, and it gives the clinician some clue as to the history of the malnutrition in the patient being examined. It has advantages too for nutritional surveys and surveillance. As recently pointed out, weight for age used alone introduces a considerable error particularly in mild or moderate PEM (19)(20). This recent UNH paper (20) stresses that the refinement suggested by Seoane and Latham (17) is very useful and has "found widespread application, and there is probably more known today about these indicators in different populations and different health situations than for any of the other indicators that have been proposed in the past."

Also important for policy makers is the need to decide which growth standards to use as a yardstick for judging malnutrition, or for surveys, monitoring and surveillance. In recent years there has been increasing acceptance of the US National Center for Health Statistics (NCHS) growth standards as published by WHO. A recent editorial in The Lancet (21) critically discusses the use in developing countries of international growth standards, particularly the WHO/NCHS. The article states that "Recent evidence suggests that the growth of privileged groups of children in developing countries does not differ importantly from these standards and that the poorer growth so commonly observed in the underprivileged is due to social
Is smallness an ethnic question?

There are still those who suggest that the low anthropometric measurements found in groups of children in developing countries may be "normal" and that "smallness" may be advantageous. This view is not supported by the evidence as has been convincingly argued by Gopalan (23). Recent data (22) strongly support the view (24) that ethnic differences are very much less important than other factors as causes of growth failure in children. Inadequate food intakes, infectious and parasitic diseases, and adverse environmental factors often associated with poverty combine to prevent children from realizing their full growth potential. Certainly genetic factors influence achieved body size and especially stature, but it seems that in prepubertal children, heredity is a much less significant cause of below average growth than are other factors. In adults both environmental factors in childhood and heredity affect stature. Acceptance of these views has important policy implications. It has been common for privileged people to suggest that underprivileged children especially of a different ethnic group are "naturally small" or better off small, and in this manner to absolve the problems of undernutrition, poverty and deprivation that are the real causes of stunting and smallness.

While there is evidence showing that caged rats receiving restricted quantities of a well-balanced diet from six weeks of life onwards have a longer life than rats fed the same diet ad libitum (23), this evidence cannot be extrapolated to man. Those rats were brought up in a germ-free environment; they were not free living and they were not required to perform physical work. But research on aging and longevity as related to nutritional status in humans is needed.

Growth monitoring is basic

The research on anthropometry and the new knowledge about the appropriateness of standards have assisted greatly those conducting nutrition surveys. Surveillance and growth monitoring. In the last decade there has been a great increase in the use of weight charts as a means of monitoring nutritional status and of involving mothers in maintaining good nutritional status in their children and rehabilitating children who are malnourished. This is one of the four activities that the United Nations Children's Fund (UNICEF) is emphasizing in its "400 approach" (based on growth charts, oral rehydration therapy, breastfeeding and immunization) to improve the state of the world's children (28). The advantages of weight charts include cheapness, their practicality, and that they provide a powerful additional means for teaching mothers how to promote or protect their child's healthy growth. The number of children worldwide whose growth is being monitored is now in the tens of millions. This is a major development of this decade. It has been stimulated by nutritional research, and is based on a method pioneered by David Marley in Africa many years ago.

The functional significance of mild or moderate PEM is still not known. Somewhat conflicting conclusions have resulted from different studies reporting on case fatality rates according to nutritional status. A study in Bangladesh reported that there was an increased mortality mainly in preschool children with rather severe PEM as judged by anthropometry (27). However the data from the Nangalal study in India suggest that children with moderate PEM also have higher mortality rates, and that there is an inverse linear relationship between fatality rates and anthropometric nutritional indices (28).

Even if higher mortality rates are associated mainly with more severe growth deficits, it is still wrong to conclude that very little attention should be directed to children with mild or moderate PEM and that wast emphasis should be placed on reducing severe PEM. Yet there is a school of thought which advocates just such policies. This ignores the fact that many public health and preventive actions are aimed at reducing risk. A child with moderate wasting with, for example a weight for height of 52 per cent of the standard at age 2 years is at much greater risk of developing severe malnutrition than is a similar child with no wasting and a weight for height of, say, 98 per cent of the standard. And if this logic holds, then a mildly wasted child with a weight for height of 52 per cent is also at greater risk. Therefore efforts need to be addressed to reduce both severe and moderate wasting.

This concept is similar to that accepted in many other preventive public health
It is a widely held view that moderate hypertension, moderately high levels of serum cholesterol, and moderate obesity all deserve attention. Moderate PEM also warrants prevention.

**Nutrition and Infections: a Soluble Problem**

Our knowledge of immunology has advanced markedly in the last ten years. It is not proposed here to review either this new knowledge or what is now known about the relationship between nutrition and infection. Instead the discussion will be limited to three strategies for the control of infections, all of which have important implications for nutritional status. These are immunizations, the treatment of certain parasitic infections and oral rehydration therapy for diarrhoea.

Recent scientific knowledge relating to all three suggests that a much wider implementation of all three could in a very few years greatly reduce morbidity, mortality and malnutrition related to a whole group of highly prevalent infections.

Children under five are at the greatest risk in contracting six common and dangerous diseases: measles, polio, whooping cough, tetanus, tuberculosis and diphtheria. But getting them vaccinated, especially in areas as here in Ethiopia, means overcoming tremendous logistical and technical barriers. Immunization has already shown that millions of children even under adverse circumstances of drought, war and economic constraint.

In the 1970s we saw the last case of naturally transmitted smallpox. We had conquered a deadly epidemic disease. International and national actions had harnessed a technology introduced by Jenner in England in 1796. This was a remarkable achievement.

If we had the political will, and were provided with the rather modest financial means, we could probably conquer measles in the same way. It would be a more difficult task because measles is more contagious than smallpox, it usually strikes children as an early age, and the current vaccine is more sensitive to adverse conditions than is smallpox vaccine. But measles does not have an animal reservoir; immunization is highly effective, and several industrialized countries have demonstrated that the disease can be controlled. Measles in childhood contributes importantly to malnutrition in the Third World. In undernourished children, case fatality rates from measles are many times higher than in well-nourished children. Immunization can therefore both reduce malnutrition and also greatly lower infant and young child mortality rates. The time is at hand when a serious effort should be made to obtain universal or near universal immunization against measles in children before the turn of the century. Perhaps one of the industrialized countries in the East or West could decide to forego the building of one large warship or the construction of one set of atomic weapons and use the funds saved to finance the eradication of measles from the world. That is all that it would take.

The industrialized countries should also consider the savings to themselves if measles eradication were achieved worldwide. Until measles is eradicated everywhere, countries like the United States will have to continue to immunize all their own children and to monitor measles incidence. This costs many millions of dollars annually. Such expenditures would be saved if measles were to be totally eradicated.

The major advances in immunology suggest that in the next decade it may be possible to develop new vaccines against common viral diarrhoeas and perhaps also against malaria. Such developments would have a major impact both on mortality rates and also on the nutritional status of children in the developing countries.

**Parasites**

Recent research has shown that common parasitic infections in children have an impact on their nutritional status. *Ascaris lumbricoides* the common roundworm is estimated to infect 1,000 million people in the world, and studies show that it contributes to...
poor growth and to malnutrition in young children (23). Helminth infections are a major cause of iron loss and anaemia (301. A new study by L. S. Stephenson and the present writer suggests that Schistosoma haematobium contributes to anaemia, retarded growth and low physical fitness in Kenyan school children. These three parasitic infections, plus several other aere infestations, are now rather easily and cheaply treated. In many poor countries rather slow progress is being made to make available safe water supplies to all households, to improve sanitation and to increase health knowledge which in the long term are measures needed for permanent control of several parasitic diseases. At least in the short term, serious consideration needs to be given to routine deworming of infected populations. Such action would have important nutritional implications. We now have the anthelminthic drugs that are cheap, effective and safe to use. The time has arrived when we move from pilot studies to mass treatment programmes. Farmers know that it pays to deworm their pigs and affluent pet owners regularly deworm their cats and dogs. Surely the time is at hand to consider deworming the infected children in the world, some of whom have several worm infections simultaneously.

The last decade has seen a revolution in the treatment of diarrhoea. Oral rehydration therapy (ORT) often performed in the home has reduced deaths from diarrhoea in many parts of the world and has largely displaced intravenous therapy. In 1976 an editorial in The Lancet stated, "The discovery that sodium transport and glucose transport are coupled in the small intestine, so that glucose accelerates absorption of sodium and water, was potentially the most important medical advance in this century." Now many countries have effective programmes to expand the use of ORT, and this has become a major focus for interventions supported by both WHO and UNICEF.

Gastro-enteritis, often due to infections with rotaviruses, is such a common cause of morbidity, of malnutrition and of death of infants and children in the third world that this new form of therapy deserves major support. It should be remembered, however, that ORT is a form of treatment, not of prevention. Other appropriate steps need to be taken to prevent diarrhoea. But ORT can prevent deaths, and the wide dissemination of oral rehydration salts to be used at home deserves support in the decade ahead. This is truly an example of where scientific research has led to a practical means to deal with an extremely prevalent disease which is known to be an important cause of malnutrition.

Xerophthalmia and vitamin A deficiency: preventable blindness

In many developing countries vitamin A deficiency is the most important cause of childhood blindness. Yet this condition is relatively cheap and easy both to treat and to prevent. In recent years there has been an increasing appreciation by governments and international agencies, and to some extent also by physicians and nutritionists, of the magnitude of the problem and of the means available for dealing with xerophthalmia. It is recognized that we possess both the knowledge and the technological means to control this disease at quite modest cost.

Recent research has considerably advanced our knowledge of the biochemistry and physiology of vitamin A and the carotenoids. Our understanding of the inter-relationship between vitamin A deficiency and infections has also increased in recent years. Numerous reports show a drop in serum vitamin A as a result of infections. But despite our improved knowledge we still do not adequately understand the relationship of measles to xerophthalmia nor whether blindness following measles is due mainly to vitamin A deficiency. Frequent reports of such blindness have come particularly from Africa. In most countries where xerophthalmia is prevalent most of the dietary vitamin A comes...
from provitamin A compounds. Newer analytical technology (36) has demonstrated that the older methods used tend often grossly to overestimate the provitamin A activity in foods. Because of this most food composition tables have major errors. This has important implications for applied programmes which aim to improve vitamin A nutritional status through raising intakes of carotene.

Important long-term studies in Central America, the Philippines, Indonesia and India have in recent years greatly extended our knowledge of xerophthalmia and its control. A project of the Instituto de Nutricion de Centro America y Panama (INCAP) in Guatemala has demonstrated that fortification of sugar with vitamin A significantly improves blood serum vitamin A levels in the community (37). This project has provided a useful model for evaluating control programmes and lessons about the technical, scientific, and political problems that need to be addressed in such programmes. The study has also demonstrated that measuring pre-school levels of retinol is a useful monitoring method.

The continuing work in the Philippines has been unique in that it has provided the only major study to evaluate the relative effectiveness of three widely suggested strategies to control vitamin A deficiency (38). In one area with a serious xerophthalmia problem (39), three different interventions were tested over a period of two years in six rural and six urban barrios or barangays. The three actions were (a) the provision every six months of a capsule containing 200,000 IU of vitamin A with 40 IU of vitamin E to all children in four areas, (b) the fortification of small 2.2 gram packets of monosodium glutamate (MSG) with 15,000 units of vitamin A in four other areas (MSG was found to be the only commonly consumed item available for fortification), and (c) a public health and horticulture intervention aimed at improving curative and preventive health services and of increasing local production and consumption of carotene-containing foods in four barangays. The results of this research showed a reduction of xerophthalmia in children in all three intervention areas. But fortification proved to be most cost-effective and to result in very significant rises in serum retinol levels particularly in the children at greatest risk of developing serious xerophthalmia.

Recently MSG fortification has been undertaken in two whole provinces in the Philippines with a third province serving as a control and using normal marketing channels for fortified MSG. This carefully controlled study has illustrated the benefits of such a strategy and has suggested some technical problems that need to be solved before a national programme can be implemented.

In Indonesia a very detailed study (40) of xerophthalmia has been completed. The investigation included a point prevalence survey and a longitudinal prospective study. This suggested that the risk of developing corneal xerophthalmia before the age of five years was two per cent and of non-corneal xerophthalmia was over 52 per cent. This Indonesian study also demonstrated that a history of night blindness was a reasonably useful screening tool for xerophthalmia, and it advanced our knowledge of the clinical and pathological aspects of vitamin A deficiency. Indonesia has had experience with a limited use of high dose vitamin A administration. The country is now seriously considering fortification of MSG with vitamin A influenced by the experience with this procedure in the Philippines. A large proportion of Indoreans of all ages, like many other Asian peoples, uses MSG regularly in foods.

India has had the most extensive experience with the use of periodic dosing of children. The national vitamin A prophylaxis programme instituted in the early 1970s now covers over 50 million children. Unlike most other countries where high dose capsules are used, India uses a locally manufactured liquid vitamin A preparation providing 1.89 mg of retinol palmitate (200,000 IU) in 2 ml of flavoured syrup to all children every six months. Several evaluations (41) have been carried out which show that the programme has been effective but has some problems.

The important studies, evaluations and pilot control projects in these four countries, supplemented by interesting applied projects in other countries including Brazil and Bangladesh, have provided the research base and the essential knowledge to allow recommendations to be made for control of xerophthalmia. It is now generally agreed that, if an appropriate value can be found, then fortification is usually the cheapest and most effective means of controlling xerophthalmia in most countries. The use of periodic high dosing is effective, but requires a delivery system which can be expensive and it necessarily locates all children at risk every six months. Often the most vulnerable children are the most difficult to reach and therefore are easily missed.

In the long run means other than fortification or dosing with vitamin A are needed and may be effective. These involve horticultural and related activities to increase the availability of carotene-rich fruits and
vegetables: nutrition education to ensure that diets contain adequate quantities of carotene and vitamin A. Actions to reduce the prevalence of various health and nutrition problems that are related to xerophthalmia, the provision of services for early diagnosis and treatment of eye and related diseases; and finally steps that will reduce poverty and allow families to grow or purchase an adequate diet and live a decent life.

Not related to xerophthalmia but of some importance, is the new evidence linking vitamin A and carotene intakes to cancer prevalence. There is now quite convincing evidence that low carotene intakes are related to a higher incidence of certain forms of cancer.

There is no doubt that... we have the knowledge and the tools to control vitamin A deficiency and to greatly reduce nutritional blindness worldwide. We need the finances, the political will and the organization to apply this knowledge for the benefit of children.

Iron-deficiency anaemia: complex causes

Nutritional anaemias are among the most common deficiency conditions in both developing and industrialized countries. Iron deficiency is by far the most prevalent form, but folate deficiency is also quite widespread.

The problem of iron deficiency is complex and control of anaemia is not straightforward as used to be believed. Knowledge gained in the last several years, has shown that the form of iron consumed is at least as important as the amount (42), and that there are important substances which enhance or retard iron utilization.

In most diets, food iron exists predominantly in the non-haem form of inorganic ferrous complexes, and a smaller amount as haem iron from animal products. During digestion the inorganic iron is partly reduced to the more readily absorbed ferrous form, and this conversion is markedly assisted by vitamin C in the diet. The assimilation of ionic iron is also enhanced by ascorbic acid.

It is now clear that haem iron is handled quite differently, being split from the globin portions of haemoglobin and myoglobin in the intestine, and the haem is then assimilated.

The question of iron nutritional status in infancy has been perplexing because breast milk contains only about 0.3 mg of iron per litre. But studies have shown that 49 per cent of the iron in breast milk compared with 10 to 12 per cent from cow’s milk or from unfortified formula (42). This work has been duplicated by others, and it helps explain how prolonged breastfeeding confers partial protection against iron-deficiency anaemia. The anehaemia which allows such extraordinary, high absorption of iron from breast milk is not fully known. But this finding too, has policy implications, and provides further support for the superiority of breast feeding.

Uterine during pregnancy, especially in the last trimester, and at an increased risk of developing both iron- and folate-deficiency anaemia. It is now known that the adverse consequences of this anaemia are mainly to the mother not the unborn child. At birth and throughout the first year of life, haemoglobin concentrations in infants born to both anaemic and non-anaemic mothers are very similar (42).

It is well established that anaemia can adversely affect worker productivity (4748). This is probably due mainly to the reduced oxygen-carrying capacity of the blood in anaemia, compared with non-anaemic workers. But it now appears that iron deficiency may also result in muscle dysfunction.

The relationship of iron nutritional status to infections remains controversial (42). Of particular concern is the evidence suggesting that provision of iron therapy in areas may precipitate attacks of malaria. As present this is far from proven but appropriate interventions to control anaemia in malarial areas have been thrown into doubt until more definitive research is completed.

For many years it has been known that hookworms such blood and that heavy, and even moderate loads of hookworms are an important cause of iron-deficiency anaemia. It is estimated that 300 million people in the world harbour hookworms, and that this remaining a terribly important cause of anaemia. Many of those infected with hookworms are poor and have other reasons for being at high risk of developing iron deficiency.

Other parasites may also play a role in anaemia by causing blood loss or for other reasons such as haemolytic anaemia resulting from malaria. Recent research has shown that schistosomiasis may be a cause of anaemia. Matfrione treatment of Schistosoma haematobium infections in Kenyan children have resulted in a significant rise in haemoglobin levels (50).

Up to now those concerned with the control of anaemia have given inadequate attention to treating and preventing parasitic infections. Yet millions of people worldwide would benefit from such actions.
Iron absorption in man has been known for a long time, it is only recently that this knowledge has been applied to improve iron nutritional status, and then in very limited trials. Ascorbic acid is a very powerful enhancer of absorption of non-haem iron consumed in the acidity found in the duodenum. There have now been numerous studies to show that ascorbic acid, or foods rich in this vitamin, such as fruits or fruit juices, will increase the absorption of both ferric and ferrous iron but also the iron present in foods consumed along with ascorbic acid. The increased absorption may be in part due to the formation of a solubilized iron-ascorbate chelate.

This knowledge has enormous implications because as stated earlier most of the world's population have fairly high iron intakes, but this is mainly non-haem iron in cereals. Therefore the possibility of increasing the availability of this large non-haem iron source is attractive. Could it be that with the rapid increase in population, and large movements from rural to urban dwellings, and with increased consumption of processed foods (where vitamin C is decreased) we have in the last 100 years witnessed a lower consumption of vitamin C-containing foods, and an increased prevalence of iron-deficiency anaemia?

The increased knowledge about iron-deficiency anaemia places us in a better position to control this common condition in the years ahead. Up to now few countries have managed to do so. The strategies available for intervention and their advantages and disadvantages can be summarized. ... They include supplementation which is now defined as medicinal iron provided to the individual; fortification with iron or with ascorbic acid to enhance iron utilization nutrition and health education to improve dietary intake of foods rich in iron and ascorbic acid; the lessening of the consumption of interfering substances, and protection of the individuals from conditions which lead to bodily iron losses; and finally control of parasitic diseases known to be a major cause of anaemia in certain areas.

In countries or communities with a high prevalence of iron-deficiency anaemia or in groups of the population at especially high risk such as pregnant women or young children, therapeutic or prophylactic supplementation programmes are indicated at least until such times as fortification or other steps can be taken to provide long-term control. We now know much more than heretofore about the advantages and disadvantages of different oral iron preparations. But such supplementation programmes require an adequate, often expensive, delivery system.

Fortification has considerable advantages over supplementation, and must surely provide the best hope for long-term control in populations both in developing and industrialized nations (54). Where the difficulties can be overcome it is cheaper than supplementation, it does not require a separate delivery system, and it reaches many more people. But a suitable carrier has to be found, an effective compound has to be added, and other difficulties need to be overcome. These have been discussed in detail elsewhere (48). ... In the decade ahead fortification of foods with ascorbic acid, or with or without added iron, deserves serious consideration and trials. This may have important advantages for anaemia control (52)(53).

Breastfeeding

Knowledge about breast feeding has existed for all of human history, and studies comparing the relative benefits of breastfeeding compared with alternative foods for the young infant have been published frequently over the past 50 years. But even though for many years we have known of the advantages of breastfeeding and a good deal about human lactation, there has in the last 10 years been an avalanche of publications on this topic. This new research has further advanced our knowledge, and the bulk of it strengthens our view of the many advantages of breastfeeding over other methods of infant feeding (60).

The heightened interest in this topic is at least in part due to the controversy surrounding the issue of bottle feeding, and also because of the recent resurgence of breastfeeding in Europe and North America. The womanly act of breastfeeding which had almost been lost in the industrialized countries has been rediscovered.

It is increasingly recognized that psychological factors can lead to lactation failure, and that support systems for women during pregnancy, delivery and post-partum are of great importance. In traditional societies the extended family often provides this support and contributes to a much lower incidence of lactation failure than that found in industrialized societies. Friendly human support, including emotional support for the woman before and after birth is of great help. These usually female supporters have been
termed "doulas" (61).

It is now proven that it is beneficial to put the child to the breast as soon as possible after birth, preferably within the first hour. But this new knowledge is not widely practiced. The advantages include beneficial effects on the mother's uterus, in mother-infant bonding, in providing immune substances to the newborn and in having a positive influence on subsequent successful breastfeeding. In many countries in Africa, Asia and Latin America very early breastfeeding is often discouraged, and in many cultures colostrum is not believed to be good for the infant and is discarded. This is one of the few instances where traditional practices related to breastfeeding are not ideal. Efforts are now being undertaken to educate both health personnel and mothers on the benefits of early feeding and of colostrum, which is a remarkable fluid (60).

The importance of rooming-in which allows women after delivery in hospitals to remain with their infants is now accepted but not practiced everywhere. By the end of this decade there should not remain a single hospital where rooming-in is not practiced at least for healthy women following a normal delivery. There is increasing evidence that the instances of undesirability of rooming-in are few in number. For example, some hospitals have shown benefits in allowing low-birthweight babies to room in and breastfeed. Of considerable importance in the battle against the spread of infant formula use which led to a decline in breastfeeding was the overwhelming vote in favour of the Code of Marketing of Breastmilk Substitutes at the World Health Assembly in 1981. The only country to vote against the Code was the United States. The very important role of a number of non-government organizations and activist groups in influencing the formulation and acceptance of this Code must be recognized. Their effort, their persistence and their tactics were a major factor in achieving a measure that an admittedly rather small group of concerned nutritionists, physicians and scientists had recommended for more than 20 years (62).

Although there are numerous violations and many countries who voted in favor of the Code have not yet adopted legislation to enforce it, nevertheless there have been important changes in marketing practices in recent years. The extent of radio, television, newspaper and other mass media promotion of breast milk substitutes to the general public has been greatly reduced. The major formula manufacturers have apparently resorted to other promotional practices which are not covered by the Code. These include provision to health professionals: the provision of research grants, travel funds and other benefits to influential pediatricians, nutritionists and physicians; and increasing advertising to the public of weaning foods. For example a 1984 Nestle advertisement for Cerelac claims that it "provides a nutritionally complete feed" and that breast milk is ideal for your baby. "But when he is four months and ready for solids consult your doctor and start him on Cerelac." Such advertising is not forbidden by the Code but is against the spirit of the Code and yet is being practiced by a corporation which claims fully to support the Code.

In the past few years there have been several studies which show the high cost of formula feeding compared with breastfeeding, and the economic implications of this for poor families and poor nations (63). The appreciation of this has influenced policy. Economists and politicians may be more inclined to support programmes to protect and promote breastfeeding when they appreciate that such measures will save scarce foreign exchange and will be of economic benefit to poor families. Of at least equal importance is our increased knowledge on the relationship of breastfeeding to human fertility. For a very long time the traditional wisdom of many societies included a belief that lactation reduced the risk of pregnancy. Often this belief tended to be labelled as an old wives' tale. Scientific evidence now proves beyond
question a positive relationship between lactation and length of post-partum amenorrhea, anovulation and reduced fertility. This topic has been reviewed elsewhere (64).

A great deal has been learned recently about two hormones—oxytocin and prolactin—that are important in human lactation. Research suggests that the frequency, intensity and duration of sucking are the most important determinants of the length of postpartum amenorrhea and anovulation following the birth of an infant. Therefore, in women who are having sexual intercourse and who are not using contraceptives, the most important physiological factor influencing the spacing of births is breastfeeding (65).

This new knowledge has enormously important implications. A decline in frequency, intensity or duration of breastfeeding may result in a narrower spacing of births. Recent data from Kenya (66) show that prolonged breastfeeding is still prevalent among poor women in Nairobi but that supplementary feeding with breastmilk substitutes is practiced by 59 per cent of women by the time the infant is two months of age, even though at six months of age over 60 per cent are being breastfed (67). Kenya has a low level of use of contraceptives of all kinds, and one of the highest fertility rates in the world. It can be predicted that if breastfeeding declines and if the pattern of early supplementary feeding spreads to the rural areas, then national fertility rates will increase further.

In many countries breastfeeding is now having a more effect in prolonging intervals between births than the combined use of the contraceptive pill, intrauterine device (IUD), Depoprovera, condoms and other modern contraceptives. Therefore the fertility-controlling benefits of breastfeeding can now be added to its other advantages which include its nutritional superiority, its role in reducing infections, its economic benefits and others.

The clear evidence of these advantages suggests that governments and other institutions should put much greater effort and resources into the support, protection and promotion of breastfeeding than is now usually the case. Several countries including Papua New Guinea, Brazil and Indonesia are in different ways taking important steps in this direction. UNICEF is providing considerable assistance to help developing countries with programs to promote breastfeeding as part of their GOBI strategy.

Over the past decade, world foodgrain supplies have become plentiful—but basic hunger and malnutrition levels have not been reduced by much.

Conclusion

In concentrating on the "big four" nutritional problems (Editor: Hunger Notes has omitted the fourth—goitre), this article discusses chronic malnutrition and hunger, and considers the problem of the decline in breastfeeding in the developing countries. Scientific knowledge and the results of various nutritional studies, many conducted in the last 10 years, show that xerophthalmia, iron deficiency anaemia, and endemic goitre all could be largely controlled in a very few years if we were to use this knowledge, and were provided with the necessary rather small resources.

Protein-energy malnutrition is considerably more difficult to prevent and will not be markedly reduced without attention to improved agricultural production, to better distribution of food, and to control of a number of infections and parasitic diseases. But the prevalence of all four nutritional diseases could be greatly reduced by a reduction in the extent of poverty and by proper attention to food demand.

The 1974 World Food Conference recognized that the relative neglect of agriculture is at the heart of both the slow pace of development and the extent of hunger in many non-industrialized countries of the South. It was clear to the Conference that the solution of these twin problems demands that more serious international concern be given to the food sector, which often serves as an indicator of the health of the rest of the
economy. The answer to the problem was seen as a major emphasis on increased food production especially in the food-deficit countries. There was general agreement that the technical knowledge exists to allow for an increase of 4 per cent annually in agricultural production. Hope was expressed that this strategy would greatly reduce hunger and malnutrition in the developing countries. World and national food security became the catchwords. But the hope of a major reduction in the extent of hunger and malnutrition between 1974 and 1984 have not been realized. During this period the world's population has increased by almost 1 billion people. We find in 1984 that the world has good supplies of cereal grains; their prices are moderately low and supplies exceed demand for grains produced in North America, western Europe and in certain grain-exporting countries. Interestingly most important increased demand for grain has been to feed livestock in the Soviet Union and western Europe. Several food-deficit countries, for example India, have in the 1980s become more or less sufficient in food production. It was unexpected and highly commendable that world food production per capita has increased during the decade, and even in the poor countries has increased only slightly. Despite these developments, malnutrition, undernutrition and hunger have not decreased very much. It is now accepted by nutritionists and food economists (if not agronomists) that important as food production is, it does not solve hunger if we do not deal with problems of food demand for the poor. The world now deals better than in the past with famine relief and this has reduced famine deaths due to starvation. Actions now should be addressed to solve the problems of the chronically undernourished whose malnutrition is more chronic than starvation, but among whom many millions of deaths a year are due to the synergism of malnutrition and infections.

Attention for the rest of this century must focus on this chronic malnutrition in the hungry poor. While efforts to increase agricultural productivity continue, attention must now be focused on the demand aspects of food security. A dilemma for many countries is that food price policies aimed at assisting the poor may be a disincentive to agricultural production. Governments and donor agencies should try to find a policy which both encourages increased agricultural production and which also allows the poor to purchase an acceptable quantity of food. Improved equity will markedly reduce the extent of malnutrition as has been well demonstrated in China and Cuba. The right to an adequate diet is a basic human right. The well-being of the citizens of a country, including their good nutritional status, has to be viewed as a measure or indicator of development....

In a disquieting economic and political situation in the world does not encourage optimism. But this glows can support all of its inhabitants and can allow them to enjoy a decent quality of life. To achieve this, all of us must accept changes. The present status quo is not acceptable, because it keeps a large percentage of the world's population living in unacceptable conditions with poor nutritional status, with a constant threat of hunger and with ill health. Changes are needed in the present economic order in the empowerment of poor peoples and nations; and in the attitudes and practices of the rich towards the poor. Billions of dollars now spent on offensive weapons and on military assistance have to be diverted to humanitarian projects in education, health, agriculture and social services. As Abraham Lincoln once said "No country can exist half slave and half free. The poor must be given the freedom to control their own lives and their own destinies.

REFERENCES

Note: Cites in numerical sequence reflect omissions from the original article. Numbering of references is the same as in the original. For the omissions see FAO'S FOOD AND NUTRITION (vol.10, no. 1, 1984).


5) F.M. Lappe and J. Collin, FOOD FIRST: BE- 
6) S. George, HOW THE OTHER HALF DIIES: THE REAL 
REASONS FOR WORLD HUNGER, Allensfield, Queens (Montclair, NY), 1976.
7) C. Gopalan, "Kwashiorkor and marasmus: evo-
nolution and distinguishing features," in McCanne 
and Widdowson, eds., CAUSES, DEFICIENCIES AND 
PREVENTION, Churchill (London), 1968.
8) A.G. Lunn, F.G. Whitehead, and W.A. Conward, 
9) P. Gopalan, "Protein-energy deficiency, " TRANS.
ATRAL ECONOMIC 27(1972), 1-24.
10) R.G. Hendrich, et al., "Aflatoxins and 
protein-energy malnutrition," TRANS. AMERICAN 
SOCIETY OF TROPICAL MEDICINE AND HYGIENE, 73:4 
(1979), 438-444.
11) S. -gel 
PRX'EIN DEFICIEKIES, Qlmhill (London 
and Widdm, 
SCCIETY 
HIND 
E?ITISH MEDICAL 
cultural development, 
Ldnr=ET ii (my 1974), 93-96.
12) R. G. &mdash, et al., "Aflatoxins and 
protein-energy malnutrition, " WORLD HEALTH ORGANIZATION, 27(1979), 109-117.
13) M.N.S. Seoane and M.C. Latham, "Nutri-
15) J.C. Waterlow and P.R. Payne, "The protein 
16) Gomez et al., "Malnutrition in infancy and 
childhood with special reference to kwashiorkor," 
ADVANCED PEDIATRICS 7 (1955), 131.
17) M.N.S. Seoane and M.C. Latham, "Nutritional 
anthropometry in the identification of malnut-
rition in childhood," JOURNAL OF TROPICAL MEDIC-
AL, ENVIRONMENT AND CHILD HEALTH 17:3 
(1971) 98-104.
18) J.C. Waterlow, "Classification and defini-
tion of protein-energy malnutrition," BRITISH 
MEDICAL JOURNAL, 3(1972), 566-569.
19) W. Keller, "Choice of indicators of nutri-
tional status," in Schonh, ed., EVALUATION OF 
NUTRITION EDUCATION IN THREE WORLD COMMUNITIES, 
(Nabokhov), World Foundation Publication 
20) W. Keller and C.M. Filburn, "Prevalence of 
protein-energy malnutrition," WORLD HEALTH 
21) LANCET editorial, "A measure of agreement 
22) L.S. Stephehson, M.C. Latham and A.A. Jensen, 
A COMPARISON OF GROWTH STANDARDS: SIMILARITIES 
AND DIFFERENCES BETWEEN NORTHERN, MEXICAN, AND PRIVILEGED 
AFRICAN CHILDREN AND DIFFERENCES WITH RESPECT 
TO RURAL CHILDREN. Cornell International Nutrition 
Monograph Series No.12 (1983), Ithaca, NY.
23) C. Gopalan, "Kwashiorkor, " NUTRITION 
FOUNDATION OF INDIA BULLETIN, 5:4 (1963),33- 
37. New Delhi.
24) J.F. Habicht et al., "Height and weight 
standards for pre-school children. How relevant 
are ethnic differences in growth potential?" 
LANCET i (1979), 611-614.
25) E.J. Mason, "Nutrition as a modulator of 
26) J.F. Grant, THE STATE OF THE WORLD'S CHILD-
27) L.C. Chen, A. Schanbry and S.I. Helfken, 
"Nutrimentoic assessment of energy-protein 
malnutrition and subsequent risk of mortality 
among pre-school children, " AMERICAN JOURNAL OF 
CLINICAL NUTRITION 33(1980),1836-1845.
28) A.A. Kielmann and C. Mcord, "Weight-for-age 
as an index of risk of death in children, " LAN-
29) L. Stephenson et al., "Relationships be-
tween Ascaris infection and growth of malnourished 
pre-school children in Kenya, " AMERICAN JOURNAL 
30) D.KT. Crompton and M. Asmah, "Malnutri-
tion's insidious partner, " WORLD HEALTH, March 
1984, 18-21.
32) M. Lubin and M. Zerach, "Aflatoxin 
and nutritional status, " JOURNAL OF CLINICAL 
33) W. Sirri and F.S. Aleman, "Fortification 
of sugar with vitamin A: background, evaluation 
and implementation, " in Metzner, ed., NUTRITION IN THE COMMUNITY, 2nd 
34) F.S. Skol et al., "An evaluation of strate-
gies to control vitamin A deficiency in the Phil-
ippines, " AMERICAN JOURNAL OF CLINICAL NUTRITION 
30(1979), 1445-1453.


55) J. Greiner, S. Alchor and M.C. Latham, THE ECONOMIC VALUE OF BREASTFEEDING, Cornell International Nutrition Monograph Series No. 6 (1979), Ithaca, N.Y.


Readers may contact Dr. Michael C. Latham, Professor of International Nutrition, in the Division of Nutritional Sciences, Cornell University, Ithaca, New York 14853-6301.

Hunger-related causes kill as many people in two days as the atomic bomb killed at Hiroshima.