

The fate of nations

Food and nutrition policy in the new world

Geoffrey Cannon

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Com meu amor

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Geoffrey Cannon

Lives and works in Brazil, has advised the federal Ministry of Health on international food and nutrition policy, and is a member of the steering committee of the global Alliance for Peoples Action on Nutrition. He advises the World Health Organization, and is an associate editor of and columnist for Public Health Nutrition.

As Director of Science, World Cancer Research Fund, he was responsible to WCRF for its first report on 'Food, Nutrition and the Prevention of Cancer: A Global Perspective'. He is now Science Advisor to WCRF International, and is working on its second report.

He was a member of the UK delegation to the FAO/WHO International Conference on Nutrition in Rome in 1992, and of the Brazilian delegation to the WHO Executive Board in Geneva in 2001. He is the former Chair of the National Food Alliance (now Sustain). He was a founder and Secretary of the Caroline Walker Trust, and Secretary of the Guild of Food Writers. He was married to Caroline Walker.

He is author of a number of books including 'The Food Scandal' (with Caroline Walker), 'The Politics of Food', and 'Food and Health: the Experts Agree'. His next book, developing this theme here, is 'The Fate of Nations'.

Previously he was a founder of New Society; chief editor of Radio Times; an assistant editor of The Sunday Times; and a journalist in print and broadcast media. He has won various UK national awards as a campaigner, writer and designer, and for achievement in public health.

The Caroline Walker Trust

The Trust was set up in memory of the nutritionist and campaigner Caroline Walker, who died in 1988.

The Trust's mission is the improvement of public health by means of good food - a cause which Caroline made important to everybody in this country.

The Trust, which relies on charitable donations, exists to further her work through research and publications.

Preface

Here I propose a new purpose and principles for nutrition science, and its expression in food policy. In my view, current mainstream nutrition science remains based on principles that partially worked in an old world, but that are now obsolescent, applicable at best only in special circumstances.

The discovery of the new world of the Americas led to the replacement of Ptolemaic by Copernican cosmology. Analogously, the world we experience now is very different from that of the mid nineteenth to mid twentieth centuries, when nutrition science was framed. Now we need a new map, a better frame for the world in which we live now.¹

Here I attempt the first lines of a broad-brushed sketch, with a few salient examples. The new map is already being envisioned by many colleagues. Others know better than I what I am writing about.

We are now living in a revolutionary period, in which nutrition science is ever more crucial to the future of humanity and also to that of the whole living and natural world. But nutrition and food policy can become an integral part of general public policy, as it once was and as it once again should be, only after its old purpose and principles are identified and set aside, and new principles put in place.

Guide to this text

In the first chapter following, I identify four linked principles still prevailing in mainstream nutrition science that should be set aside and replaced, and in the following three chapters I give examples of the application of these outdated principles in the past and now. I include some stories from the countries I know best, Britain and Brazil.

In the final chapter I suggest a new purpose and principles for nutrition science, with an example from my own experience of how these may work well in the common interest. After these chapters, there are notes indicated as for example¹, to give further explanation and related lines of thought. Then I acknowledge people who have influenced me; and list my references, cited as for example (WHO, 2003a).

A note about tone. I believe that science should not be discussed just in technical monotone. Nutrition and food policy is everybody's business, and I believe, as did the founders of the Royal Society, that the most vital scientific issues need dynamic expression and vigorous debate in plain language. Everybody concerned with the sustenance of the whole living world now and in future, is in a battle against dark forces.

Caroline's legacy

It is a pleasure to give the 16th Caroline Walker Lecture of which this text is the basis, for Caroline set me on my path, we wrote a book together (Walker, Cannon, 1984, 1985), we campaigned with many friends and colleagues, and were married.

The parable of the loaves and the fishes also tells us that the disciples of Jesus included men who knew how to take fish out of the sea, with partners who knew how to bake and cook. Caroline also knew what she was talking about. When she appeared on television and gave public lectures, she showed food. This helps to explain her abiding impact.

As a founder of the Caroline Walker Trust, I am proud to be a midwife of her immortality, evident at the Trust's annual evening of celebration at the Royal Society. She knew that speaking and writing should inspire action (Cannon, 1989). In Britain, she is still around, in the Trust, and in other organisations concerned with policy action, such as the Food Commission, of which in its original form she was a founder, and the National Heart Forum, whose key work was originally done by the Coronary Prevention Group, of which she was Secretary.

Caroline's work and example is very English; but I realised its value and power only after I left Britain to live and work in a world elsewhere, which for me is Brazil. Caroline's 'Prof' John Waterlow told me that her MSc thesis on food poverty (Walker, Church, 1978) gained the highest marks ever awarded up to that time at the London School of Hygiene and Tropical Medicine; and she prepared to live and work outside Britain in the wider world, in the tradition of the School, and of intrepid women of previous generations. But she was thwarted by illness.

Caroline remains a guide to what I write and how I act. She also reminds us to seize the day, that a short life may have its own purpose, and that we should live each year as if it is close to our last - which indeed it is.

CHAPTER 1

The old world

Like all disciplines, nutrition science is governed by a linked series of principles, and it is expressed in food and nutrition policies. As far as I can see, the current general purpose of mainstream nutrition science is to study interactions of constituents of food with biological systems, and to apply this knowledge to prevent disease and sustain human health¹. Such a general purpose is valid, but as I propose here, too narrow.

The big picture

Nutrition science and food policy are of vast importance. Since the middle of the nineteenth century when the discipline developed from the much older practice of dietetics, governments and industry have accepted the advice of nutrition scientists on how best to feed populations. The physical size and shape of much of the human race, with all this implies, is a result of the application of nutrition science (see chapter 3). Food policies based on nutrition science affected the outcomes of both world wars (Drummond, Wilbraham, 1991). After the creation of the UN system, nutrition science became a global enterprise, and it is now thought that the impoverished countries of the South need to be supplied with food or supplements by the rich countries of the North (George, 1986).²

Appropriate nutrition is vital not only for prevention of the deficiency diseases agreed to remain rampant in the South, and for increased resistance to infectious diseases especially of childhood (Scrimshaw, Taylor et al, 1968), but also for protection against chronic diseases including obesity, diabetes, heart disease and cancer. Nutrition is indeed everybody's business.³

Nutrition science affects human, animal and plant health, and also has cultural, social, economic, environmental and ecological dimensions which I believe should be integrated into its principles and purposes. Further, it is part creature, part creator of the industries that produce most of the food consumed in the world.

We can understand current and future issues only when we are aware of past decisions that have shaped the world in which we live, and when we are sensitive to the dynamic nature of perceived reality and felt needs.⁴ This introductory chapter touches on the contexts of food policies, and of nutrition science since its beginnings until now, and for the future.

The cost of mangoes

My main professional interest since the early 1980s has been nutrition and food policy.

When I left Britain for Brazil in 1999, I guessed that from then on I would see things differently. I was right. In the North the main concerns are those of the consumer. In the South families and communities are one part of the food systems that include food supplies 'from plough to plate', which affect all of life (Sobal et al, 1998). From a Southern point of view, preoccupation with the individual consumer is selfish, and also foolish and pitiable.

Here are two stories about food policies, which may at first seem not relevant from a Northern point of view. Both are about fruit. Both are also about consumers, producers and the wide world.

Consumption of lots of vegetables and fruits helps to prevent chronic diseases. Diets high in a variety of vegetables, fruits, legumes (pulses) and other plant foods, protect against deficiency diseases and increase resistance to infectious diseases. This is all now agreed (WCRF, 1997; Cannon, 2003a; WHO, 2003a; Ministério da Saúde, 2003). So food policies designed to increase production and consumption of vegetables and fruits should be good news for people everywhere.

But much depends on who you are: a privileged consumer, or an impoverished producer, for example.

In January 2003 I walked out of my apartment building in Brasília, an original block on the Asa Sul (South Wing) opened by President Juscelino Kubitschek himself in 1960, went to the newsstand on the corner, and bought that day's *Correio Brasiliense*. The front page lead story showed the new Brazilian President Luiz Inácio Lula da Silva addressing the World Economic Forum in Davos, advocating a new world social and economic order (Domingos, 2003).

A mango landed in the grass, fallen from the mangueira (mango tree) whose shade makes the newsstand a pleasant place to pass the time of day. I ate the mango for breakfast. Its scent and flavour fresh from the tree gave me a vision of a world in which fruit trees grow in all possible public places, as in Brasília.

Fifty years ago, what is now Brazil's capital city was in the middle of the vast sparsely populated upland cerrado, the Brazilian savannah. The city was designed by three men, including Lúcio Costa and Oscar Niemeyer. The third man was the landscape architect Roberto Burle Marx, who ordered the planting of countless thousands of trees, including Brazilian native and established fruit trees bearing avocado, pitanga, jamelão, cacao (cocoa), limão (lime) as well as manga (mango), and the protection of already growing native cerrado fruit or nut trees like the jaboticaba and buriti, and goiaba (guava) and pequi, some of whose fruits are intensely rich in vitamin C or A (RSC/MAFF, 1991; ENDEF, 1981).

Some weeks afterwards, on my daily walk to my local supermercado, I saw Elias my regular driver throwing a stick into the branches of another tree whose leaves give shade to his taxi. He was knocking down avocados. On my return, he got up from a game of dominoes under the mangueira and gave me four giant fruits. They were the first course for my suppers for the next eight evenings, again - as I thought - for free. Forty years on, the trees of Brasília are fully grown. Burle Marx has recreated a commons in a modern city.⁵ The mango and avocado trees bear fruit for everybody. I envisioned parks and streets in cities, towns and villages everywhere, full of fruit-bearing trees - like in Britain, apples, pears, plums, damsons, cherries, and walnuts, hazelnuts and cobnuts (NFA/SAFE, 1996). This I felt could be a universal food policy with all sorts of righteous aspects. Free fruit for the world!

So far this story is enthusiastic. The whole story is bitter. Yes, lower class people who spend their days in the central Plano Piloto before catching a bus home to the 'satellite cities' ten or twenty kilometres distant, sometimes do forage for fruit. But middle class people think of fruits on the trees as rubbish, dirty and wormy. For them, like consumers in the North, fruits come from shops, safe and clean, in bags. Kids play football with windfall mangoes.

And while the price of the fruit on the trees of Brasília is free, their cost is high. Railways are the first reason. Later in the year, I found out why so many lines in Brazil have been ripped up, abandoned, or used only for goods. There are some passenger routes left, as seen in the Walter Salles movie 'Centro do Brasil', but nothing like a national network. But why? In Brazil, skilled labour is plentiful and cheap, secure work is a plank in every government's policy platform, and much of the country is relatively level. A national railway network run on economic and on social lines, as in India (Cannon, 2003b/3), would have been a precious national resource.

Why, is that in order to establish the new capital of Brazil within the then almost empty interior, with links to Rio de Janeiro, São Paulo and elsewhere, Kubitschek did a Faustian deal with foreign investors. The deal was to destroy the national railway system. Brazil became a country of highways and automobiles. Now, people without cars or taking long journeys almost always have to use coaches, more expensive than trains need be, and vulnerable at night to highway robbery by armed gangs.

This is one of the costs of my mango. The greater cost is foreign debt. Vast loans were taken out to build Brasília. Debt and inflation created economic, social and political instability, the overthrow of two elected Presidents, and twenty years of military rule. Brazil became a stable democracy only in the 1990s. Eight years after Brasília was inaugurated, all automobiles constructed in Brazil were made in foreign-owned factories, of which 90 per cent were owned by Ford, General Motors and Volkswagen (Fausto, 1999; Galeano, 1997).⁶

In Davos in 2003, Lula denounced the intolerable burden of Brazil's foreign debt incurred by his predecessors. Unless a new equitable deal is struck, Brazil's vast foreign debt remains a social and political powder keg. The true cost of mangoes from the mangueiras of Brasília is high. In January I thought I had found a model for a sustainable food policy based on sound principles. I was wrong.

Yes, we have bananas

My second story is from the 1940s, when I was a pupil at Ambler Road LCC elementary school in Finsbury Park, north London. My class learned about the Empire and Commonwealth from food labels. The teacher put a world map on the wall. I was impressed by all the countries coloured red. We were asked to bring labels from our mothers' larders, to be fastened by the sides of the map and connected by a string to the country of origin.

Tea from India, and from Ceylon. Butter from Australia. Oranges from South Africa. Lamb: a flag from the butcher in Blackstock Road, 'prime New Zealand, 1s 9 1/2d a lb'. Oranges? Strings to South Africa and Palestine. Bananas? A string to Jamaica. Sugar? A string to Barbados and other West Indies islands. Dates, Egypt. Corned beef? Argentina and Uruguay were not coloured red, but were joined up to Britain too, possibly because our teacher understood commercial imperialism (Galeano, 1997; Davis, 2001), probably just to encourage us.⁷

As a kid I thought this was amazing. Postage stamps gave me the same feeling, that the women and men pictured in the fields were smiling at me. Later I took novels by Upton Sinclair (Sinclair, 1955) and John Dos Passos (dos Passos, 1938) from my father's shelves and read them, and realised that the people in the fields had little to smile about.⁸

Here is my second story, about bananas. I was offered my first banana by an aunt in 1946, who laughed when I sucked it. Bananas are nutritious. They come in handy natural packages. Tennis stars eat bananas between sets. They are good for the health of the consumer, and their price in the shops is low.

Up to 40 million tons of bananas are grown every year, and three-quarters of exported bananas come from Central and South America and the Caribbean (McClatchey, 2000). The banana republics of Central America are so-called because bananas have been or are their main cash crop, whose production and sale has since the late nineteenth century been controlled by US corporations, notably the United Fruit Company, also known as *el pulpo* (the octopus). United Fruit forces the cost of production and distribution down, which keeps bananas cheap in the shops, and also has the effect of making rural people landless and destitute.⁹ The price of bananas in the shops is low. Their cost to the countries in which they are produced is high.

Similar stories can be told from all over the world (Oxfam, 2002; UNCTAD, 2002). Most thinking consumers in the North may know that food is a political issue. Southern producers know so without having to think.

The context of nutrition and food policy

To recommend a global commons of fruit trees on the basis of what has been done in Brasília would be to overlook the insupportable cost of the construction of the city.

Recommending an increase in consumption of bananas and other tropical fruits on a global basis without considering the impact on their producers, may create more inequity and instability. For the impoverished producer, these are issues of life and death. For the rich consumer, these are now issues of prudence as well as justice. Yesterday's dispossessed farmers sometimes became insurgents. Today's dispossessed farmers may become transnational terrorists.¹⁰

It is now well understood that intensive food systems favouring animal over plant foods devastate the immediate environment (Lappé, 1971; McMichael, 1993; Vidal, 1997; Leitzmann, 2003). It is also becoming well known that modern food systems generating energy-dense fatty, sugary, salty food supplies, involving intensive farming of animals with exponential use of agrochemicals and drugs, are not only a menace to human health, but also have created vast and often irreversible global ecological devastation (Robbins, 1987; McMichael, 2001; Schlosser, 2002).

Now that Marshall McLuhan's vision of the 'global village' is manifest, I believe that nutrition scientists and food policy makers should accept that such wide dimensions and implications are their business, and are intrinsic to their work. If good people remain silent, the moloch of unregulated economic globalisation will trample any prospects of a good life on earth for future generations (Stiglitz, 2002; McMurtry, 2002; Magdoff, 2003).¹¹

My stories about mangoes and bananas are vignettes: for the crops in the fields, the fruit in the trees, the animals in the sheds and the food in the shops, are not there by chance. Here in a few pages is the story of the place of food and nutrition in human history.

Homo sapiens emerged perhaps around 200,000 years ago, and for almost all of the time between then and now, humans have been foragers, gatherer-hunters and then pastoralists, whose food came from the plants and animals in nature (McMichael, 2001).¹² Then within the last ten thousand years, the human-made environments of villages, towns, cities and empires were made possible by agriculture. It seems likely that humans evolved with the food naturally around them, and then adapted to the food they cultivated in ways suitable to climate and terrain.

Then beginning in the eighteenth century, and with accelerating velocity in the mid and late nineteenth century, a sequence of scientific and technological developments created new food systems, at first in Europe.

Britain was the first country to be industrialised, in ways that during its time of greatest power also had direct impact on the countries of its Empire and Commonwealth, on other European countries, and on the USA. The food supply of the dramatically increased British urban population was transformed, and most of all in just 20 years between 1870 and 1890. White bread became mass produced from flour ground on the new steel roller mills that replaced stones. Refined sugar flooded the market after the lifting of sugar taxation, and generated jam, biscuit, chocolate, cake and confectionery industries. The mechanisation of slaughter using railways, disassembly lines and refrigeration, made meat and its products cheap everyday food for the masses. Canning and bottling made processed foods with cheap ingredients staple items on grocers' shelves. Not all but most of these developments degraded the nature and quality of food.

In the early twentieth century the hydrogenation process was invented, and used to make hard table margarines and cooking fats from the cheapest oils and fats available anywhere in the world. Nutrition scientists rationalised these developments, for example advocating sugar and fat as energy foods (Drummond, Wilbraham, 1991; David, 1977; Mintz, 1985; Giedion, 1942; van Stuyvenberg, 1969; Cannon, 1987).

In the mid nineteenth century British food was mostly starchy and processed on an artisanal basis from local resources. In the early twentieth century it was mostly fatty and sugary, increasingly mass manufactured, and imported from all over the world (Drummond, Wilbraham, 1991).

These dramatic demographic and nutritional shifts were then repeated, at first throughout the North, in North America, other European countries, and the British Dominions. There is no reason to believe that humans can adapt to such abrupt change in the nature and quality of food supplies (Hegsted, 1978). Indeed, babies born to parents accustomed to traditional foods, that are fed energy-dense foods, are evidently most vulnerable to chronic diseases (Barker, 1998).¹³

Phase One. Deficiency and infection in the North

Nutrition science as a useful discipline has three phases. In its first phase of expansion and success, roughly between 1850 and 1950, governments, industries and scientists worked in unison, to engineer the food systems of industrialised countries. Attention focussed on babies, children, and young adults. The purpose was to eliminate deficiency diseases, reduce vulnerability to infectious diseases, and breed big tall strong populations.

The common people of Britain suffered the Industrial Revolution in its first most crude and cruel form. The peasantry had been destroyed, driven off their land into the new cities. The new working classes lived in squalor and darkness, mothers often had to feed their babies on crude formulas and feed their families on store food, and so the common people became weak, stunted, deformed and diseased.¹⁴

The demographic and nutritional shifts that were aspects of the Industrial Revolution caused dramatic increases in nutritional deficiency and infectious diseases (Dubos, 1959, 1987; McKeown, 1979). A hundred years ago population health in Britain was worse than that of practically all countries in the world now. A quarter of children died at birth or in infancy. Rickets, tuberculosis, bronchitis, pneumonia, dysentery, typhoid, typhus and cholera were rampant (McKeown, Record, 1962; Howe, 1972).¹⁵ Average expectation of life in Manchester in the 1880s was 29 years for men and 33 years for women and, in 'healthy' areas of England, 51 years for men, 54 for women (Glass, Eversley, 1965; Mathers, Sadana et al, 2001). An official Committee on Physical Deterioration noted in 1904 that half the men recruited to fight in the Boer War were too weak to carry arms, and the minimum height for British soldiers was lowered from 5 foot 6 inches to 5 foot (1.67 to 1.52 metres) (Drummond, Wilbraham, 1991).

This was the context for the development of nutrition and food policy in Britain, and in Europe, the USA and other Northern countries. The science on which these policies were based was created and flourished in response to the shattering impact of industrialisation on public health.

The British ruling classes became preoccupied with the condition of the poor partly for fear of proletarian revolution, and partly for fear of wars in which Britain would be defeated and lose its Empire.¹⁶ With knowledge of protein as a growth promoter (see chapter 3) and later of the role of vitamins and minerals in prevention of deficiency diseases, governments accepted the advice of nutrition scientists, of whom John Boyd Orr became the best-known (Boyd Orr, 1936).¹⁷ During both world wars rations for soldiers were formulated according to current knowledge of nutrition, and in the Second World War the British national food supply was manipulated so as to become more nourishing.

Thus in Phase One of nutrition science, food policies became part of central government policies in Europe and North America. The overall objectives of successive governments were internal social security, competitive advantage over other industrialised nations, and domination of the rest of the world. Consequent food and nutrition policies included legal, fiscal, regulatory and other methods affecting price, availability and quality. They succeeded.

Phase Two. Chronic diseases in the North

Phase Two of nutrition science, of contraction and fragmentation, can be dated roughly between 1950 and 2000 - and continuing. Attention has focussed on middle-aged people. In this phase governments generally have withdrawn from active commitment to public health, have resisted interventions designed to improve food systems, and have stated their intention to encourage people to look after themselves. The purpose has been to reduce the incidence of chronic diseases, and keep individuals healthy into old age.

In the North after the Second World War, nutritional deficiency and infectious diseases were replaced as mass epidemics by debilitating, disabling and deadly chronic diseases.

These include gut diseases, obesity, adult-onset diabetes, osteoporosis, coronary heart disease, and cancers of the colon and rectum, breast, ovary, womb and prostate; and also constipation, dental caries, hypertension and stroke, and cancers of the mouth and throat, stomach and cervix, which had already become common (WCRF, 1997; WHO, 2003a). Coronary heart disease and cancer rapidly became the two leading causes of premature death in most if not all industrialised countries. Between the 1960s and the 1990s it became generally agreed that an important immediate cause of these diseases is the diets typically consumed in the North, energy-dense and high in fats, saturated fats, sugar, salt and alcohol (Cannon, 1992; WCRF, 1997; WHO, 2003a).¹⁸

Governments became concerned about chronic disease after pressure from progressive academics and health professional and civil society organisations, amplified by the media; no doubt because politicians, officials and their families are themselves vulnerable; and also because of the costs of treating these chronic diseases and of loss of productivity, estimated in the USA in 1998 at over \$US 550 billion (Lang, 2003).

However, the *laissez-faire* ideology prevailing since the 1980s is hostile to legal, fiscal and regulatory intervention in the public interest. Food and nutrition policies have been mostly restricted to information and education. Guidelines are regularly published by UN agencies and national governments, and (see chapter 2) the food manufacturing industry has agreed to list some chemical constituents of processed food on standardised nutrition labels, with the stated objective to encourage individuals to choose to purchase and consume more nourishing food.

Phase Two recommendations to prevent chronic diseases in middle age, conflict with Phase One policies to grow big babies and young people. This dissonance causes confusion and scepticism. Here is an example from my campaigning days in Britain (Walker, Cannon, 1985; Cannon, 1987).

In the mid 1980s the British health ministry commissioned a report on the diets of

schoolchildren that was shelved on the instructions of the then Prime Minister, Mrs Margaret Thatcher.¹⁹ A copy was sent to me. National newspapers splashed the story, and Granada TV mounted a special investigation. The Guardian then reported: 'The leaked report showing that schoolchildren's diet consists largely of crisps, chips and biscuits, is to be released' (Veitch, 1986). A government advisor said: 'This is the sort of diet which has been condemned both in this country and in many countries in the world as the one most likely to lead in later life to a whole variety of ill-health'. He specified heart disease and cancer (Granada TV, 1986).

The response of the then Health Minister was revealing. Evidently briefed by civil servants still coming from Phase One, he said: 'A report which shows that the children studied are taller and heavier than people expected and the standards that apply; what can be wrong with that?' (Granada TV, 1986). Indeed, fifty years previously the findings of the survey would have been thought a triumph.

Decline and fall of nutrition science

In the last half century, the impact of nutrition and food policy on the health and welfare of the whole world has become ever more evident. But nutrition science became trivialised in its second phase, and continued to work by Phase One principles. After decades of expert reports, expert consensus and media coverage, it is well-known that nourishing food to which most people in the North have access and can afford, including a plentiful variety of vegetables, fruits and other foods and drinks relatively high in nutrients and low in energy, protects against chronic diseases (Cannon, 1992; WHO, 2003a).

But many nutrition scientists, discouraged by the prevailing ideology that has also privatised public health, have shrunk into industrial and technical work and become aloof from public policy. And the restriction of nutrition and food policies to information and education, implies that obesity, heart disease, cancer and other diseases are the result of duff genes (heredity) or bad habits ('lifestyle').²⁰

The approach generally adopted by governments to food and drink is strikingly different from those for control of smoking of tobacco and drinking of alcohol, whose supply and demand is modified by taxation of price and regulation of advertising and marketing.²¹ The public in the North has become correspondingly apathetic. It takes big food or bug scandals, that threaten government and industry and interest civil society and the media, to provoke sustained public debate (Walker, Cannon, 1984, 1985; Cannon, 1995).²²

In Phase Two, nutrition science-based policies have been agreed by health ministries and sometimes also food and agriculture ministries, throughout the industrialised world. But governments have not seen any need to integrate these policies with those

of other ministries, for example those responsible for industry, employment and trade, and health ministries are usually also responsible for the welfare of the disease treatment professions and industries.²³ Perhaps with the partial exception of coronary heart disease, policies in which food labelling and exhortation have been unsupported by government intervention have failed.²⁴

Phase One principles, which historically had value for those parts of the world in which they were devised, have persisted and are still applied throughout the world (this is a theme of chapters 2-4).

Thus, nutritional deficiencies are common throughout the South, impoverished because of the rapacity of the European colonial powers, and hollowed out by the current economic and political policies of the most powerful countries. These continue to have the same sort of impact on the world's common people as the original industrial revolution had on the common people of Britain, Europe and the USA (Goldsmith J, 1994; Stiglitz, 2002; McMurtry, 2002; Oxfam, 2002).

As remedies, the US Agency for International Development (USAID), other Northern governments, the World Bank, and relevant UN and other agencies, distribute, sell and promote food of minimum nutritional standard as famine relief, together with nutritional supplements and foods 'fortified' with vitamins and minerals, with the declared purpose to eliminate deficiency and reduce infectious diseases (see chapter 4). Like all forms of charity, these policies overlook the underlying and basic causes of diseases, and at best have had limited success (WHO, 1990a; Pinstrup-Andersen, 1993; Jonsson, 1993; IFPRI, 2002).²⁵

Nutritional deficiencies are now uncommon in the North. Nevertheless, education and information programmes, some like food labelling devised jointly with industry, continue to imply that a large number of deficiencies, including some that were never common, are major public health issues (see chapter 2). Phase One policies also persist in rich countries in the form of encouragement of 'bonny bouncing' fat babies, and fortification of basic foods like bread and milk with vitamins and chemical elements. And a flourishing 'health food' industry markets vitamin, mineral and other pills and potions, often at levels far above those obtainable from food, to treat and prevent all sorts of diseases.²⁶

Phase Three. The global triple whammy

Phase Three of nutrition as a useful science and of its renaissance can be dated as from 2000. International non-government organisations will take the lead, working with UN agencies, national governments and electronic and print media, with the support of progressive scientists (in chapter 5 I give an example of such collaboration). The purpose of nutrition science now and in future should be to create the conditions in

which nutritional deficiency, infectious diseases, and chronic diseases all become increasingly less common throughout life, in the context not just of human health, but also that of the whole living and natural world.

The need for nutrition science and food policy to restore its original ambition and achievement should be almost self-evident.

In the North urbanisation, industrialisation, the transformation of food systems, and the consequent emergence of mass epidemics of nutritional deficiency, infectious diseases and then of chronic diseases, occurred with phenomenal speed between the late eighteenth and twentieth centuries.

These linked sequences of demographic, nutritional and epidemiological transition are now occurring all over the world with exponential velocity, as a result of the current crude and cruel form of economic globalisation. Rates of diabetes in early life, and also of obesity, itself a cause of premature death from heart disease and cancer, are now rocketing in many countries in Asia, Africa and Latin America (Cannon, 2001; Popkin, 2002; WHO, 2003a).

Nutritional deficiency and infectious diseases are no longer overwhelming burdens in those countries of Europe and North America that became rich and are becoming richer by exploiting the rest of the world. But for the impoverished countries of Asia, Africa and Latin America, colonialism in any form is not an option. And on a population basis, nor is medical and surgical treatment of chronic disease. The only feasible and rational approach is prevention (WCRF, 1997).

In the South nutritional deficiencies persist; old and new infections such as tuberculosis, malaria and HIV-AIDS are often out of control; and also chronic diseases have become epidemic. This triple burden on already impoverished countries is crushing Southern Africa, and is liable to destroy not only the health but also the cultural integrity, economic viability and political cohesion of other regions of the world. This is a human-made global disaster whose underlying and basic causes are not yet being effectively addressed (FAO/WHO, 1992; ACC-SCN/IFPRI, 2000; Gillespie, Haddad, 2001).

A new vision and a new map

The main purposes of this text is first to face what confronts us, and second to propose ways in which nutrition science and food policy can play a leading part in the prevention of disease and the sustenance of health in the fullest sense, in its third twenty-first century third phase.

It is first necessary to recognise the prevailing principles of nutrition science, which

remain stuck in the glory days of its first phase, and to replace them with new principles that work well now and in future. Here are four Phase One principles that still prevail:

- 1 The key to food is its chemical and biochemical division
- 2 The measure of good health is accelerated growth in early life
- 3 Food from animal sources is preferable to food from plant sources
- 4 Human health is separate from that of the living and natural world

In the next chapters I propose that these principles are at best of only limited use and should now be replaced. In these chapters I select principles 1-3 above, and give examples of their application to nutrition labelling, to animal protein, and to vitamin A. The whole text alludes to the fourth principle. In the concluding chapter I outline what I believe to be good nutrition and food policy principles, with the example of the new global strategy on infant and young child feeding (WHO, 2002).

Nutrition scientists now are confused, as were the Iberian sailors on their great voyages of exploration half a millennium ago, who became increasingly uneasy as they found that their celestial reckonings, based on Ptolemaic principles, were not a good guide to the new world they were discovering (Kuhn, 1957, 1962).

Likewise, many nutrition scientists now are perplexed by the paradoxes they encounter in their work, and the mismatches between what they have been taught and what they find in the world. How can policies designed to prevent nutritional deficiencies be reconciled with policies designed to protect against chronic diseases? How can consumers enjoy cheap food while producers sustain equitable livelihoods? How can traditional food cultures survive the invasion of transnational fast food chains? In the face of these and other quandaries, some nutrition scientists and food policy makers have put the old maps away, and are steering their own path.

The task is to make new maps based on principles that fit the world in which we live now.

CHAPTER 2

Chemistry, and food labels

The first original and surviving general principle of mainstream nutrition science and its expression in food policies, is that the key to food is its chemical division. Food is separated into elemental and other chemical constituents, and their biochemical effects examined. The case given in this chapter is nutrition labelling.

What principles?

A place to find the rationale and structure of a discipline is in the contents lists and general statements of its basic textbooks. For nutrition science, take 'Human Nutrition and Dietetics', a foundation text all over the world (Garrow, James et al, 2000).¹

After an historical chapter, its first section digests current thinking on body composition and energy, then carbohydrates, proteins, fats, alcohol, water and electrolytes, then minerals and vitamins, and then gene-nutrient interaction.

The next section on food works in parallel. There are chapters on food composition, cereals, vegetables and fruits, meat, fish and eggs, milk, fats and oils, drinks, herbs and spices, food processing and consumer protection. These are mostly descriptive, with details of nutritional composition. For example, on a page opened at random on meat, the reader is told that dog is 60.8% water, 14.5% protein and 23.5% fat, camel is 59.1% water, 19.6% protein and 20.3% fat, and frog is 83.6% water, 15.3 per cent protein and 0.3 per cent fat.

The third and fourth sections have chapters on special situations, deficiency diseases, and nutritional aspects of some chronic diseases in random order.² The structure of the previous edition (Garrow, James, 1993) is much the same; a difference between them and earlier editions is the addition of chapters on chronic diseases.

I have not found any explicit statement of basic principles in the book.³ However, like all disciplines, nutrition science has governing principles. As far as I have found, these are not stated explicitly, but are implicit, in textbooks and scientific reports and articles.

They are also implicit in the reference text for nutritionists, dietitians and specialist writers, 'The Composition of Foods', originated in the UK and also used all over the world (FSA, 2002). Here foods are divided into energy, water, protein (and nitrogen), fat (various fractions, and cholesterol), and carbohydrate (starch, sugars, dietary

fibre). Then there are analyses of twelve chemical elements and of fourteen vitamins. Since the 1990s such analyses have proliferated electronically (Southgate, 2002a).

So the first general principle of nutrition science is now evident. A further clue is provided by the co-publisher of earlier editions - the UK Royal Society of Chemistry (RSC/MAFF, 1991).⁴

Of course a chemical approach has value. But why should the only 'scientific' approach be one that divides food into constituent parts? ⁵ To identify the chemical principle, is to question its supremacy.

A meditation on porridge

I now give an example of the application of the chemical principle to food policy: nutrition labelling of processed foods.

Take porridge. In August 2003, while the thermometer in England soared to 100°F, midwinter temperatures in my part of Brazil were dropping to 10 or even 5°C at night. So I made porridge for breakfast, from oats, honey and cinnamon.

While I stirred the oats in simmering water and as they changed from flakes to sustaining gumminess, I looked at their nutrition label, and those of milk (commonly used in porridge, though not by me), honey and cinnamon. I have been thinking and writing about nutrition labelling since the 1980s. Perhaps because I was now studying the labels in a foreign language as if for the first time, I noticed how strange they are.

Nutrition labelling was introduced in the USA in the 1970s and in Europe in the 1980s. In Brazil laws requiring nutrition labelling were made in 2000 (Southgate, 2000b; Anvisa, 2000). Nutrition labels are the most ubiquitous chemical information ever: a household may stock scores of them, and the family may browse information about carbohydrates, cholesterol and niacin printed on the side of ready-to-eat breakfast cereals, wrapped bread, milky drinks and other products, at breakfast. But what is nutrition labelling for, and what use is it?

Nutrition labelling is in addition to ingredient or 'recipe' labelling, in which the items that make up processed food are listed in descending order of weight. It was introduced as a nutrition science Phase Two strategy, after the evidence that food supplies and diets high in fat and saturated fat are an immediate cause of coronary heart disease was accepted by governments to be irresistible. Nutrition labels include details of chemical and other constituents of processed food considered most relevant in the context of chronic diseases, in particular coronary heart disease, and are meant to give purchasers information to guide their choices. Fresh food is usually not labelled.⁶

THE CHEMISTRY OF PORRIDGE

	Oat flakes		Full fat milk*		Honey		Cinnamon	
	cals/g	%DV	cals/g	%DV	cals/g	%DV	cals/g	%DV
Calories	150	6	130	5	20	1	4	0
Carbohydrates	23g	6	10g	3	5g	1.5	1g	0
Proteins	5g	10	7g	14	0g	0	0g	0
Total fat	4g	5	7g	9	0g	0	0g	0
Saturated fat	0.5g	2	4g	16	0g	0		
Cholesterol	0mg	0	30mg	10	0g	0		
Dietary fibre	4g	13	0g	0	0g	0	0g	1
Calcium	26mg	3	239mg	30	1mg	**	9mg	1
Iron	0.6mg	4	0.16mg	1	0.05mg	**	0mg	2
Sodium	0mg	0	85mg	3	0mg	0	0mg	0
Vitamin A			240mcg	30				
Vitamin D			1.5mcg	30				

For each food, the second column shows the Brazilian daily value (DV) for a portion as specified by regulation, which is 40g of oats, 200ml of milk, 5g of honey and 1g of cinnamon. DVs are based on a daily intake of 2,500 calories, taken to be the average in Brazil. *Milk fortified with vitamins A and D.

** Less than 1% of the DV. Blank cells - no values given.

As can be seen from the chemistry of my breakfast porridge in the table here, nutrition labels in Brazil are similar to those in Europe and the USA. Each portion of porridge with milk supplies 304 calories. This is 12 per cent of the energy 'daily value' of 2,500 calories as specified for the official Brazilian reference person. Calories are one of the 'Big Four' - calories, carbohydrates, proteins and total fat - listed on nutrition labels with their weight in grams, and the percentage of the DV contained in a designated portion of the food.

What is the point of information about calories? Are mothers being encouraged to give their children a Phase One rib-sticking energy-packed breakfast? But few people likely to read nutrition labels are in energy balance at 2,500 calories a day; most basically sedentary women will gain weight if they consume an average 2,000 calories a day. So is the calorie information a Phase Two warning against calorie-dense foods? Or, for families that include members who are too thin and also too fat (Doak, Adair et al, 2000), is it both?

Next come carbohydrates, compounds of carbon (as dioxide) and water (hydrogen and oxygen), originally identified as a chemical constituent of food in the 1820s (Harper, 2000). The table shows that the porridge contains 10.5 per cent of the carbohydrate DV. But lumping starches and sugars together as carbohydrates, is

worse than useless. Practically all dietary guidelines designed to prevent chronic diseases recommend more starchy foods and dietary fibre, but less added sugar (Cannon, 1992; Freire, Cannon et al, 1994).

Stripped of fibre, vitamins, minerals and other bioactive compounds, including many poorly understood and doubtless others not yet identified, sugars are 'empty calories', of value only as a source of energy; and refined starches also have little other value. Indeed, there is good evidence that diets high in refined starches and in sugars are an immediate cause of obesity and so also diabetes (RCP, 1980; Englyst, Hudson, 2000; Liu, Willett et al, 2000).

Useful information to protect against tooth decay, obesity, gut diseases, and chronic diseases whose risk is increased by obesity, is not about chemistry but overall quality, not carbohydrate content but degree of processing and refinement (WCRF, 1997; WHO, 2000a; WHO, 2003a). Information on carbohydrate content of foods fails the 'why am I being told this?' test.⁸

The next item on the nutrition label is proteins, also made up from carbon, hydrogen and oxygen, plus nitrogen. Without milk, my porridge contains 10 per cent of the DV for protein; plus milk, 24 per cent. Protein was identified in the 1830s as having special value, rather like vitamins and minerals. Belief in protein characterises Phase One nutrition science (see chapter 3).

So are nutrition labels designed to make consumers think that products relatively high in protein are for this reason healthy? The dairy industry boasts about the protein in milk, but keeps quiet about its fat and saturated fat content. Anybody likely to use nutrition labels almost certainly consumes surplus protein (FAO/WHO/UNU, 1985; DOH, 1991). This information is useless, and if it draws consumers to foods high in protein and also in saturated fats, is pernicious.

Useful is not merely chemical

The fourth of the 'big four' items on the label, is fat. Labelling of fat and saturated fat content of processed foods is useful Phase Two information. Thus, it is fairly easy to see that porridge made with full-fat milk contains a lot of fat and saturated fat, because the figures of 14 and 18 per cent of the DV are high relative to its energy content. When consumers know that it is best to eat less fat and saturated fat, a look at the label may prompt a prudent decision to switch to low-fat products, or like me, to avoid the product.⁹

Fat labelling is useful, because it is certain that food supplies and diets high in total fats and saturated fats cause heart disease, obesity, and other diseases (WHO, 2003a). By contrast, the significance of carbohydrates and proteins as such is minimal.

There is a basic difference between carbohydrates and proteins, which are chemical entities, invisible, intangible and insensible, and fats. Fats and oils, while having a chemical composition, being made up from carbon, hydrogen and oxygen; can often be seen and touched, as in the cream of full-fat milk, table and cooking fats and oils, and the fat of meat; and the taste of fat and its feel in the mouth is distinctive.

So the second reason why information about the fat content of food is useful, is because fats and oils are not just chemical constituents of foods, they are foodstuffs. That said, the same point that applies to starches and sugars also applies to fats: from the health point of view, the main issue is type and degree of processing not only of manufactured products but also of the animals turned into these products (Ascherio, Katan et al, 1999).¹⁰

The next item on the nutrition label is dietary fibre. Food supplies and diets high in fibre may well protect against a range of gut disorders and diseases (RCP, 1980; Trowell, Burkitt et al, 1985). The value of fibre itself in prevention of obesity, diabetes, heart disease and cancer is less clear, but plenty of whole and minimally processed vegetables, fruits and cereals, high in fibre, certainly protect against these diseases (WCRF, 1997; WHO, 2003a).

Information about dietary fibre on nutrition labels is also useful.¹¹ Dietary fibre resists chemical definition and is diverse, and the term is biological and botanical. One definition is 'that portion of food derived from the cellular walls of plants which is digested very poorly by humans' (Trowell, 1985). Fibre is found 'in different plants and in different parts of the plant - for example root, stem, leaf, pod and seed - and at different stages of growth' (RCP, 1980).

In the UK fibre is defined as 'non-starch polysaccharides', fractions of carbohydrates chemically identifiable and measurable as being insoluble in a solution of 80 per cent alcohol, a process meant to mimic digestion (DOH, 1991). This chemically-derived term has not caught on internationally.¹²

So far then, inasmuch as nutrition labels list chemical constituents of processed foods, they are useless or worse than useless, unless these constituents are also foodstuffs, or tangible. The problem is not nutrition labelling as such, it is the persistent Phase One principle of categorising food in terms of its chemistry.

Branded breakfasts

Now for some branded and energetically advertised and marketed foods also consumed for breakfast in Brazil: Kellogg's 'Sucrilos' ready-to eat cereal, plus full-fat milk, and Nestlé's 'Nesquik' ready-to-drink fruit-flavoured sugary milky product. As with my porridge, their nutrition labels are shown in the table that follows.

The composition of the branded breakfast as shown in the top half of its combined nutrition label seems much like porridge. Calories: 345 compared with 304. Carbohydrates: 16.5 per cent of DV (because of added sugar) compared with 10.5. Protein: 15 per cent of DV (22 if milk was doubled) compared with 24. Fat and saturated fat, 10.5 and 20 per cent compared with 14 and 18 per cent (difference in proportion is because most fat in oats is unsaturated). Cholesterol, both 10 per cent of DV. Dietary fibre is different: 3 per cent (the corn in 'Sucrilos' is refined), compared with 14 per cent (the whole oats of porridge).

So far then, any parent relying on nutrition labelling might think it was a toss-up between the two breakfasts, and will know that kids enjoy the Kellogg's 'sugar bear' as featured on television, and the trendy packaging of 'Nesquik'. Porridge might be chosen only by parents who know that high fibre content is a marker for generally nourishing food, or who prefer food in whole form to products whose labels look like those of chemistry sets.

But now look at the lists of minerals and vitamins on the two labels. Three minerals are standard on Brazilian nutrition labels. Iron is a Phase One item, the unstated purpose being to consume more, to reduce the risk of anaemia. So a high DV score as from 'Sucrilos', fortified with iron, is 'good'. Calcium and sodium are Phase Two items, the unstated purpose being respectively to consume more (to reduce the risk of osteoporosis), and less (to reduce the risk of high blood pressure and stroke). So a high DV score for calcium in which milk is rich, is 'good', and a low score for sodium, as contained in 'Sucrilos' with its added salt, is 'bad'.

Anaemia is the presence below specified levels in the blood of haemoglobin, a protein that contains iron and carries oxygen. It shows clinically as physical and mental lethargy, and is agreed by UN and other agencies to be the most common nutritional deficiency throughout the world (UNICEF, 1990; World Bank, 1994; Allen, Gillespie, 2001). But isolating the chemical element of iron ignores the fact that it works in the body with zinc and copper. Like calcium, iron bioavailability is increased by plenty of fresh vegetables, fruits and other foods high in vitamin C; information not on nutrition labels. A simple way to increase iron intake is to cook in iron pots or pans, traditionally used within Africa and Brazil.¹³

Most processed foods have salt added, as a preservative and flavour enhancer. The food industry also keeps quiet about salt.¹⁴ Average consumption of salt is vastly in excess of requirements, and being reminded of this on nutrition labels is useful. As with sugar, salt (40 per cent sodium) is tangible and visible, unlike calcium and iron. But isolation of sodium on nutrition labels ignores the fact that it too works in the body in combination, with potassium, and that it is as important to increase consumption of vegetables, fruits and other fresh foods as it is to cut down on salty

THE CHEMISTRY OF FORTIFIED BREAKFAST

	Sucrilos*		Full fat milk**		Nesquik***	
	cals/g	%DV	cals/g	%DV	cals/g	%DV
Calories	110	4	65	2.5	170	7
Carbohydrates	27g	7	5g	1.5	30g	8
Proteins	1g	2	3.5g	7	3g	6
Total fat	0g	0	3.5g	4.5	5g	6
Saturated fat	0g	0	2g	8	3g	12
Cholesterol	0mg	0	15mg	5	15g	5
Dietary fibre	1g	3	0g	0	0g	0
Calcium	**	**	120mg	15	124mg	15
Iron	3.5mg	25	0.08mg	**	**	1
Zinc	3.75mg	25				
Sodium	200mg	8	42mg	1.5	0mg	0
Vitamin A	120mcg	15	120mcg	15	210mcg	30
Vitamin D			0.75mcg	15		
Vitamin E					2.1mg	30
Vitamin C	15mg	25			13.5mg	30
Vitamin B ¹	0.35mg	25			0.3mg	30
Vitamin B ²	0.40mg	25			0.36mg	30
Niacin	4.50mg	25			3.9mg	30
Vitamin B ⁶	0.50mg	25			0.42mg	30
Vitamin B ¹²	0.25mcg	25				
Folic acid	50mcg	30				

For each food, the second column shows the Brazilian daily value (DV) for a portion as specified by regulation: 30g of Sucrilos (to which 100ml of milk is added) and a 200ml pack of Nesquik. DVs are based on a daily intake of 2,500 calories, taken to be the average in Brazil. *Sucrilos fortified with iron, zinc, vitamins A, C, B¹, B², niacin, B⁶, B¹², folic acid. Sucrilos also gives starch content and sugar content (about 40% of total calories). Milk fortified with vitamins A and D. Nesquik fortified with vitamin A, E, C B¹, B², niacin, B⁶. DVs for children up to 10. ** -less than 1% of the DV. Blank cells - no value given.

and salted foods (DOH, 1991; DOH, 1994; Wrong, 2000; WHO, 2003a).

But it is the bottom half of this combined nutrition label that is most striking. A total of eleven vitamins are listed, all added in synthetic formulations as percentages of the DV. Products so 'fortified' must make statements and may make claims on their labels. Products that naturally contain vitamins and minerals, like oats, may not.

The information on this combined label is accurate, and at the same time is a form of legalised fraud, made possible by reduction of food into its chemical constituents. Packaged cereals and breads 'enriched' or fortified with vitamins B1 (thiamin), B2 (riboflavin), B3 (niacin) and B6 (pyridoxine), boast on their labels about these

additions, without mentioning that the products are made from refined grains stripped of these vitamins. Moreover, much of the fortification has no health function. The associated deficiency diseases beri-beri (thiamin), pellagra (niacin) and forms of dermatitis were important in the early twentieth century or thought to be so, but now may be common only among displaced populations who are starving or supplied with grossly unbalanced food relief (Cannon, 1987; FAO/WHO, 1992). The same point applies to vitamin C (ascorbic acid) and scurvy its associated deficiency disease, now only occasionally diagnosed in people who because of illness or debility are usually deficient in many nutrients. More details about vitamin A later (see chapter 4).¹⁵

Origins of the chemical principle

Given the evident limited value of the chemical approach to food, why does nutrition science persist with this Phase One principle? Here are some reasons.

History. Biochemistry, the study of the effects of chemicals on biological systems, was devised in the nineteenth century and gained enormous prestige. Early in the twentieth century, Nobel prizes were awarded to scientists who identified the role of vitamins in the prevention of diseases some of which, like rickets, scurvy, beri-beri and pellagra, are now uncommon but remain textbook classics. The chemical approach was then imprinted in nutrition science as taught and practiced, and in Phase Two was applied to chronic diseases.

Industry. The chemical approach to nutrition created the food manufacturing industry in its modern form. A committee reporting to the UK Cabinet Office in the early 1980s stated: 'The ability to fractionate and recombine food components will create more opportunity for the fashioning of food products in novel ways' (ACARD, 1982). Food technology can make palatable products out of almost anything. Nutrition labelling enables industry to use more chemical additives in the form of vitamins and minerals.

The North. The massive shift of populations from rural to urban areas at first in the North in the nineteenth century, has depended on industry using chemical techniques such as hydrogenation to create processed products from cheap ingredients. With the global spread of refrigeration and other techniques that preserve food in whole form, chemical techniques are now obsolescent, but represent a massive investment and are still profitable.

Reductionism. The prevailing convention distinguishes between 'hard' and 'soft' sciences. Physics and chemistry are 'hard' sciences that attract big research money and science Nobel prizes. 'Soft' sciences include economics, sociology, anthropology, politics and such like. These deal in quality as well as quantity. The chemical principle is an attempt to define nutrition as a 'hard' science, as is the move of the

biological sciences to work at the sub-cellular level. This text proposes that nutrition is properly seen holistically.

The fortification of poverty

Industry with its associated foundations has a lot of money to spend on fortification of food with chemical elements and vitamins. The apparent benefits of fortified food depend on nutrition labelling. In 2002 the Bill and Melinda Gates Foundation gave a massive boost to Phase One principles in the form of \$US 50 million to create the Global Alliance for Improved Nutrition (GAIN), a 'public-private partnership' whose purpose is to fortify foods. GAIN was launched by Bill Gates at a special session of the UN General Assembly.

Kraft Foods is the third biggest food manufacturer in the world, now owned by Big Tobacco in the form of Philip Morris.¹⁶ Around the time of the UN launch, the chairman of Kraft Food International said that partnership in GAIN will 'complement our own focus on health and wellness as a key growth platform'.¹⁷ In Brazil Kraft markets 'Trakinas' chocolate flavoured vitaminised biscuits to children, and Kraft's 'Kool-Aid' and 'Tang' are fortified. Procter and Gamble is test-marketing 'Nutri-Star', a powdered drink mix fortified with iodine, iron and vitamin A (Zimmerman, 2002).

The French-owned Carrefour, the second biggest food retailer in the world (after Wal-Mart) with a turnover in 2002 of \$US 60 billion a year, is the food retail leader in Brazil. I had a look around the branch in Juiz de Fora, a Brazilian provincial city. 'Sucrilos' and 'Nesquik' are not alone. First I found a Brazilian brand of milk fortified with calcium and iron and eight vitamins. As well as 'Sucrilos' the ready-to-eat breakfast cereal section included lots of fortified sugary products. As well as 'Trakinas' the biscuit section included Nestlé's fortified 'Vitalife' biscuits.

Then I realised that the displays, shelves and check-outs were stuffed with fortified products marketed at mothers and children. Thus, at the check-outs, Coca-Cola markets 'Kapo' sugared fruit juice drinks in five flavours with added vitamins. 'Ninho', the Nestlé powdered milk drink formulated for children over the ages of 1, 3 and 6, is a fatty, sugary vitaminised and mineralised powder. The ready-to-drink sugared UHT milk products 'Nescau', 'Milky Bar', 'Nesquik' and equivalents, also have nutrition labels that look like those of vitamin and mineral pills. These are foods marketed by very big global businesses. Nestlé is the biggest food manufacturer in the world. The global advertising budget of Coca-Cola in 2002 was US\$ 1.4 billion, matched only by McDonalds (Lang, 2003).

A number of ready-to-consume sugared, coloured and fruit-flavoured yogurt drinks are marketed for young children in bright four- or six-pack tubs. Nestlé's 'Farinha

Láctea' is fortified with 11 vitamins and minerals, even more than 'Danoninho' (little Danone), aimed at the same market.

Impoverished families cannot afford these products. But mothers will spend a high proportion of their available income on them, if led to believe that they are vital for the health of their babies and children, as is known from the global commercial success of energetically marketed formula feeds and weaning foods (Palmer, 1988). If products marketed to children fortified with vitamins and minerals gain a 'healthy' image irrespective of their main contents, mothers will buy them. If the administrators of hunger relief programmes, such as the Brazilian Bolsa Alimentação project, promote fortified products, then mothers will buy them with the money they are given.

In June 2003 the director of GAIN announced at a meeting of the World Economic Forum held in Africa, that GAIN will encourage industries and governments to welcome the fortification of staple foods such as flour, oil, sugar and salt. He said: 'Five or six years from now, children will not be going blind any more in recipient countries that fortify foods with vitamin A' (GAIN, 2003).

Breaking out of the chemical trap

Nutrition labels are advertisements for the chemical principle of nutrition science. Their listings of macronutrients, chemical elements and vitamins testify to Phase One policies most of which were either always useless or else are now irrelevant. What useful information they include is better expressed not chemically but in terms of food.

It is practically impossible to make sense or use of the information about the chemistry of food on nutrition labels or in any other form, except as an academic exercise, or in specific clinical and other unusual situations, or as an adjunct to meaningful approaches.¹⁸

In the 1990s, nutrition scientists concerned to make their work useful began to break out of the chemical trap. UNICEF, the UN agency concerned with children and their mothers, agreed a model outlining underlying and basic social, economic and political causes of nutritional deficiency, as well as immediate causes (UNICEF, 1990; Jonsson, 1993). Then a UN agency consultation agreed that from then on, policies designed to make food supplies and diets healthier should be food-based (FAO/WHO, 1998). The World Cancer Research Fund report on food, nutrition and the prevention of cancer worldwide found that much of the best evidence relates not to chemical constituents of foods, but types of food, such as vegetables and fruits, and even to diets as a whole (WCRF, 1997).

If science is divided solely into physics, chemistry and biology, then a scientific approach to food can only be chemical or biological. However, there are other sciences. The way forward in this third phase of nutrition science, is to treat food as food and to think as a whole, of food systems in all their dimensions.

CHAPTER 3

Fast growth, and animal protein

The concept that the measure of good health is accelerated growth in early life is the second surviving original principle of mainstream nutrition science. Thus, babies born relatively large, children that grow fast, and relatively tall and heavy adults, are seen as relatively healthy for these reasons. This principle, whose expression is the promotion of animal protein, still has a profound impact on world nutrition and food policies.

The creation of nutrition science

Protein of animal origin was originally promoted by the governments of the most powerful Northern nations, for three reasons of state: power, empire, and war.

The gospel of protein as the master growth promoter was first preached in the mid and late nineteenth century, above all by Baron Justus von Liebig who, after Antoine Lavoisier, saw life in terms of its chemistry, and was the most powerful founder of nutrition science.¹

In 1840 von Liebig showed that concentrated nitrogen, together with phosphorus and potassium (NPK), accelerates the growth of plants. In 1842 in his great book 'The Chemistry of Animals' he extended this discovery to animals and to humans. The culmination of his work at Giessen in Germany was the isolation of protein, its identification as the master nutrient, and ambitious programmes for its use to push the growth of plants, animals and humans.²

For plants, von Liebig devised artificial fertiliser using guano shipped from the coasts of Peru and Chile. For humans, he patented 'Liebig's Extractum Carnis' in which 36 pounds of beef were boiled down in Fray Bentos, Uruguay, into one pound, making an extract that became all the rage in Europe as an elixir of health. He also believed that the more physically active people are, the more protein they need, and that diets including plenty of meat are essential to sustain physical activity.³ For babies he patented 'Liebig's Food', a formula made from cow's milk and flour cooked with potassium bicarbonate.⁴

The doctrines of von Liebig were amplified by his many followers, including Lyon Playfair in the UK, Carl von Voit and Max Rubner in Germany, and Wilbur Atwater in the USA, all of whom made estimates of human protein requirements accepted as the basis for government-backed engineering of food supplies throughout Phase One of nutrition science, until the middle of the twentieth century (Griggs, 1986; Drummond, Wilbraham, 1991).

Thus, von Voit recommended 118-137 grams of protein a day, based on measurements of the nitrogen turnover of his laboratory assistant and of brewery workers in Munich, amounting to roughly 15 per cent of energy as protein. An official committee meeting towards the end of the First World War to resolve the world's food problems recommended 145 grams of protein for a 'standard' man weighing 70 kilograms (Drummond, Wilbraham, 1991; Harper, 2000; Interallied Commission, 1918). This amount is almost twice the average by weight now consumed in most Northern countries (DOH, 1991).⁵

Successive generations of scientists did not see what might seem common sense, that measurements of protein turnover simply show the amount of protein the subjects happen to be consuming, and also that humans are evolved to adapt to high and low protein consumption. The protein turnover of burly Germans is high, whereas that of Asian populations whose staple is rice is low. If the men of Munich had halved their protein consumption, eventually their protein turnover would have halved, as would their evident protein requirement, with no ill-effects; indeed, they probably would have become healthier and lived longer (DOH, 1991; Millward, 2000, 2003).⁶

But at the time in Europe and North America, the human model was not an Asian peasant.⁷ If 150 years ago China had been the dominant world power whose needs had generated nutrition science, protein requirements based on turnover experiments would have been very different. There again, the Chinese concept of human energy was not then based on chemistry as developed in Europe.

An engine of empire and war

What originally attracted political leaders to the doctrine of animal protein was not just the beauty of research data and the charisma of scientists. In its first phase of ascendancy, nutrition science became an engine of government, and protein the master nutrient, because concentrated animal protein promotes growth in early life. This was a period when the most powerful European nations and then the USA were expanding their empires and engaged in or preparing for mass wars fought by land armies (James, 1994; Morris, 2001). Growth in every sense was a basis of prevailing ideology, seen as self-evidently good. Governments of imperial nations needed production of more, bigger, faster growing plants, animals and humans. Their need was supplied by the discoveries of von Liebig and his successors.

It was known from the beginning that protein is of plant as well as animal origin, and that grains and legumes are important sources of protein. But protein of animal origin has always been dominant in nutrition and food policy in Western Europe and the USA, where proof of prosperity has usually included regular eating of relatively expensive meat. Experiments on young rats and humans showed that animal protein, especially from eggs and cow's milk, most effectively accelerated growth. And the

mistaken idea that to build flesh means to eat flesh, has always been appealing.⁸ From the mid nineteenth century, governments of industrialised nations pushed food systems geared to produce meat, milk and their products. The plan was to transform their populations into the model of scientific perfection - Munich brewery workers.

Political and commercial imperatives coincided. Meat, milk and dairy production, together with grains much of which were grown as animal feed, dominated agriculture in Western Europe and the USA. In the second half of the nineteenth century the indigenous people and the buffalo on which they depended were exterminated from the central plains of North America or driven into reservations, and replaced by white settlers and cows. The Hatch Act of 1887 created what remains US food and agriculture policy and practice, establishing a series of research stations across the country including what is now Cornell University, dedicated to the development of meat, milk and dairy technology.

One and two generations later, the young men from the USA reared on diets high in milk and meat who came over as soldiers to win the wars in Europe in 1917 and in 1941, seemed to Europeans to be like young gods, tall, broad, heavy, strong, radiating confidence: all the more remarkable, since many of them had much smaller parents and grandparents, who had emigrated to the USA in living memory.

As mentioned above (chapter 1) for competitive and expansionist European governments, the main human impediment to continental supremacy and imperial aggrandisement was the physical weakness of their working classes. Animal protein and then vitamins were boosted as the solutions to deficiency diseases, and not only for reasons of state: social reformers also dedicated themselves to elimination of deficiency. Increase in production and consumption of animal protein remained a British national priority up to the time of the Second World War. Lord Woolton, Minister of Food, recalled: 'I was charged with the task of feeding a nation...I decided to try to develop a food policy based on the scientific knowledge of those engaged in the study of nutrition and biochemistry...People began to give as much thought to consideration of food, as the skilled engineer affords to the feeding of his engines' (Woolton, 1955; Drummond, Wilbraham, 1991).

Then as now, nutrition scientists served governments by rationalising agricultural and industrial developments. Thus, milk has been over-produced in countries suitable for dairy farming since the early twentieth century. In this context a League of Nations expert committee declared in 1936 'milk is the nearest approach we have to an ideal food... it contains all the materials essential for the growth and maintenance of life... milk should represent a large proportion of the diet of every age'. A pragmatic comment was 'milk is of course not an essential food... But it is so rich in first-class protein, minerals and most of the vitamins, that it is the most valuable and cheapest

food available for making good the major deficiencies in the diet of the poor' (Boyd Orr, 1940).

Some mothers

The ideas that fast growth in early life and therefore diets high in animal protein are vital for human health, remain ingrained particularly in the minds of parents and paediatricians. Here are stories from my life now in Brazil, and my life as a child in Britain.

In 2001, I spent Christmas with a prosperous family in Fortaleza, a big city on the littoral of the state of Ceará in north-eastern Brazil. The meals were feasts of vegetables and fruits, beans and rice, fish, chicken and other meats, and spices and herbs, bought in the city markets and cooked by three maids directed by the family matriarch, Dona Silveirinha. One of her nine grown-up children was vegetarian. She confessed her worry about him to me. How could he get enough protein if he didn't eat meat?

She was worried because she had been taught, like practically everybody now middle-aged or older, that diets low in animal protein are for this reason deficient. I thought of Dona Silveirinha when in early 2003 I was travelling in Tamil Nadu, Southern India. Roadside shops advertised chickens and eggs for sale with the word 'protein'. Production of broiler chickens in India increased from 31 million birds in 1981 to 800 million two decades later (Gold, 2003).

I remember my mother spooning boiled egg into me in the mid 1940s, and what she said: 'Just the stuff to give the troops'. A few years afterwards I was a pupil at Christ's Hospital, which has a special place in the formulation of food policy. British boys' boarding schools in those days were useful institutions for scientific experiments, because their food supplies could be manipulated without reference to the pupils or their parents. In the 1930s the school doctor, Dr George Friend, found that substantial amounts of full-fat milk increased the height and weight of the boys in his care. His and other human studies confirmed the results of previous experiments on rats.⁹

Dr Friend and his successors at Christ's Hospital specified the nutritional composition of the meals made for the boys, and kept detailed records of their consequent growth. Every day after prayers all 850 boys lined up in their houses for half a pint of milk plus a big biscuit we called 'squashed fly' because it contained currants. In the summer term of my first year I decided I was fat, and exercised more, ate less, and dropped 6 kilos - a stone in old British measure - between the beginning and end of term weigh-ins. Of all the lines on the doctor's graph, mine was the only one pointing in what was for him the wrong direction - down. I can still feel his wrathful inquisi-

tion. I had messed up his data! I still wonder if my notes said 'failed to thrive', 'vegetarian', 'anorexic', or 'bolshie'. Perhaps I was treated as an outlier and crossed off.

Speed kills

I may be giving the impression that I think protein is unimportant. Not so. Proteins (or rather, the constituent amino acids of protein) are essential for physical growth and maintenance and for life itself, like vitamins. Steady growth is a vital measure of child health. Babies and children who really are failing to grow need special care. 'Stunting' and 'wasting', terms that actually mean height and weight a long way below norms agreed by technical experts, are reliable markers of infection and infestation, both common in children in the South (FAO/WHO/UNU, 1985; ACC-SCN/IFPRI, 2000).¹⁰

But none of this argues for food systems and diets high in animal protein.¹¹ Bigger and bigger is not better and better. To the contrary: the principle that accelerated growth means health, and that for this reason animal protein is the master nutrient, has proved disastrous.

If the only concern is human health and disease, one reason is enough. The same energy-dense food supplies high in animal protein and saturated fats that increase body size and mass, and breed big strong tall young people, increase the risk of chronic diseases such as obesity, diabetes, hypertension, coronary heart disease, and cancer of the breast and other sites (WCRF, 1997; WHO, 2000a; WHO, 2003a). You do not have to be a boffin to sense why. To take a mechanical analogy, a car that is accelerated all the time, wears out quickly.

Very high animal protein intake is itself harmful (DOH, 1991). Worse, are energy-dense food supplies high in animal protein and also high in saturated fats from the meat of intensively reared animals and their products, now one major immediate cause of uncontrolled chronic diseases throughout the world, including Asia, Africa and Latin America (Popkin, 2002; WHO, 2003a). The high animal protein policies that prevented deficiency diseases in early life in the countries suited to meat and dairy farming, have created pandemic chronic diseases, first in the North, and now throughout the world.

What it means to be human

The Phase One high animal protein principle should also be judged by Phase Three principles that give nutrition science cultural, social, economic, environmental, ecological, political - and evolutionary - dimensions.

The human species is evolved to grow uniquely slowly. This is a defining difference

between humans and all other species. Humans are born with uniquely large brains, and are dependent for a substantial period of life. By contrast, calves and rats are evolved to grow fast. They are able to walk almost immediately after birth, and breed early in their lives. This is why about 40 per cent of the energy of rat's milk is from protein, and about 18 per cent of the energy of cow's milk is from protein. Correspondingly, the protein content of human milk is uniquely low, more than three times lower than cow's milk, at 5-6 per cent of energy (FSA, 2002; Millward, Jackson, 2003). *Homo sapiens* is evolved to grow fastest at the speed that corresponds to that of the protein content of human milk.¹²

Modern formula feeds contain a dilute version of cow's milk, but remain over 50 per cent higher in protein than breastmilk (Golden B, 2000). The growth curves used throughout the world to judge the health of infants are based not on breastfed infants, but on samples of US infants partly or wholly fed formula (WHO/UNICEF, 2000). Formula feeds push the growth of infants. They are an artificial fertiliser used on humans. And when a mother who is breastfeeding is warned that her baby is failing to thrive because its height and weight are not following the lines on the growth charts based on the higher protein formula feeds, she is likely to reach for the bottle. The commercial benefits for the manufacturers of formula feeds are substantial. In 2002 Nestlé's turnover was over \$US 50 billion a year (Palmer, 1988; Lang, 2003).

Later in childhood, energy-dense diets high in animal protein are a social menace. Onset of sexual maturity, which through history was 12-15 years of age, dropped rapidly as from the nineteenth century and is now 11-12 (Frisch, 1978; Prescott, 2000). A variation of the 'fast growth equals health' principle, is 'the sooner the better', and so early sexual maturity, if not assumed to be by chance, is often supposed to indicate 'progress'. Age of sexual maturity is determined by body weight and mass, itself mostly a function of diet. In one generation, energy-dense diets high in animal protein can lower the age of sexual maturity from over 14 to under 12 (Gopalan, 2000).¹³

High-protein baby formulas followed by energy-dense food supplies high in animal protein bring forward adolescence, the period of conflict between immature thoughts and feelings in a matured body, into the period even before the first teenage years. Young teenagers now spend more time acting out hormonal urges before they are mentally, emotionally or even physically ready, and less time learning in school. Rates of premature pregnancy soar, as do those of failure at school, and of disruption and violence perpetrated by children (Figs, 2002).

There is a current apparent argument against these points here. The 'Barker hypothesis' proposing that people born relatively heavy are protected against chronic diseases, is now becoming generally accepted (Barker, 1998; ACC-SCN/IFPRI, 2000;

WHO, 2003a). This well-documented observation is commonly misunderstood. It does not show any intrinsic problem of being born small. The problem comes from being born small, and then being weaned and fed on energy-dense foods. The 'insult', to use a technical term, is when a child that has been fed sparingly in the womb, is after birth slammed into calorie excess. The phenomenon is most evident in populations where the parents are the last generation evolved to be relatively small, whose children are fed excessively.

Why Cancún collapsed

The wider impact of global application of the animal protein principle is catastrophic. The meat and dairy industries destroy indigenous food and agriculture systems and their living and natural environments. Evolved agriculture systems based on local foods of plant origin that require mainly human inputs, are still being ripped up and replaced by capitalised systems producing cheap milky meaty fatty sugary processed foods of foreign origin. In Brazil now, unsustainable cattle ranches and farms producing soya mostly as animal feed are replacing the Amazon rainforest, and the cerrado (savannah) that covers almost a fifth of the country (Oxfam, 2002; Vidal, 2003).

By 1999 agriculture subsidies given by Northern governments mostly to producers of meat, milk, dairy products and animal feed, amounted to \$US 360 billion a year (Soros, 2002). When exported, subsidised foods undercut the prices needed by producers in the South and destroy their livelihoods (Oxfam, 2002). For example, fresh milk produced by African farmers cannot compete with powdered milk imported from the USA and Europe, where cows are subsidised at the rate of \$US 2 a day, more than the income of African farmers. This is reason enough for the collapse of the Cancún World Trade Organization meeting in September 2003 (Stiglitz, 2003).

A feast is too much

So how much protein do humans actually need? The last UN report on the subject was published in 1985 (FAO/WHO/UNU, 1985). This report is out of print, a collector's item. The copy in the Ministry of Health in Brasília is in tatters. I got my own copy by going to the library at WHO Geneva and photographing the whole 212 pages.¹⁴

Until the 1960s UN agency estimates for protein requirements followed the Phase One principles of von Liebig and von Voit. Correspondingly, in 1953 the Food and Agriculture Organization of the United Nations announced that protein malnutrition was: 'The most serious and widespread nutritional disorder known to medical or nutritional science'. Estimates of its prevalence, based on global extrapolations from original studies of malnourished West African children, formed a basis for official estimates of the total global prevalence of malnutrition. 'Closing the protein gap' became the most important world food aid programme, and millions of tonnes of dried cow's milk were shipped to the South.

In the 1970s everything changed. The UN agencies estimated protein requirements at a far lower figure, just over half a gram a day per kilogram of bodyweight - much less than half the old estimates.¹⁵ Correspondingly, protein malnutrition, also known as kwashiorkor, disappeared as a global scourge: 'at a stroke of the pen', virtually all the 'protein gap' was closed.¹⁶

The 1985 UN report adjusts protein requirements upwards to 0.75 grams per kilogram of body weight. This figure translates to a requirement for a 70 kilogram man of 52.5 grams of protein a day, or 55 grams a day as recommended in a more recent UK report (DOH, 1991).¹⁷ Another way to say this, is that protein requirements derived from modern analytical methods work out at around 8-10 per cent of total energy intake (FAO/WHO/UNU, 1985; Scrimshaw, 2000).

These figures may seem rather dull and technical, from a Northern perspective. Practically everybody in Europe, North America and other enriched countries is replete with protein, mostly of animal origin. But from a global perspective their implications are social, economic and political nitroglycerine.

Take rice. The protein content of wheat is about 12 per cent of energy; of rice about 8 per cent (FSA, 2002). If protein requirements are based on the Phase One principle of accelerated growth, and are set somewhat lower than actual Northern consumption, at say 12-14 per cent of energy, as proposed in a recent textbook published by the International Life Sciences Institute (Bowman, Russell, 2001), then all Asian and other Southern rural populations that subsist on rice, with beans and legumes, and small amounts of animal foods, become identified as malnourished.¹⁸ Further, wheat becomes defined as a superior staple crop - commercially very promising for transnational grain industries, and also for foreign governments who use food aid and trade as an instrument of power (George, 1986).

The high animal protein principle is used to justify the transformation of the world's food systems to approximate to those of the North: more meat, more milk, more dairy products, conveniently marketed as cheeseburgers and milkshakes, or else dumped on vulnerable countries as 'trade' or 'aid' (Tudge, 1979; George, 1986; Oxfam, 2002). This of course is what has been happening since the Second World War, with accelerating pace. Many if not most traditional food systems have already been burgered (Popkin, 2002, 2003).

By contrast, the convergence of scientific thinking outside the USA as reflected in UN reports, that human protein requirements are much lower than once thought, implies that almost all food systems that supply enough energy also supply enough protein.

Low requirements suggest that all grain-based food systems are adequate or more

than adequate in protein, and that perhaps only those populations whose staple foods are very low-protein roots and tubers, in particular cassava (manioc), are at great risk of protein deficiency. In turn this means that traditional plant-based food systems of the South are generally preferable to those of the North, provided they supply enough energy and are relatively varied.¹⁹ Low requirements mean that the energy-dense, fatty, sugary and salty diets of rich countries, whose protein content mostly from animal food is around 15-16 per cent or higher (Jackson, Margetts, 1993; DHHS, 1988), are at best wasteful, at worst comprehensively pathogenic.

A low figure for protein requirements, if confirmed by the UN system and member states, and grasped by non-governmental organisations and the world's media, has revolutionary implications for industrialised and traditional food systems, rural and urban livelihoods, concepts of food security, calculations of who in the world is malnourished, and for the profitability of firms such as McDonalds, Nestlé, and Yum! Brands.

The right size

If protein requirements become based on the evolution of the human and not of the cow, hundreds of millions of people in the South now defined as malnourished become seen as short, light and adequately nourished. The obverse of this argument is that many hundreds of millions of people in the world in high-income countries usually perceived as well nourished become seen as big or fat and unhealthy. Which is to say, the dominant nutrition crisis in the world now is not too many short slim people, but too many big fat people (WHO, 2000a; WHO, 2003a).²⁰

What is the right size for humans? An ecological point is obvious: slim small people eat less food, and a physically active world population with an average height of say 1.60 metres and weight of 60 kilograms in energy balance at say 2,000 calories a day, would consume 20 per cent less food than a sedentary population with an average height of say 1.75 metres and weight of 75 kilograms getting steadily fatter in energy imbalance at say 2,500 calories. With a world population expanding from 6 billion, that is a lot of food. A physically smaller world population would consume less living and natural resources, and leave a better legacy for future generations.

Origins of the growth principle

The Phase One principle of nutrition science that gives priority to protein of animal origin now makes little sense except in special circumstances. Here are four reasons why it persists.

History. The association of accelerated human growth with health originated in the mid-nineteenth century, an age when the policies of the dominant nations expressed what seemed the self-evident doctrine that the bigger, the better. Animal protein was

seen as the fuel for growth, as coal fuelled locomotives and ships. The concept of the intrinsic value of fast growth predates nutrition science, and is a feature of the materialist philosophy developed in Europe since the Reformation, which asserts a manifest destiny of humans to exploit and control the living and natural world (Tawney, 1938).

Industry. The animal protein principle was a blueprint for the European and North American meat and dairy industries. After globalisation of the meat supply in the late nineteenth century, the centrepiece of the main meal in the USA was the steak, in the UK the roast, in Eastern Europe the sausage, and now everywhere the burger. Infant formula feeds derived from the protein content of cow's milk founded the fortunes of Nestlé.

The North. Food systems high in animal protein gave governments of the dominant nations of the North the means to accelerate the breeding of plants and animals fit for harvest and slaughter, and of generations of young people fit to fight long land wars. In that context, going for growth worked. Northern countries continue to subsidise agriculture and food systems producing vast surpluses of meat, milk and their products.

Reductionism. Nitrogen was the first chemical element, and protein the first chemical constituent of food, to be isolated and promoted as master nutrients. Later discovery of the nature and functions of amino acids contained in food, and of the protein-based structure of all living cells, has preserved the chemistry of protein as a glamorous science.

Requirements for what?

Artificial fertiliser speeds the growth of crops. Farm animals fed on concentrates high in protein achieve slaughter weight faster. Humans grow faster on energy-dense diets high in animal protein.

If the right policy now was to 'fulfil human potential' by acceleration of the growth of babies and children, and achievement of sexual maturity and final adult height as early in life as biologically possible, then energy-dense food systems high in animal protein are 'just the thing to give the troops'. But now there is no special reason to grow physically big populations. Unlike crops and animals, we humans are not harvested or slaughtered when we are first full-grown. We live on.

At the end of the last chapter I proposed that chemistry is just one of the disciplines relevant to nutrition, which properly understood is a holistic science. Similarly, estimations of requirements for protein, and indeed for all nutrients, should derive not just from experiments on animals and humans, but from knowledge of life in the

world outside the laboratory, study of long-evolved food systems that produce adequate and varied food supplies, awareness of human evolution, and commitment to sustain not only the human race but also the living and natural world.

Animal food, and vitamin A

A third obsolescent general principle of nutrition science and its expression in food policies, is that food from animal sources is preferable to food from plant sources. More precisely, this principle means that food supplies and diets in which animal foods are central, are superior to those with little meat and other food of animal origin. The case given in this chapter is vitamin A.

Perceived value of animal food

One way to check if mainstream nutrition science still persists with this Phase One principle, is to look up the references to 'vegetarian diet' and 'vegetarians' in the most recent editions of a standard textbook (Garrow, James, 1993; Garrow, James, et al, 2000).¹ On the one hand, there are various references to relatively recent findings that vegetarian diets of various types reduce the risk of gallstones, high blood pressure, heart disease, stroke and cancer, which collectively seems important. But I have not found any passage underlining the benefits of plant-based diets in prevention of chronic diseases.²

On the other hand, there are explicit warnings against vegetarianism. Here are two examples. 'In communities which are largely vegetarian, purely nutritional factors are of great importance, often as the only factor causing iron deficiency' with an example of Hindus living in London (Hallberg et al, 1993). And referring to schoolchildren: 'Vegetarian diets, and particularly vegan diets, tend to be low in energy density, their calcium, iron and zinc bioavailabilities are low, they are deficient in vitamin B12, and if the sources of protein are not varied sufficiently, they may be deficient in one or more amino acids' (Golden B, 2000).

Another check is the latest WHO report on prevention of chronic diseases. This includes in its introductory sections: 'the high-value protein that the livestock sector offers improves the nutrition of the vast majority of the world. Livestock products not only provide high-value protein but are also important sources of a wide range of essential micronutrients, in particular minerals such as iron and zinc, and vitamins such as vitamin A' (WHO, 2003a). If the report contains any commendation of plant-based diets, I have not found it.

Apparent dissonance between what the science shows with chronic diseases, its main concern in its second phase, and what it shows with nutritional deficiency and infectious diseases, its main concern in its first phase, might be thought insignificant in the North, where deficiency diseases are now much less common. But in most of the

world now, chronic diseases, nutritional deficiency and infectious diseases are all epidemic, and co-exist in the same communities and families (Peña, Bacallao, 2000; Doak, Adair et al, 2000). An integrated approach is needed, but has not yet been attempted by relevant UN agencies, or as far as I know by any other authoritative body.³

There are no good nutritional reasons to avoid animal foods. Vegans and other strict vegetarians are usually motivated for philosophical and environmental reasons. Food supplies that include some meat, fish and other animal foods, are more varied in all respects.

As already stated (chapter 3, above) food systems geared to mass production of animal foods, as those of most countries in the North, are unsustainable. Animal-based food systems use too much energy, wreck ecosystems, poison the landscape, and contribute to global warming. They also produce vast amounts of fat and saturated fat, a prime immediate cause of what is now a pandemic of obesity (Popkin, Du, 2003).

Meanwhile meat, dairy and other animal foods are promoted, not only because of their 'complete' protein, but also because they are potent sources of vitamin A, calcium, iron, zinc and other nutrients and - so it is claimed - protect against deficiency diseases. But is it true that animal foods are essential in prevention of nutritional deficiency and protection against infections? I cannot give a complete answer here. What I have done is to look at one case, that of vitamin A.

Vitamin A is essential

Vitamins are essential to health and life. Vitamin A comes in the form either of carotenoids, pigments found in foods of plant origin, or retinol, found in foods of animal origin. The potency in the body of carotenoids is thought to be an average of one-sixth that of retinol.⁴

Textbooks indicate or state that animal foods are better sources of vitamin A, if only by listing them first. Thus: 'Common dietary sources of preformed vitamin A are liver, dairy products such as milk, cheese, butter, and ice-cream, and oily fish', followed by: 'Common dietary sources of provitamin A carotenoids are carrots, yellow squash, dark green leafy vegetables, tomatoes, papaya and oranges' (Olson et al, 2000). Textbooks also mention that red palm oil is very high in carotenoids; one questions the essentiality of carotenoids, and states: 'the richest sources of vitamin A are foods of animal origin or spreads enriched with the vitamin' (Solomons, 2001).

Adequate vitamin A protects against respiratory, gastrointestinal and other infections common in childhood, and transmission of HIV infection from mother to child. The

deficiency disease, xerophthalmia, causes night blindness, damages eyes, and eventually causes complete blindness. Young children are most vulnerable.

Response of the UN agencies

After it became obvious that lack of protein in itself is not a global epidemic, the UN and other aid agencies regrouped, and identified deficiencies of specific micronutrients as the most important and urgent global public health priorities, and in particular, on a 'somewhat arbitrary' basis, iron, iodine - and vitamin A (Alnwick, 1996). Folate or folic acid, present mostly in plant foods, was not included, although it was well-known at the time that adequate folic acid, of which green leafy vegetables are a good source, prevents birth defects.

Estimates of vitamin A deficiency throughout the world are high. In 1986 the number of people in the world who are blind because of vitamin A deficiency was estimated at 6 million (NRC, 1986). By the early 1990s the WHO estimate was 13.8 million people with xerophthalmia of whom more than half will die, and 190 million at risk (World Bank, 1994). Estimates accepted by WHO and UNICEF in the mid 1990s were that vitamin A deficiency is or may be a public health problem in around 90 countries, that over 250 million children are at risk of deficiency, that at least 5-10 million children develop xerophthalmia every year of which between a quarter and a half go blind, and that 'at least one million child deaths would be prevented every year if vitamin A nutriment were improved' (WHO/UNICEF, 1995; Sommer, 1995).⁵

Populations most at risk live where it is hard to grow a variety of crops. Poverty, inequity, famine, dislocation, invasion and civil war are basic social, economic and political causes of vitamin A deficiency, and of course much else besides (Indaba Declaration, 2002).

The virtual elimination of vitamin A deficiency by 2000 was a goal of the 1990 World Summit for Children. In 1998 a consortium of UN and other agencies launched a new global vitamin A initiative with a new deadline of 2010. The first and second priorities of the UN and other aid agencies are supplementation with very high doses of vitamin A, and fortification of commodities such as sugar, fats, oils, milk and monosodium glutamate with vitamin A. 'Gardening and other methods' are also recommended as a long-term approach (IVACG, 1992; MI, 1996; UNICEF, 1998; Allen, Gillespie, 2001).⁶

Vitamin A in animal foods

A recent report prepared for the Asian Development Bank (ADB) and the UN Standing Committee on Nutrition, designed for countries in Asia, 'development partners, and scholars interested in applying science and technology to investment decisions' states: 'The main cause of vitamin A deficiency is a low intake of animal

products... Some plants are very high in beta-carotene. However, this is generally less well absorbed by humans than retinol' (Allen, Gillespie, 2001).

Another report by the Washington-based International Food Policy Research Institute (IFPRI) for the ADB states: 'The main cause of vitamin A deficiency is a low intake of animal products', and: 'Unfortunately, children in developing countries often receive only small amounts of food that contain animal products' (Gillespie, Haddad, 2001). Another IFPRI report states: 'Vitamin A from plant sources is usually found in large amounts in only a few fruits and vegetables, many of which are highly seasonal', and that there are 'fundamental questions regarding the potential efficacy of all plant-based strategies to control vitamin A deficiency' (Ruel, 2001).

However, few types of animal food contain retinol. Meat contains practically none. Oily fish such as tuna, herring and mackerel contain small amounts. Egg yolk is a good source. Milk, butter and cheese contain moderate amounts; so does human milk. Because retinol is stored in the liver, all animal livers are exceedingly rich sources.

I have not found a table listing amounts of vitamin A in animal foods, compiled in the specific context of prevention of deficiency. So I have compiled one myself: it is on the next page. It shows foods of animal origin, and also some foods commonly fortified with retinol, that are useful sources of vitamin A.⁷ It comes from tables of food composition and one other source (FSA, 2002; ENDEF, 1981; Bégin, Cervinskaskas et al, 2001).

I have shown in the third column which of these foods is cheap or free for impoverished communities in the South. One such food that is free is human milk. Colostrum is more than twice as rich in retinol than mature human milk, and so may deliver a surplus to the new-born to be stored in its liver. Cow's milk is as good a source of vitamin A as human milk, but is not cheap or free for impoverished communities unless they rear cows for their own use, or unless milk is part of a hunger relief programme. Other than human milk, the one cheap food is fortified sugar, which might be handed out free.⁸

The fourth column lists the foods that are good sources of other micronutrients. Fortified sugar and margarine are not, the rest are. The next column lists the retinol equivalent (REs, measured in micrograms) in every 100 grams of the food. The final column shows which foods delivers the estimated average requirement sufficient to build up stores in the liver, for children up to the age of 10, estimated as 400 mcg RE a day (FAO/WHO, 1988), in 100 grams or, in the case of fats, 25 grams.

The table shows that with one exception, the few animal foods that contain retinol are

ANIMAL AND FORTIFIED FOODS THAT ARE GOOD SOURCES OF VITAMIN A

Food	Type	Cheap or free (1)	Other mics (2)	RE/mcg/100g (3)	100%+ 100g (4)
Liver	Meat	No	Yes	20,000*	Yes
Liver pate	Meat	No	Yes	6,000*	Yes
Liver oil (cod)	Oil	No	Yes	18,000	Yes
Oily fish (average)	Fish	No	Yes	50	
Milk (cow)	Milk	No	Yes	50	
Double cream	Dairy	No	No	600	
Ice-cream (dairy)	Dairy	No	No	115	
Eggs (chicken)	Eggs	No	Yes	200	
Eggs (yolk)	Eggs	No	Yes	500	Yes
Butter	Fat	No	Yes	800	
Cakes, puddings	Cakes	No	Yes	125	
Cheese	Dairy	No	Yes	300	
Milk (human)	Milk	Yes	Yes	60	
Colostrum (human)	Colostrum	Yes	Yes	150	
Sugar (fortified)	Sugar	Yes	No	1,500	Yes
Margarine (fortified)	Fat	No	No	800	

1. Cheap or free, meaning low price in shops, or else commonly available, grown or found.

2. Other mics - a good source of other micronutrients and bioactive compounds.

3. RE/mcg/100 grams - retinol equivalents measured in micrograms contained in 100 grams. All figures for retinol or RE content rounded averages. * - middle of wide range. Values are for cakes and puddings made with dairy produce.

4. 100% + 100g. Yes means that 100 grams (or in the case of fats and cream 25 grams) contains more than 100% of the estimated average daily requirement of vitamin A for children (400 RE mcgs). **Yes** in bold means a portion contains more than the requirement for a week.

Sources: (RSC/MAFF 1991, 1992; FSA, 2002; ENDEF, 1981; B gin, Cervinkas et al, 2001 (sugar fortification); FAO/WHO, 1988 (estimated daily requirement)).

not particularly good sources of vitamin A. The exception is liver and liver products: 100 grams of liver delivers enough vitamin A for over a week, as indicated by the bold type, as does cod liver oil. But impoverished communities do not have regular access to liver or cod liver oil. Foods fortified with retinol, which in some countries includes cows' milk, are of course good sources of vitamin A. The reason why most high-income populations are replete in vitamin A is because of high production and consumption of milk, eggs, cheese and butter, as such or contained in products and meals.

A vital message most of all for impoverished populations, is that babies and young

children exclusively breastfed are well nourished in vitamin A (DHSS, 1991; Sommer, 1995). A UN consultation in Ottawa in 1993 concluded 'a combination of interventions is usually needed to prevent vitamin A deficiency: these include dietary modification (including the production, processing, marketing and consumption of vitamin A - rich foods), breastfeeding promotion, food fortification and supplementation' (Gillespie, Mason, 1994).

Further, the new WHO global strategy on infant and young child feeding includes a Resolution approved by the World Health Assembly indicating that premature weaning is a cause of vitamin A deficiency, blindness and death (WHO, 2002).⁹ But this is unusual. Most reports on vitamin A deficiency that I have seen mention breastfeeding, but without emphasis.

If it is true that animal foods are the best source of vitamin A, it would indeed seem that children in the South are at very high risk of deficiency and therefore of blindness and death, unless they are given supplements of vitamin A or their food is fortified.

Brazilian experience

So I looked into food, nutrition and vitamin A in Brazil. Deficiency is endemic in the north-eastern region. This was the area of the original Portuguese conquest, a land mass bigger than Western Europe that the colonisers turned into vast estates for monoculture of sugar, cotton and cattle. The native Brazilians were exterminated or driven away; the surviving indigenous people usually live in reservations far distant from their native lands.

In the sertão, the rural backlands, some caatinga or semi-desert, some cerrado or savannah, the poorer white and mixed race inhabitants, mostly relatively recent migrants, scramble an existence as hard as that of rural Africans. Their children may starve. Brazilian vitamin A deficiency programmes are managed on behalf of the government by the Pan American Health Organization (PAHO), the regional office of the World Health Organization for the Americas. This means high-dose capsules.

Vitamin A in plant foods

I also have not found a table listing amounts of vitamin A in plant foods, in the context of prevention of deficiency, so again I compiled one myself; it is on the next page.

First I looked up the standard UK food composition tables, also used internationally (RSC/MAFF, 1985, 1991, 1992; FSA, 2002). These show that a number of vegetables that are also now common in Brazil are good sources of carotenoids. Converted into retinol equivalents, carrots (after which carotene is named) contain more vitamin A than any animal food apart from liver and its products. Many dark green leafy

BRAZILIAN PLANT FOODS NATURALLY RICH IN VITAMIN A

Food	Type	Cheap or free (1)	Other mics (2)	RE/mcg 100g (3)	100%+ 100g (4)
Abóbora (pumpkin)	Vegetable	Yes	Yes	500	Yes
Abóbora (leaves)	Leaf	Yes	Yes	600*	Yes
Alfalfa leaves	Leaf	Yes	Yes	1,000*	Yes
Azedinha (like spinach)	Leaf	Yes	Yes	1,250*	Yes
Babaçu	Fruit, Nut	Yes	Yes	?	Likely
Babaçu oil	Oil	Yes	Yes	?	Likely
Batata doce (sweet potato)	Root	Yes	Yes	650**	Yes
Bettaraba (beetroot)	Root	Yes	Yes	10	
Bettaraba leaves	Leaf	Yes	Yes	500*	Yes
Buriti coconut	Fruit, Nut	Yes	Yes	6,000	Yes
Buriti oil	Oil	Yes	Yes	50,000	Yes
Cenoura (carrots)	Root	Yes	Yes	1,000**	Yes
Couve (like cabbage)	Leaf	Yes	Yes	600*	Yes
Dendê (red palm) (pulp)	Fruit, Nut	Yes	Yes	10,000	Yes
Dendê oil	Oil	Yes	Yes	45,000	Yes
Espinafre (spinach)	Leaf	Yes	Yes	650*	Yes
Inhame (yam)	Root	Yes	Yes	125**	
Macaúba palm	Fruit, Nut	Yes	Yes	?	Likely
Macaúba oil	Oil	Yes	Yes	?	Likely
Mandioca (cassava)	Root	Yes	Yes	125	
Mandioca leaves	Leaf	Yes	Yes	1,000*	Yes
Manga (mango)	Fruit	Yes	Yes	250**	
Mostarda (mustard)	Leaf	Yes	Yes	700	Yes
Pimenta (pepper)	Vegetable	Yes	Yes	650	Yes
Pequi fruit	Fruit, Nut	Yes	Yes	20,000	Yes
Pequi oil	Oil	Yes	Yes	28,000	Yes
Pupunha coconut	Fruit	Yes	Yes	1,500	Yes
Tucumã coconut	Fruit, Nut	Yes	Yes	6,000	Yes
Tucumã oil	Oil	Yes	Yes	30,000	Yes
Urucum nut	Fruit, Nut	Yes	Yes	?	Likely
Urucum oil	Oil	Yes	Yes	?	Likely
Vinagreira (hibiscus)	Leaf	Yes	Yes	700	Yes

1. Cheap or free, meaning low price in shops, or else commonly available, grown or found.

2. Other mics - a good source of other micronutrients and bioactive compounds.

3. RE/mcg/100 grams - retinol equivalents measured in micrograms contained in 100 grams. All figures for retinol or RE content rounded averages. * - values of outer leaves can be up to 50 times higher. ** - middle of wide range. Values are for orange pumpkin, sweet potato and melon, yellow cassava, melon and yam, and orange and red pepper.

4. 100% + 100g. Yes means that 100 grams (or in the case of oils 25 grams) contains more than 100% of the estimated average daily requirement of vitamin A for children (350 RE mcs) **Yes** in bold means a portion contains more than the requirement for a week.

Sources: (RSC/MAFF 1991, 1992; FSA, 2002; ENDEF, 1981; Franco, 2001 (Buriti oil, tucumã); FAO/WHO, 1988 (estimated daily requirement).

vegetables like cabbage, spinach and broccoli, are good sources. So are red and yellow peppers. Pumpkins and mangoes are identified as good sources, yams as moderate sources.¹⁰ Some herbs are concentrated sources. None of this matters much in the UK or other countries whose food supplies are high in milk and dairy products, and where most vitamin A is in the form of retinol.

I was already intrigued by a textbook reference to two Brazilian palm oils, dendê and buriti, stating: 'A Brazilian palm fruit, buriti, is the richest plant source of pro-vitamin A' (Solomons, 2001). I also read that half a teaspoon of red palm oil a day supplies the vitamin A needs of a child and that 77 million hectares of Brazil are suitable for palm oil production (FAO/ILSI, 1997, Bégin, Cervinskis et al, 2001). This was valuable information, from the point of view of Brazil, and many other tropical countries where palms produce red oil.¹¹

During my work with the federal Ministry of Health I made two discoveries. The first was an article in a US journal on buriti and vitamin A deficiency (Mariath, Lima et al, 1989).

The buriti palm grows wild in the north, north-eastern and central regions of Brazil, and its fruit, a type of coconut, is cheap or free for the people who live there. Its vitamin A is almost all beta-carotene. The vitamin A content of its fruit (expressed as retinol equivalents) is extremely high, and its oil is richer in vitamin A than liver. As I have seen, buriti is processed on an artisanal basis by country people and consumed as a fresh fruit drink or in the form of sweets.

The study was conducted as follows. Buriti fruits and sweets were bought in the market in São Luiz, the capital of Maranhão, a north-eastern state, and their chemical composition analysed by standard methods. Three towns in another north-eastern state were selected, and 44 children with clinical vitamin A deficiency were included. Mothers were asked to give their children one 12 gram buriti sweet a day for 20 days; the sweets containing 1116 mcg RE per 100 grams. In all but one case all clinical signs of xerophthalmia vanished. The authors concluded: 'The results justify greater attention to this natural food source of provitamin A [as] an alternative intervention to be combined with or to replace the massive distribution of vitamin A capsules'.

One of the authors was a colleague at the Ministry. I asked her if any interest had been expressed in the more than ten years since the results of the study were published, by the Brazilian government, UN or international aid agencies, other funding agencies, or industry. She said no. She was at the time working for PAHO on a new programme of retinol capsule distribution.

Then I looked for more Brazilian data. Over the years the Brazilian government has

collected information about national food patterns, neglected by Brazilian health professionals in favour of US data. My second discovery was a photocopy of a book of Brazilian food composition tables (ENDEF, 1981), used by colleagues in the Ministry working on native and established foods.¹² The tables were compiled over 20 years ago by the Brazilian national institute responsible for statistics. I am told that Brazilian food composition analysis techniques are good (Southgate D, personal communication). The Brazilian tables are out of print and not reproduced internationally.

The table above lists the vitamin A content of a number of Brazilian plant foods - vegetables, leaves, fruits, nuts, seeds and oils - using the Brazilian and also the UK food composition tables, and one other source. It is presented in the same way as the previous table.

The results are striking. First, where these plant foods grow, they are all cheap or free. Second, they are all also rich in other vitamins and minerals. Third, weight for weight, a rich variety of green leafy vegetables are as good sources of vitamin A as any animal food apart from liver and egg yolks, and the leaves of the staple foods mandioca (cassava), and batata doce (sweet potato) are also good sources. Fourth, at least three more native or established palm and other fruits, dendê, tucumã, and pequi, are as rich in vitamin A as buriti. I am told that three more, babaçu, macuabá and urucum, are also rich sources (Bittar R, personal communication).

The table here is of just some of the rich variety of Brazilian plant foods that are good sources of vitamin A. Most grow wild in Brazil or, like couve (a kind of cabbage) and mangoes, are commonly cultivated. Mandioca and sweet potatoes are staples.

So in the case of one very big tropical country, the assertion or implication that animal foods are the best sources of vitamin A is completely wrong. And any suggestion that animal foods are the most available or appropriate sources of vitamin A for impoverished populations is at best ignorant, at worst outrageous.

This information is not well known, nor acted upon in Brazil. One day I went into the Health Ministry with a bottle of pequi oil, and said to another colleague 'here is an answer to vitamin A deficiency in Brazil'. She was surprised and asked me where I had found it. 'In my local supermercado, Pão de Açúcar' I said. Pequi slices and oil are marketed as delicacies to be added to pasta and other dishes. Their labels do not refer to their vitamin A content.

The original native Brazilians will have known that buriti, tucumã and pequi and no doubt other native plant foods, work against xerophthalmia. People who live in nature need to see at night.¹³

But the native Brazilians who lived in what are now its northern, north-eastern and central states are gone, and the people who now live with vitamin A deficiency in these territories are mostly relatively recent migrants from Europe who have little idea of the riches surrounding them, literally dropping off the trees in their yards and streets.

The facts about the quality of Brazilian native and established plant foods are available, and the implications of these facts are plain to see. In Brazil, the solution to vitamin A deficiency in Brazil is growing all around, an unexplored national treasure. The federal and state governments, health professionals, and civil society organisations in Brazil, need to know the facts, get together, and act.

I predict that what I have found in Brazil in the case of vitamin A will turn out to be true for other nutrients and other deficiency diseases, in tropical countries all over the world. Colleagues living in other countries may make their own investigations.

Origins of the animal principle

Given the evidence that plant-based diets protect against the chronic diseases now epidemic in almost all countries in the world, why does nutrition science persist with the general principle that animal foods are first-class and that plant foods are second-class? Some reasons why can be classified as in the previous two chapters.

History. Most studies of food and nutrition in Phase One of nutrition science were done on animal foods, at a time in history when technological invention was driving a massive increase in production of meat, milk and dairy products. A large proportion of nutrition scientists still work for this section of industry, and the investment in animals and their inputs and outputs is huge.

Industry. The discovery of the essentiality of retinol in industrialised countries led to the promotion of milk, butter, cheese, eggs and liver, fortification of milk and margarine, and in the UK during the Second World War, mass production of cod liver oil. These were thought to be the most effective ways to prevent vitamin A deficiency in countries whose food systems were abundant in milk and dairy products. The legacy is bloated, highly subsidised milk and dairy industries in rich countries, with surpluses to trade and dump on poor countries.

The North. As already stated, the main preoccupation of science-based food policy in its first phase, notably in the context of wars of national survival, was to prevent and control nutritional deficiency in children and young people in their own countries, at a time when breastmilk was becoming replaced by formula feeds, and animal foods were in abundant supply. These Phase One policies have been transferred to the South, ignoring the fact that outside Europe, traditional food systems have almost always been plant-based.

Reductionism. All the essential amino acids can be found in some animal foods, and the vitamin A, iron, zinc and other nutrients in them are more bio-available. So they were identified as 'master foods' or quasi-medicine. The fact that most established food systems where people have enough to eat include a variety of foods that in traditional combinations provide balanced nourishment, was ignored.

There is a fifth factor: power politics. I give deficiency diseases in general as an example. Many of the people working to prevent and control deficiency diseases are dedicated idealists. But the general tendency is to inflate the incidence of deficiency diseases, and to assert that internationally controlled and managed intervention is essential and local solutions impractical.

The transnational food and drug industries want to export their products. Executives in the UN and the aid agencies feel a need to set dramatic agendas. Researchers have careers to maintain.¹⁴ Governments of impoverished countries project statistics of deficiency like beggars display their stumps, and plead for more aid despite knowing this will cause further ruin to the economy, culture and identity of their countries.

This is not a conspiracy, in any usual sense, but a global community of interests shared by those in power in government, industry and science. As a result, estimates of micronutrient deficiencies are exaggerated, supplementation and fortification programmes promoted, and the value of traditional food systems overlooked.

How to prevent deficiencies

Vast numbers of children in the world suffer serious infection, damaged eyesight and blindness, of whom many die, because of vitamin A deficiency. The rational way to eliminate this deficiency as a major global public health problem, which will also have major health, social, environmental and other benefits, is as follows.

Governments, supported by relevant UN agencies, should give serious national priority and major material support to promotion of exclusive breastfeeding, according to the agreed global strategy (WHO, 2002), together with maintenance and development of sustainable food systems making maximum use of locally available plant foods. This will prevent nutritional deficiencies, including that of vitamin A, increase resistance to infections, and prevent chronic diseases.

The new world

Nutrition science needs a wide definition, broad principles and a full context. It has chemical and biochemical aspects, as do all disciplines concerned with the living world. But neither these nor any other of its aspects should be dominant.

It is irrational to constrict nutrition science into any narrow frame, if only because it is a meeting ground of many disciplines. It is a life science that includes biochemistry, physiology, pathology and medicine. It is also a social science involving economics, epidemiology, anthropology and ecology. In its application to food policy it embraces dietetics, agriculture, technology and geography.¹ And many of these disciplines are related to one another and to others.²

The scope of nutrition science is indicated by the number of government departments affected by food and nutrition policies. These include finance, foreign affairs, home affairs, education, urban and rural affairs, industry, trade, planning, environment and culture, as well as food, agriculture and health (NFA, 1997).³

Many people working in or with nutrition science see parts of this big picture. Here are just some examples. Study of the food systems of gatherer-hunters requires anthropological and archaeological research. Recommendations for increased production and consumption of vegetables and fruits imply knowledge of botany, agriculture, food culture and food preparation. Understanding of the metabolism of different types of saturated fats and trans fatty acids involves study of food processing. Proposals to control obesity on a population basis may include policies for urban design. In my view these and innumerable other aspects and applications should be seen not as peripheral but intrinsic to the theory and practice of nutrition science.

Outlines of the new map

As the last three chapters indicate, current conventional nutrition science is riven with contradictions and confusions. It has diminishing relevance in the world where we live now, and to the most important issues facing humanity.

The impact of the promotion of animal protein on human health and on the living and natural world, is perhaps the most dramatic example of how nutrition science can be 'bad medicine' which in resolving one problem, creates more problems. Indeed, since its beginnings and overall, the application of nutrition science may have done as much harm as good in the world. In any case, its current general principles derive from obsolescent philosophical, political and scientific paradigms that are now

beyond further modification or repair. Nutrition science needs a new unifying general theory, a new map.

What will the new map, designed to work in the new world in which we live now, and which we should make fit for our descendants, look like? Here I attempt only an outline sketch.

One way to start is simply to enlarge the current evident general purpose of the science as identified above (in chapter 1), so that it takes the form of a series of statements. These can be presented, discussed, developed, revised, reiterated and agreed at suitable meetings and by electronic process, and then used to define the subject as presented at conferences and in textbooks and courses.⁴ Thus:

The general purpose of nutrition science is to:

- Study the interactions of food and drink and their constituents with biological and all other ecological systems.

Such a statement is designed to enlarge the scope of nutrition science to include not only personal and population but also planetary health. Then the second part of the current evident general purpose can also be developed. Thus:

The application of nutrition science is designed to:

- Prevent disease and sustain the health and integrity of the human, living and natural worlds.
- Ensure evidence-based policies that promote and protect rational, equitable and sustainable food systems.

As in all such statements, key words, terms and concepts are used that need definition and explanation. Terms used here such as 'ecological', 'integrity', 'rational', and 'sustainable', which in their ordinary use have different shades of meaning, need explicit definitions that work in the context of nutrition science, and that are consistent with their ordinary meanings.

Other terms indicate the full scope of the new nutrition science. Thus, 'equitable' and 'sustainable' point to the 'deep' underlying and basic causes of good and bad health (UNICEF, 1990; Jonsson, 1993).

Likewise, concepts like the systems approach need explanation and definition. Thus, 'food system', a concept essential within an ecological frame, is broader than 'food chain', and includes the planting and breeding, production, harvesting and slaughter, preservation, storage, transport, manufacture, processing, packaging, trade, distribution, sale and preparation of food, as well as its composition, consumption

and metabolism; and also the cultural, social, environmental and ecological aspects and impacts of all these inter-related processes. As evident in the literature, the quality of food systems is a major determinant not just of human health, but also of the integrity of nations, and the health of the living and natural world (CIIFAD, 1996; Sobal, Khan et al, 1998; Sustain, 1999; Indaba Declaration, 2002; Leitzmann, 2003).⁵

Integrated principles and practice

The scope and purposes of any discipline, which is to say its definition, should be framed to be timeless. By contrast, the principles by which any discipline operates should be framed to be useful in the present and foreseeable future, and also to allow for shifts in response to changing circumstances. As already stated here, the original principles of nutrition science that still dominate mainstream thinking were effective in a previous period of history, but are now obsolescent, if only because times have changed.

Framing principles for the new nutrition science is an challenging prospect. But no individual can complete this task; it is teamwork.⁶ I make a start here, simply by reversing the four principles that I identified above (in chapter 1) as still dominating mainstream nutrition science. Thus I propose:

The principles that govern nutrition science include the following:

1. The key to food is its biological, social and ecological integration
2. A measure of good human health is slow growth in early life
3. Food from plant sources is preferable to food from animal sources
4. Human health is integral with that of the living and natural world

What will a broader definition for nutrition science mean in practice? Here are examples from the case studies given in the previous three chapters.

Nutrition labelling. Nutrition scientists now seem to be only marginally interested in the way the dietary reference value (or in Brazil the daily value) system as featured on nutrition labels, is used (Southgate, 2000b). However, the system was sanctioned if not devised by nutrition scientists (DOH, 1991). If the system is failing, responsibility rests with the scientists as well as with the regulators who authorise the system. In any case, a new comprehensive approach will consider what forms of information including dietary guidelines, food advertising and marketing, as well as food labelling, will have the most beneficial impacts on human health, patterns of food consumption, family and community integrity, and also on living and natural resources.⁷

Protein. Nutrition scientists now seem not to be thinking about the cultural, social, environmental nor even the health implications of bigger, heavier human populations.

Many seem to be unaware that the application of nutrition science to the shaping of food systems has influenced the accelerated speed of childhood growth, early sexual maturity and the greater height and weight of adults, and in turn the greater pressure on food systems and natural resources.⁸ New nutrition scientists will be well aware of these effects, and will reformulate recommendations for food systems with a lighter environmental impact. These will also have the effect of allowing young humans to grow as a natural speed, and may also lead to human populations of a more economical size as well as a healthier shape.⁹

Vitamin A. Most nutrition scientists now, seem to have a hazy idea of what foods are good sources of vitamin A, which of these are indigenous or established in countries where deficiency is an important public health problem, and which are good sources of other nutrients. New nutrition scientists will take a holistic approach. They will have knowledge of the composition and availability of such foods, of their place in traditional food systems suited to climate and terrain, of their cultural and culinary acceptability, of their trading and commercial potential, and of their capacity to sustain impoverished communities and populations as well to prevent nutritional deficiencies. The same point applies to all other nourishing native and established foods, especially in the South.¹⁰

In such ways the theory and practice of nutrition science will no longer be concerned just with the metabolism, composition and consumption of food and its effect on human health, but also with other and broader impacts and outcomes. Other examples touched on in recent statements taking a holistic view of nutrition science, are the use of land and natural resources in the production of food; the impact of food processing and distribution on the environment; the effect both of biocides and of genetic engineering of plants on species other than those targeted; and the resource implications of a global increase in production and consumption of fish and of vegetables and fruits (Bellagio Declaration, 2002; Indaba Declaration, 2002; APAN, 2003). Currently many nutrition scientists may feel that such areas are interesting but beyond their scope. I think that any such attitude not only trivialises nutrition science, but also overlooks its power in practice, which should be power for the good.

Need for global solidarity

As I have stated, nutrition science originated in mid-nineteenth Europe because of the pressing needs of the European powers and then the USA, which included maintenance of empires, expansion of territories and waging of wars, and was fostered at national level by governments working in partnership with industry with the support of scientists.

Now the pressing needs are global. These include the need to conserve living and natural resources, and are felt mostly in the South. So I think it is likely that the new

nutrition science will develop first in the South, where it is most needed, will embrace environmental, ecological and other life sciences, will be the product of collective judgement and experience, and will use electronic communication. It needs planning and publicity, which I believe is most likely to be initiated by influential non-government organisations (NGOs) representing civil society, supported by scientists and other professionals who already see the whole picture.

Some first moves are already coming from NGOs not so much concerned with nutrition as conventionally defined, as with many of the subjects I believe should now be incorporated into or associated with nutrition science but which are now mostly seen as separate, such as human rights, food security, land tenure, subsistence and family farming, livelihoods, the environment, the status of women and children, animal welfare, and traditional culture. Leading organisations in such fields already draft resolutions, laws and regulations and generally drive agendas for UN and other international agencies, national governments, and industry. They have now been brought together in the broad global alliance of the World Social Forum, whose first three annual gatherings have been held in Porto Alegre in the southern state of Rio Grande do Sul in Brazil; the Forum has also acted as a focal point and catalyst of mass protests against economic globalisation in Seattle, Genoa, Washington and Cancún.¹¹

Such NGOs therefore need to learn that nutrition science as it has been and still is put into practice in food and nutrition policies impedes their work, inasmuch as it leads to greater food insecurity, drives farmers off the land and destroys their livelihoods, damages the environment, invalidates women, abuses animals, and erodes traditional cultures. In these and other respects the new nutrition science as proposed here should be seen as an integral part of the work of such NGOs, essential to their success. In turn, this will give the theory and practice of nutrition science more power and more value. The Caroline Walker Trust could play a part in this process.

At the beginning of the new century, there are already moves to this end. Thus, the Bellagio Declaration on the 'nutrition and health transition in the developing world', agreed in August 2001, involved senior officials from relevant UN agencies, and is signed by scientists concerned with nutrition and food policy from China, India, Malaysia, South Korea, Thailand; Egypt, South Africa, Tanzania; Iran, Morocco; and Brazil, Chile and Cuba; as well as Europe and the USA (Bellagio Declaration, 2002).¹²

This declaration followed a conference at the Rockefeller Center at Bellagio on Lake Como in Italy, at which detailed accounts of the impact of the nutritional and epidemiological transitions on the health, welfare and independence of nation states throughout the South was presented and seen as parts of a global picture. It states

that: 'Phenomenal social and economic changes on a scale and at a speed unprecedented in history have resulted in an epidemic of nutrition-related chronic diseases that must be contained. Prevention is the only feasible approach to nutrition-related chronic diseases. The cost of their treatment and management imposes an intolerable economic burden on developing countries... Immediate action to control and prevent nutrition-related chronic diseases is not only a public health imperative but also a political, economic and social necessity'.

A year later, the Indaba Declaration on 'food, nutrition, health and sustainable development' was agreed on the occasion of the World Summit on Sustainable Development in Johannesburg, South Africa. This was an initiative undertaken by academics and representatives of NGOs and international agencies, together with the South African Department of Health, and is signed by people from India, Malaysia; Kenya, Malawi; South Africa, Zimbabwe; Turkey; Brazil and Jamaica; as well as Europe and the USA. It has been reproduced in a World Health Organization report on the impact of globalisation on human health (WHO, 2003c).

It states that: 'The nature and quality of food systems, and therefore of diet and nutrition, are fundamental determinants of human health and welfare, and that of the whole living and natural world'. It emphasises the underlying and basic causes of disease, including: 'Inadequate sanitation, polluted water; poverty, inequality, injustice; personal, communal and national debt; unemployment, dangerous environments, precipitate urbanisation; unsustainable agriculture, land degradation; poor governance, expropriation, dislocation; the effects of colonialism, unfair terms of trade, subsidy of industry in high-income countries; destruction of indigenous and traditional food systems and culture; commodity speculation, unregulated markets, aggressive promotion of degraded, cheapened and energy-dense food and drink; the use of food aid and trade as an instrument of power; and persecution, terror and war'.

Correspondingly: 'Successful and accepted public policies for example concerning transport, energy, firearms, tobacco, alcohol and water, include legal, regulatory and fiscal instruments designed to balance the interests of civil society with those of industry and government. The protection and creation of healthy food systems, integral to healthy environments and to human health, also requires the use of law, regulation and pricing policy'.

The Bellagio and Indaba Declarations are ad hoc statements, albeit signed by influential people and well-publicised. In March 2003 a further step was taken with the launch of the global Alliance for Peoples Action on Nutrition (the Alliance) in Chennai, Tamil Nadu, at an annual meeting of the UN Standing Committee on Nutrition (SCN). The founders of the Alliance include the three elected civil society representatives on the SCN steering committee, from South Africa, Malaysia and

Brazil. The Alliance is designed as the voice for all relevant international and national civil society NGOs within the global movement represented by the World Social Forum. One of its mission statements is 'to advocate socially responsible public health nutrition policies and initiatives, in the context of food and nutritional security and human rights'.

The Alliance was represented at a special meeting in May 2003 called by the World Health Organization for formal consultations with international NGOs on the WHO global strategy to prevent and control chronic diseases. The Alliance statement on the strategy was welcomed by outgoing WHO Director-General Dr Gro Harlem Brundtland. It goes further than the Indaba Declaration, stating that social, economic and political factors that are underlying and basic causes of disease are magnified and accelerated by unregulated capital flow, unregulated markets, and increased domination and control of materially weak by materially strong nations (APAN, 2003).

Two months later another NGO initiative was announced. In July 2003 a Manifesto on the Future of Food was published and sent to all government ministers attending the World Trade Organization meeting in Cancún. This is the result of consultations between another global network of civil society NGOs brought together by the International Commission on the Future of Food, concluded at a meeting organised by the state of Tuscany in Italy. Like the Alliance, the links of the Commission are with the World Social Forum (ICFF, 2003).

The Commission condemns the effects of economic globalisation on traditional and established food systems. It also gives many positive cases of good practice. Thus in Brazil, 70 per cent of the annual \$US 500 million budget for school lunches in the country's 5,561 municipalities must by law be spent on fresh vegetables and fruits and minimally processed foods, preferably purchased from local producers and farming co-operatives (Coitinho, Monteiro et al, 2002). The programme works, as I have seen in favela "slum" schools in Rio de Janeiro.

The Commission gives another Brazilian good example. Over twenty national governments, following an ideological lead given by non-government organisations, have declared that access to adequate nutritious food is a basic human right (UNCHR, 2000; APAN, 2003; ICFF, 2003).

Starting in 1993 the city government of Belo Horizonte, the fourth biggest city in Brazil, has confirmed and enacted this principle. Patches of city-owned land are made available at low rent to local farmers, on condition they keep their prices within the reach of the poor. The city makes sure that the federal government school lunch money is spent on local organically produced fresh food, resulting in not only

improved nutrition but also sustainable family farming livelihoods, low transport costs and other light environmental impacts. University researchers working with the city post the lowest prices of 45 basic food commodities every week at bus stops and on community radio stations. All such initiatives cost just 1 per cent of the city's budget. The programme is now being followed in other cities throughout Brazil. I have seen it at work in Belo Horizonte.

The case of Belo Horizonte is an example of the initiatives made by energetic non-government organisations being recognised and enacted by local government, with the support of local industry, academics and other non-government organisations.

The case of infant nutrition

Declarations made by non-government organisations and other groups are theoretical. Here in more detail is the example I know best of an enlarged concept of nutrition, involving social, economic and political factors, becoming actual world policy, as a result of collaboration between a global non-government organisation and national governments from the South, backed by nutrition science. This is the new World Health Organisation global strategy for infant and young child feeding, which includes the statement that: 'As a global public health recommendation, infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health' (WHO, 2002).

In the year 2000 Brazil had an exceptionally ambitious and focussed Minister of Health, José Serra, who in office had a special interest in public health.¹³ With this leadership, officials working in the section of the Ministry concerned with food and nutrition policy prepared a draft Resolution on Infant and Young Child Nutrition, designed to be supported by WHO member states and thus adopted globally by WHO, which after a long debate at the WHO World Health Assembly in May 2000 in which delegates from 54 countries participated, was accepted for further drafting at the next WHO meeting, of its Executive Board in January 2001 (WHO, 2000b, 2000c).¹⁴

The Brazilian draft resolution caused a sensation within WHO and also the infant food industry for a number of reasons, one being its assertive and comprehensive presentation, and strong, even passionate style. It insisted that infant and young child nutrition be put in the context of access to adequate food and nutrition as a basic human right. It urged reinforcement of existing laws, regulations, codes and conventions meant to enable and encourage mothers to breastfeed. It denounced industry's use of aggressive advertising and marketing that flout international codes, including abuse of the internet in ways that mislead health professionals into believing that formula feeds are safer and healthier than breastfeeding.

Another clause of the resolution proposed that the recommended period for exclusive breastfeeding be the whole first six months of life, rather than the then WHO policy of four to six months (WHO, 2000c; DHHS, 2000). This was one of the most contentious clauses, one reason being that formula feeding between four and six months was reckoned in 2000 to have a value to industry of around \$US 1.5 billion a year (IBFAN, 2001a). At that time the 61 national governments supporting a policy of six months were all from Africa, Asia, Latin America, the Middle East and the former USSR. Between the World Health Assembly and the Executive Board meeting, leading scientific journals carried many articles in which independent academics and industry went into battle on this and related issues (Lutter, 2000; Latham, Preble, 2000; Yamey, 2000; Coutoudis, 2000; IAIFM, 2000).

At this point I became involved, having begun to work as international food and nutrition policy advisor at the Ministry of Health in Brasília. In late 2000 the Brazilian resolution was supported at a special meeting of North and Latin American member states held by the Pan American Health Organization in Washington. It was also reinforced by a report of the US Department of Health and Human Services, which emphasises the value of breastfeeding not only for the baby at the time, but also for the mother and child throughout life (DHHS, 2000).¹⁵

On behalf of the Brazilian government, I reworked the original resolution to clarify and update it, and to take into account amendments suggested during the World Health Assembly by many member states including Angola, Bangladesh, Brazil, Malaysia, Nicaragua, Pakistan, Palau, the Russian Federation, Tanzania, Thailand, the USA, Venezuela, and also the Food and Agriculture Organization of the United Nations and Consumers International. The WHO secretariat undertook a similar exercise which resulted in different wording, notably on the 'six months versus four to six months' issue. As a result, delegates to the January 2001 Executive Board meeting were presented in Geneva with three variations of the resolution: the version accepted for further drafting at the World Health Assembly, and the two new 'competing' drafts as amended by Brazil and by WHO.

One remarkable feature of this process, was that the pressure imposed by the baby food industry on WHO, nation states, nutrition scientists and the media, was matched in effectiveness by pressure and counter-pressure from one global non-government network, the International Baby Food Action Network (IBFAN), working with sympathetic larger NGOs such as Consumers International. IBFAN is made up from over 150 groups in over 90 countries, many of whose members work voluntarily, and has modest material resources. It is the vigilant guard of the 1981 WHO International Code of Marketing of Breast-Milk Substitutes and of many other World Health Assembly Resolutions on breastfeeding and the nutrition of mothers and children.

Among NGOs concerned with nutrition, IBFAN in my experience is uniquely networked, intelligent and militant. It is responsible for the global campaign to boycott the purchase of any goods made by Nestlé, regularly attacks Nestlé at shareholders' meetings using forthright language and direct action techniques pioneered by Greenpeace, Friends of the Earth and other environmental groups, and has phenomenal contacts within the UN system, with civil servants and politicians within national governments, and with the mass and specialist media.

During 2000, in preparation for the World Health Assembly and then the Executive Board meeting, IBFAN gave the Brazilian Ministry of Health information, guidance, background documents and other resources without which the Brazilian resolution would not have progressed, one reason being that IBFAN could and did lobby other nation states in many of the countries in which it is represented to support the resolution, in ways that went beyond normal diplomatic practice and that were beyond the capacity even of a large Southern country like Brazil.

I was asked to join the Brazilian government delegation to WHO in January 2001. This work gave me insight into the normal conduct of business within UN agencies, and how they can be made to work harder in the public interest when pressed by governments and non-government organisations working in broad alliance.¹⁶

In Geneva it was immediately apparent that WHO itself opposed the Brazilian resolution, on the grounds that the scientific evidence on the optimum period for exclusive breastfeeding was unclear. A letter from a UN official sent to an IBFAN representative and thus to Brazilian officials said: 'The only way to combat the unbalanced view of WHO is to counter them on the science... I don't think that WHO is going to change until the scientific and international public health community challenges with hard facts and data that a six month policy is better in both low-risk and high-risk environments'.¹⁷

Gro Harlem Brundtland, then WHO Director-General, argued in her opening plenary speech that any discussion on the whole subject should be delayed until 'six months versus four to six months' was resolved by the findings of a special systematic review of the scientific literature that had been specially commissioned by WHO and which, she indicated, had not yet been completed. In this respect WHO was allied with Nestlé and the rest of the baby formula industry, and also the USA and the European Community. The battle lines were evidently drawn between the nations of the South and the nations of the North, with WHO on this occasion on the side of the North, together with industry. But in a charged atmosphere, Brazil revealed in its initial plenary response that while the systematic review might not have been finally processed, it been received by WHO; and the drafting committee, on which I was Brazil's lead representative, began what turned out to be three full days of discussion,

often attended by Dr Brundtland and an array of WHO senior executives and advisors.¹⁸

After 18 hours of intense and sometimes heated discussion, during which an increasing number of nation states positively supported Brazil, the resolution as redrafted by Brazil, suitably refined, with allowance either for 'six months' or 'four to six months' pending the emergence of the special review, was agreed by the drafting committee. During this process the US delegation repeatedly stated that the clause on abuse of the internet was unacceptable, but the US was not supported by any other delegation, so the chairman of the meeting accepted the clause as drafted.¹⁹ Three months later WHO announced that the special review supported six months of exclusive breastfeeding, which accordingly became part of the new WHO global strategy on infant and young child feeding, after final debate and agreement at the next World Health Assembly four months later (WHO, 2001, 2002).

A triumph for Phase Three

All types of public policy should be based on evidence. Thus, food and nutrition policy should be supported by evidence from nutrition science. But without general theories and corresponding principles, the findings of scientific research are not evidence, but accumulations of data without significance; and at a time of conflicting theories and principles, the same information can be used as a basis for different conclusions, just as two builders with two different blueprints will make different houses from the same sorts of bricks, cement and planks and other raw material.

The issue of the optimum duration of exclusive breastfeeding, which affects the health of future generations and thus of itself the fate of the world, is a case in point. Supporters of the 'four to six months' policy stated that after four months of breastfeeding, increase in the weight and height of babies often 'falters'. In response, supporters of the 'six months' policy said all this showed was that the height and weight of breastfed babies often do not follow the 'growth curves' partly based on measurement of formula fed babies. But the underlying debate is between those who believe in the principle of fast growth and those who believe in the principle of slow growth, for humans: and evidence for any such general principle comes from many disciplines.

And what counts as admissible evidence? Those who preferred relatively early use of complementary foods and relatively early weaning, justified this by examination of growth charts, considering fast growth to be healthy in itself and evidence of initial 'fulfilment of human potential'. Those who preferred longer continuation of exclusive breastfeeding, admitted as evidence data from broader investigations, pointing to the data showing that this protects against an array of infectious diseases of the child, is a

natural contraceptive, reduces post-partum depression, and protects the later health of the mother as well as the child (DHHS, 2000).

The debate was not only about breastfeeding, it was also between Phase One and Phase Three nutrition science. The WHO verdict in favour of a period of six months for exclusive breastfeeding, within a global strategy that will be adapted, adopted and followed in many if not most countries, has given the Phase Three holistic and integrative theory of nutrition science greater credibility and visibility. Potentially it has also increased the influence of the relevant Phase Three nutrition scientists both with governments and with non-government organisations.

Commenting on the new WHO global strategy, César Victora of the University of Pelotas in Brazil, one of the nutrition scientists responsible for assessing the systematic review, said: 'For fifteen years we have been accumulating evidence on the benefits of exclusive breastfeeding, and this has at last led to a change in global policy. The scientist's greatest frustration is when our studies do not result in changes in the real world' (IBFAN, 2001b).

The world seen as a whole

One of the defining icons of the Middle Ages are maps of the then known world, centred as a matter of religious principle on Jerusalem. Then in the early fifteenth century Prince Pedro returned from Venice to Portugal and his brother Prince Henry 'the Navigator', with world maps using new projections which recorded new lands to the West of Europe, certainly derived from voyages made by Arabs, possibly also by great Chinese fleets. It is likely that the adventurers commissioned by Iberian royalty to sail west in the later fifteenth century, including Christopher Columbus, were sure that they would find land. In the early sixteenth century maps of the world based on the new knowledge of European explorers, had taken a modern form (Menziess, 2002; Roberts, 1985).

We all now live in a world wider than that delineated by nineteenth and early twentieth century theories and principles. The discovery and mapping of new worlds begins by becoming open to exotic ideas. With nutrition science, this should now involve incorporation of many disciplines, special attention to history, tradition and culture, respect for the testimony of those with deep knowledge or experience, commitment to the reconciliation of policies and programmes designed to protect the human, living and natural world all together, and faith in the guiding light of principles such as those that have now begun to be outlined here. The whole map will be drawn as a result of this adventure.

Notes

Please do not skip these notes. Think of the numbers in the main text referring to the notes, as computer hotlinks. My intention is to maintain a narrative and logical flow in the main text, while at the same time using notes to elaborate and deepen some of the arguments, and to give my general thesis more colour. As is usual, the main text should stand by itself, but judging from reactions so far, some of the questions that will occur to readers are addressed in these notes. I suggest that you keep a marker in the notes as you read.

Title page

- 1 As translated in the most readily available English version this aphorism is rendered: 'The destiny of nations depends on how they nourish themselves'. This is half-way to a version I prefer which makes too free with the aphorism of the great philosopher and gastronome: 'The fate of nations is determined by what they are given to eat'.
- 2 The architect and visionary Siegfried Giedion shows the driving force of technology. One example is the impact of railways on the mechanisation of slaughter, first in the Parisian abattoir of La Villette designed by George Eugène Haussmann, then in the Cincinnati and Chicago slaughterhouses modelled on the French system. Henry Ford devised his automobile assembly lines after visiting the slaughterhouses of Chicago, and Adolf Hitler's human disassembly lines were designed as reverse versions of those of Ford. Technological developments tend to be a cause, not a result, of other developments (Giedion, 1948).

- 3 The Brazilian President Luiz Inácio Lula da Silva, elected in 2002, is universally known in Brazil as Lula (which means 'squad' in Portuguese). Born in the Pernambuco backlands city of Garanhuns, age 12 he was shining shoes and selling popcorn, and in the 1960s and 1970s was an auto workers' union leader in São Paulo, and a founder of the PT, the Brazilian socialist party. The military dictatorship of the time was relatively mild, and he was not assassinated. He stood for the Presidency four times, beginning in 1989. He was elected at a time when the country was in a good mood, Brazil having just won the football World Cup for the fifth time; voters reacted defiantly against the usual vicious external political and economic pressure when there is a prospect of a socialist government in Latin America. Having participated in the first two gatherings of the World Social Forum in Porto Alegre, whose mission is 'another world is possible', in January 2003 Lula attended now as President, and then took a flight immediately to the World Economic Forum in Davos, where he repeated the mission phrase of the World Social Forum. Whether Lula's government will or can do anything sustainable about inequity and poverty in Brazil, remains to be seen.

Preface

- 1 The concept that scientific principles are never absolute, and after periods of evolution and adjustment are liable under pressure of circumstances to be modified or revolutionised, is developed by the philosopher of science Thomas Kuhn (Kuhn, 1957, 1962, 1977, 2000). One example he gives is the replacement of

Ptolemaic with Copernican-Keplerian cosmology. Another example is the replacement of the 'hygienic' principle that diseases are caused by disordered environments, with the germ theory of disease promoted by Louis Pasteur (Dubos, 1987; Latour, 1988). Kuhn's general proposal is that scientific principles have ideological bases. Tested in evolving circumstances they survive as long as they remain seen as adequately simple, broad, relevant, plausible and useful. When they consistently fail these tests, the scientific discipline affected goes through a period of confusion during which new principles will be advocated. The set of new principles with the most effective champions will then rival the old principles, and if circumstances make the old principles less and less useful, will replace them. The analogy with maps is apparent. In Kuhn's terminology, this text is proposing a paradigm shift in nutrition science.

CHAPTER 1

The old world

- 1 Doubtless this proposal for the current purpose of mainstream nutrition science can be improved. I have not found any other definition in relevant textbooks. One attempt in a recent publication is 'the study of the totality of the relationship between the functional (metabolic, behavioural) characteristics of the organism and its dietary environment' (Young, 2003). This is not quite as circular as the definition in the New Shorter Oxford Dictionary: 'The branch of science that deals with (esp. human) nutrients and nutrition'.
- 2 In this text I use the terms 'North' to refer to Europe, North America and other

high-income countries such as Japan, Singapore, Australia and New Zealand, and 'South' to refer to the middle- and low-income countries of Asia, Africa and Latin America. The terms 'developed' and 'developing' are troublesome. They imply being and becoming in a good state because of money; but riches and poverty are not just a matter of cash (Sen, 1999). 'North' and 'South' are only very roughly accurate geographically, but they are not loaded terms. Another example of a loaded word is 'America'. The Americas are divided into the countries in the north (including Canada and Mexico); the central region; and the southern continent. Use of the word 'America' as synonymous with the USA suggests US expropriation of Latin America. Here the value-free words 'North America' and 'USA' are used. On a related point, the term 'chronic disease', which has replaced inappropriate terms like 'diseases of civilisation' or 'Western diseases' and is usually preferred to 'non-communicable diseases' is now also being challenged. Mark Wahlqvist, 2001-2005 President of the International Union of Nutritional Sciences, proposes 'eco-nutritional diseases' instead, for a number of good reasons (Wahlqvist, 2003). Perhaps wrongly I have here kept with 'chronic diseases'.

- 3 In Asia, Africa and Latin America information about food, nutrition and disease is regularly broadcast on television and radio, published in newspapers and magazines, and in health centres and clinics. What people are able to do with this information is another matter.
- 4 'Perceived reality and felt needs' may seem a gnomic phrase. Examples may help to explain. I guess for most people

reading this text, the perceived reality of being in the world changed after the collapse of the USSR. And felt needs are to some extent a function of psycho-social, economic and other status: destitute people feel they have different needs than do royal families. These are not merely existential points for individuals to ponder: part of the purpose of history is to map shifts in perceived realities and felt needs at societal, national and global levels. Hence the relevance to this text: nutrition science developed during a period in history when perceived reality included continual collision between and within European nations, and the felt needs of governments included 'going for growth'. Times have moved on but the principles of nutrition science have remained stuck in the past.

- 5 The 'commons' has been the great battleground between socialist and capitalist politics. Originally, European peasants had rights to shared land, commemorated in English place names including the word 'common'. Then landowners encroached on the commons, and drove the peasants out. These 'enclosures' eventually destroyed the English peasantry and the Scottish crofters, who were driven into cities, forced to emigrate, or even massacred. The wars between the English and the Welsh and Scots were in large part about land rights. At the time of the republican Commonwealth led by Oliver Cromwell in the mid seventeenth century, radicals named Levellers and Diggers tried to reclaim communal land, and are seen as the first communists. The communards of Paris in 1870 had similar vision. The term 'commons' as in 'House of Commons' has the same original meaning, of interests held freely in common (Tawney, 1938; Hill, 1972).

What first happened in England continues throughout the world now, as peasants are driven off their land into squalid areas of cities. The older and cautious usually become shop assistants and servants, the younger and bolder may become bandits and prostitutes.

- 6 Lula was then a young auto trades union leader in the 'ABC' agglomeration of greater São Paulo, then perhaps the greatest concentration of foreign-owned automobile factories in the world (Fausto, 1999).
- 7 Globalisation of food supplies is not new. The spice trade has been intercontinental for over a thousand years. Sugar, coffee and tea were all world trades centred in Britain in the eighteenth century. Railways, steamships, refrigeration, canning and refining made meat and grain world commodities before the end of the nineteenth century.
- 8 Upton Sinclair and John dos Passos are early twentieth century writers who evoked the staggering story of the USA in fictional form; their novels are similar to television drama-documentaries. Sinclair's book 'The Jungle', on the Chicago stockyards, provoked Theodore Roosevelt, the fabulous early twentieth century US President, to create the organisation that became the US Food and Drug Administration (Morris, 2001). The books of Dos Passos recording US adventures at home and overseas first appeared at the time of the Franklin Roosevelt presidency. Sinclair and dos Passos are worth reading now: they describe working conditions, and social, economic and political atrocities, evident now all over the world.
- 9 Whether or not this has been part of a plan by successive US governments to

control Central America, as the East India Company once controlled parts of Asia on behalf of the British government, is disputed. During two visits to Guatemala in 1997 and 1999 I learned more. While I was beginning to enjoy a regular cheap supply of bananas in London shops, two successive Guatemalan Presidents introduced land reforms. These included expropriation of 200,000 unused acres of the 550 million acres held by United Fruit, which were given to landless peasants. The Guatemalan government was denounced as Moscow-inspired by then US Secretary of State John Foster Dulles and his brother CIA Director Allen Dulles, both of whom had also acted as lawyers for United Fruit. The US government supported a military putsch. The military government stopped land reform and banned trades unions, and a long period of atrocious civil war began, in which hundreds of thousands of people were killed (Handy, 1984; Perera, 1993). Points about bananas apply to other cash crops that have dominated Southern economies, such as in Latin America, sugar and coffee.

- 10 Dispossessed farmers have been and are ready recruits for revolutionary movements throughout the South. They are angry and have nothing to lose. They also may become leading insurgents. This is well-known in Central America and is also true in South America, Africa and Asia, one reason being that the 'green revolution' has increased crop yields, but has also devastated rural livelihoods. The most damaging effect of monoculture of cash crops in the South is that farmers are no longer able to produce food for themselves and their communities (IFG, 2002).
- 11 I think globalisation is in itself wrong only inasmuch as it implies

homogenisation of world culture, such as in the form known in Brazil as 'cola-colonização' or else as burgerisation. This is now a very real and present danger. But in other ways globalisation represents new freedoms. Thus, while the almighty power of Microsoft and the positioning of Bill Gates as a saviour of the world is troublesome, the electronic revolution as at least as potent a force for communication of information and ideas to and from the common people as was print and the radio. Non-government organisations in the South, including those representing the interests of impoverished people, are now potentially much more potent, because of the internet. That said, from the view of all but the most privileged, current unregulated economic globalisation is obviously a form of imperialism. The resolution is not to attempt to overturn globalisation as such, but to struggle to make it work for the common good. Curiously, global politics in the electronic age is taking forms that resonate with those of the nineteenth century (APAN, 2003; Monbiot, 2003).

- 12 I have not found the source of the re-characterisation of palaeolithic humans as 'gatherer-hunters'. The suggestion is that women have always been the doers, the providers of food, whether foraging, planting or shopping and cooking, and men have always sat around talking, while occasionally spearing, shooting or barbecuing. Intuitively, and from records and observation of all sorts of societies, this seems rather plausible.
- 13 Deficiency diseases have existed and may well have been common throughout history. But the notion that the nutritional quality of food improved with industrialisation is mistaken. One example. In 1863 Dr Edward Smith, a

Fellow of the Royal Society, made a survey of the diets of 51 farming families in Wales so meticulous that the nutritional composition of the foods could be worked out in 1982 by Dr Elwyn Hughes of the University of Wales. Dr Hughes fed this diet, and the current Welsh diet, to mice. His conclusion was that the peasant diet was more healthy and had greater lifespan potential than the modern diet. The farmers' staples were rough bread and potatoes, with small amounts of meat, fish, butter, eggs and cheese (Barber et al, 1970; Hughes, Jones, 1984).

- 14 The main characteristic of store food is that it stores well. It includes white bread, refined grains, white flour, fats, condensed milk, sugar, salt, biscuits, confectionery, coffee or tea, liquor, dried beans and other legumes, some roots and tubers, salted or dried meat, and canned, bottled and packaged goods. In such forms basic foods have long shelf life because the perishable nutrients in them have been destroyed. Multiple deficiency diseases are endemic in populations that subsist on store food. At first in Britain, 'company stores' were set up by industrialists who paid employees partly in coupons redeemable for food only at these stores. Factory conditions made it impossible for mothers to breastfeed their babies. Thus much of the working class population was condemned to deficiency diseases. Impoverished people in rural as well as urban areas often now subsist mostly on superstore food, which now also includes cola and other soft drinks, UHT milk products, pasta products and preserved meat.
- 15 None of this is intended to suggest that food and nutrition were (or are) the paramount determinants of public health. Uncontrolled industrialisation also results

in gross air and water pollution, for example, then and now. But food and nutrition have probably always been more important than generally realised: thus, malnourished populations, infants and children most of all, are most vulnerable to infectious diseases (Dubos, 1959; Scrimshaw, Taylor et al, 1968).

- 16 Many social reformers were philanthropists. But Britain then was the world's greatest imperial power. In the nineteenth century continental Europe was racked by revolutions. The case for Communism made by Karl Marx and Frederick Engels, both of whom lived in Britain, was partly based on Engels' own investigations of the conditions of the poor in Manchester. In South Africa, the puny British recruits were no match for the sturdy Afrikaners, and Britain came close to losing the Boer War (James, 1994).
- 17 John Boyd Orr, later Lord Boyd Orr, was the first Director-General of the United Nations, soon resigning in disgust. His vision was frustrated by the consequences of the 1944 Bretton Woods conference, at which the US delegation blocked the proposals of John Maynard Keynes, and sowed the seeds of current economic globalisation (Stiglitz, 2002; Monbiot, 2003).
- 18 This is not to say that deranged food and nutrition is the only or even the main single immediate cause of these diseases. Other immediate causes are important, two examples being smoking and other use of tobacco, and physical inactivity. As a separate point, expert reports usually emphasise diets, not food supplies. This implies that the responsibility lies with the individual, which is only partly true even for privileged people. What people eat is

more a function of supply than demand. The neutral approach is therefore to bracket 'food supplies and diets' as I usually do in this text.

- 19 This was not the first time that Mrs Thatcher had suppressed an officially commissioned report on food, nutrition and public health. In the early 1980s, with Caroline Walker, I found out that she had suppressed another report whose main conclusion was that the food supplied to and consumed by the British population was - as it still is - the main single cause of the diseases from which they still mostly suffer and die (NACNE, 1983). This revelation led to vast media exposure of the 'food scandal', with a six-month BBC TV and Radio 'Food and Health Campaign' including five separate TV series (Granada TV, 1985; Cannon, 1987, 1989).
- 20 Another example of use of loaded words. Chronic diseases are now often described as 'diseases of lifestyle' (WHO, 2003a), the implication being that individuals are free to choose whether or not to decrease their risk of chronic disease, which in turn implies that prevention is all about education and information. The concept of 'lifestyle' was formulated in the late 1970s at Stanford Research Institute in California as a way to identify US sub-populations, so that products and politicians could be marketed more effectively. It is an extremely problematic concept applied to disease. The obvious example is diseases caused by regular smoking of tobacco and drinking of alcohol, both of which are and can be addictive. Also, it is now believed that some chronic diseases may originate early in life and even before birth (Barker, 1998; ACC-SCN/ IFPRI, 2000). It is fanciful to use the word 'lifestyle' to apply to a young child or a foetus.

Further, while middle-class people in high-income countries can have lifestyles and may make choices, most communities in the world have little choice but to consume the food they are supplied with and have little scope for style.

- 21 True, food and drink is not the same as alcohol and tobacco. There is no such thing as healthy tobacco, and on a population basis the less alcohol drunk the better. But legal and regulatory interventions that make fresh foods cheaper and more fatty and sugary foods more expensive are feasible, and may be on their way (Walsh, 2003). Also, nobody has yet devised that famous 'level playing field': mass manufactured fatty and sugary products tend to be artificially cheap.
- 22 The US public is more actively interested in food, nutrition and health, probably because of the outrageous cost of medical and surgical insurance and treatment. The more it costs to treat disease the more it pays the consumer to stay healthy.
- 23 The publicly and privately owned industries responsible for the treatment of disease are not concerned with public health. The more that is spent on drugs and surgery and other forms of treatment, the more value is added to the economy, and the more prosperous a country becomes, by current measures of development. Also, an ageing population is fiscally troublesome: the biggest favour people can do for ministries of finance is to drop dead at retirement age. It seems unlikely that politicians and civil servants plan for people to become chronically ill. I am though impressed by the growth of fast food cafés and pharmacies side by side throughout Brazil. This is not to suggest that these enterprises have common ownership.

- 24 Throughout the industrialised world, rates of obesity, diabetes, osteoporosis and cancer continue to rise, and I know of no evidence that incidence of these diseases has been reduced by current policies. Rates of high blood pressure, stroke and stomach cancer have dropped in many countries, perhaps mainly because of the general use of refrigeration, for which nutrition science does not take credit (WCRF, 1997). Rates of coronary heart disease have dropped rapidly in many industrialised countries. Nutrition scientists can take some credit here, in particular those who successfully pressed for reduction of fat, saturated fat and trans fatty acids in food systems, and for increased supply and availability of fresh food. Unfortunately the fat in processed food has been replaced by sugar, and as rates of coronary heart disease have dropped, obesity, itself a cause of diabetes, heart disease and some cancers, has become a mass epidemic (WHO, 2000; Nestle, 2002; WHO, 2003a).
- 25 Note, 'declared purpose'. It is commonly thought in the South that the actual purpose of these policies is to maintain Northern domination of the South, as a continuation of imperialism in a different guise. My view is that policies and programmes designed to eliminate nutritional deficiencies and reduce infectious disease succeed only when they are originated and maintained in the countries affected, in ways that are culturally appropriate. In the South now, Cuba, Costa Rica and South Korea are examples. On the issue of charity, I am reminded of the story of the first British woman MP, the immensely rich Lady Astor, on a public platform, advising her disgruntled electorate how to get by in hard times. She offered a recipe for cod's head soup. A voice from the crowd was heard: 'Who eats the cod?'

- 26 Nutritional medicine is based on the proposition that the vitamins, minerals and other nutrients contained in food are not as good as a feast, and that most people will enjoy better health if they take supplements, often in 'megadoses', either as treatment for existing sub-clinical or clinical pathologies, or for optimum health. A large proportion of middle-class people in the USA and increasingly round the world, use supplements. Judiciously used as well as and not instead of nourishing food, supplements may be as effective as drugs, and certainly are less toxic. Herbal remedies are probably a better choice.

CHAPTER 2

Chemistry, and food labels

- 1 Other textbooks, both orthodox and 'alternative', have the same basic structure. The exceptions are books advocating fundamentally different philosophies, such as aryanvedic or macrobiotic diets.
- 2 A logical sequence for chronic diseases might be biophysiological, by systems of the body, as for example digestive system, cardiovascular system, etc; or epidemiological, according to the time sequence in which chronic diseases become epidemic as a result of the transition from traditional to industrialised food supplies (Trowell, Burkitt, 1981). A random order suggests a science that has lost sight of its principles, or has not yet identified them.
- 3 My criticism of nutrition textbooks is not of their editors and contributors, but of the general principles that they follow. As a first stage a textbook designed to reformulate nutrition science will need explicit identification, as for example

'Nutrition. Twelfth edition. Arranged according to new principles' and then 'Formerly "Human Nutrition and Dietetics"'. It will require courage from the publishers, editors and contributors. When Galileo Galilei believed the time was right to shift the paradigm of cosmology, he was subjected to the Inquisition and shown the instruments of torture. For scientists now the equivalent is being accused of 'pushing the evidence' and being cast into the obscurity of no research grants and no membership of prestigious committees.

- 4 The title of the first edition was 'The Chemical Composition of Foods' (MRC, 1940), as was that of the second edition. The omission of the word 'chemical' from the title of the third edition of 1960 marks the time when the basic principle of identifying food with its chemical constituents was no longer questionable. Later editions have included more foods and more chemical constituents, in a basic format unchanged since 1940. The fact that 'The Composition of Foods' is often referred to as 'the bible' is significant.
- 5 Does it seem 'unscientific' to resist division into constituent parts? The problems of a reductionist approach to nutrition and other aspects of life are now discussed both in the 'alternative' literature (Goldsmith E, 1992; Hartvig, Rowley, 1996) and also in mainstream writing (McMichael, 2001; Leitzmann, 2003). Benefits of a 'holistic' approach are apparent with cancer, where the evidence shows that it is vegetables and fruits as a whole that protect against cancer, rather than individual or combined constituent parts. Experiments in which diets have been supplemented with micronutrients in the hope that these might prove to be 'magic bullets' have

proved ineffective or seem even to have had the effect of increasing cancer incidence (WCRF, 1997).

- 6 Nutrition labelling contains its own absurdities and confusions. In common with other countries, the system in Brazil as required by law, adapts and mangles the 'Dietary Reference Value' concept originally devised in the UK, which is meant to be neutral in connotation (DOH, 1991). DRV is a Phase Two concept, designed to protect against chronic diseases. In many countries DRVs replace the older term RDA (recommended daily amount) which is a Phase One concept designed to protect against deficiency. The 'neutral' concept means that equal treatment is given to nutrients liable to be consumed excessively by those people who may read nutrition labels, such as saturated fats and salt, and to nutrients that are depleted in processed foods, such as fibre. As a result consumers may think they are being encouraged to attain the DRV (or DV) for all nutrients listed, including fat and saturated fat. Worse is to come! In Brazil, a woman in energy balance say at 1,750 calories a day, who tops up her saturated fat intake in order to reach its outdated DV calculated for energy turnover at 2,500 calories a day, can only increase her risk of a heart attack. Systems of nutrition labelling are devised in collaboration with industry, so suspicious minds may think they are meant to be confusing.
- 7 As readers of slimming information know, a kilocalorie, the unit used on food labels, is the amount of energy needed to raise 1 kilogram of water 1 degree centigrade. Many textbooks and reports now use joules, a unit named after James Joule, who formulated the first law of thermodynamics. The kilojoule is equivalent to 4.184 kilocalories, a

megajoule is equivalent to .004184 of a kilocalorie: thus, 2,000 kilocalories are 8.4 megajoules. If joules are adopted for nutrition labels, the experts will ensure that information on energy content and energy density is indecipherable at least for years, and always for many older people.

- 8 Useless for the consumer, that is. What consumers need and want to know, is added sugar content. It is said that the deal struck by the food manufacturers and the international and national regulators who make rules about food labelling, has been to list carbohydrates but usually not sugars, in order to avoid letting the consumer know just how sugary so many manufactured products are. This has been made possible by the chemical approach to food, which enables regulators to claim social responsibility while actually authorising useless information. The story with fat is different. Industry was not united against fat labelling; manufacturers of low-fat and high-polyunsaturated fat products encouraged nutrition labelling as a marketing tool - as do manufacturers of products with added minerals and vitamins.
- 9 But to be told that oats, honey and cinnamon contain no cholesterol, found only in animal foods, is absurd. It may well not be useful to list cholesterol, whose role as an independent immediate cause of heart disease is believed outside the USA to be exaggerated (DOH, 1994). The demonisation of nourishing foods very high in cholesterol but relatively low (eggs) or very low (shellfish) in saturated fat, has probably not improved public health.
- 10 The more useful information on fats can be found on ingredients or 'recipe' labels,

which list oils that have been hydrogenated into saturated fats or trans fatty acids, in processed products. Do not buy or eat them! However, neither this nor information about saturated fats is any use with fresh meat, unless it is labelled. The advice I find most useful is: consume hard fats, and oils that are hard in cool temperatures, only occasionally and sparingly. Much simpler and more useful than chemistry lessons.

- 11 Up to a point. Fresh vegetables and fruits do not have nutrition labels, and some processed products which may be high in fat, sugar or salt, are 'fortified' with fibre. And 'the beneficial effects associated with unrefined plant foods cannot be restored by adding "fibre supplements" to fibre-depleted foods. The structural integrity of the naturally occurring plant cell wall must be retained' (Englyst, Hudson, 2000).
- 12 The proposal that fibre be redefined chemically was first made in a report of the British Nutrition Foundation (BNF, 1990), which is controlled by the UK food manufacturing industry, and in my campaigning days was, in the words of an ex-BNF director-general 'solely taken up with defensive actions for the industry' (Granada TV, 1985, Cannon, 1987).
- 13 Any general statement about calcium and iron requirements is contentious, partly because of the vast commercial and intellectual investment in promotion of high intakes. As common sense and an evolutionary perspective suggests, the body adjusts both to high and low intakes of calcium and of iron. Turnover studies done on people with normally high intakes will suggest high requirements, and vice versa. This point applies to many nutrients (and see chapter 3). Studies

done on chemicals and their compounds singly or in combination are always liable to produce distorted or misleading results. Except in cases of acute severe clinical deficiency, the safe choice is whole and minimally processed food: less interesting for the chemically inclined researcher, but better for human health.

14 Industry will however rant and rave when expert reports recommend that the salt content of processed foods be reduced. The salt industry is not so much the salt refiners as the transnational and other international food manufacturers whose product formulations depend on the use of a lot of salt. Ready-to-eat breakfast cereal and tinned soup manufacturers are two examples. The same general point also applies to sugar. Sugar refiners have historically defended their product in the face of the overwhelming evidence that food supplies high in sugar are pathogenic, but it is the cola and other soft drink manufacturers above all, that defend sugar with zeal and big budgets.

15 Like the addition of iodine to salt to prevent goitre, the policy of folic acid fortification is necessary as an immediate way to reduce incidence of neural tube defects. But this is at the high price of distracting attention from the fact that folic acid is so-called because found in foliage. Whole foods naturally rich in folic acid such as vegetables, fruits and wholegrains, usually do not advertise the fact and anyway have small advertising budgets. The full story of folic acid and NTDs is told elsewhere (Wynn, Wynn, 1979; Cannon, 1987)

16 Philip Morris has now changed its name to Altria. Perhaps 'Altruistics' and 'Altrue' were already taken.

17 For example, both the WCRF report (WCRF, 1997) and the Brazilian dietary guidelines (Ministério da Saúde, 2003) include more than one set of recommendations, the first being food-based, and the second derived from the first also specifying dietary constituents for use by health professionals in for example drawing up specifications for institutional catering.

18 Thus, if labels used a 'traffic light' system, where above specified levels fat, sugar and salt gained a red 'do not eat me' sign, and fibre gained a green 'eat me' sign, chemical nutrition labelling would be more useful. Given that nutrition labels are the result of discussions between regulators and industry, any such system is wishful thinking; besides which, the most useful labelling will emphasise degree and nature of processing.

CHAPTER 3

Fast growth, and protein

1 The significance of von Liebig and his followers in Europe and the USA is discussed in a current encyclopaedia of food (Kiple, Ornelas, 2000), but von Liebig is not mentioned in the leading current textbook of nutrition science (Garrow, James et al, 2000). Knowledge of the origins of current beliefs is essential to their understanding, assessment, adaptation and replacement, in all disciplines.

2 Von Liebig was not alone. François Magendie, Jean-Baptiste Boussingault, Gerrit Mulder, Jacob Berzelius and others worked in collaboration at much the same time as von Liebig, in various European countries. Berzelius proposed the term 'protein' after the Greek term

meaning 'first' and the god Proteus, saying that protein is the 'fundamental or primary substance of animal nutrition'. Von Liebig was not only an outstanding scientist but also a dogmatic, energetic and effective entrepreneur. His impact on the modern world resembles that of Louis Pasteur (Kuhn, 1962; Latour, 1988).

3 It is not true that protein requirements increase as a function of physical activity. Like other mistaken ideas about protein, this myth persists. The advocacy of high animal protein was opposed in the nineteenth and early twentieth centuries both by popularisers and entrepreneurs such as John Harvey Kellogg and Horace Fletcher, and scientists such as Russell Chittenden and Mikkel Hindhede.

4 These early breastmilk substitutes often destroyed the health of the children to whom they were given. But then as now, formula-fed infants and young children grew fast. A comment written in the late 1930s was 'Indeed, they usually put on weight too well. At two or three years they were overweight for their age but pale, fat and flabby' (Drummond, Wilbraham, 1991). Now, 'and' would be substituted for 'but'.

5 People were much more physically active 150 years ago, and so this amount of protein is less than double what is now consumed as a percentage of energy. At habitual high levels of intake, animal protein leaches calcium out of the bones and so is a cause of osteoporosis. It may also contribute to high blood pressure, and damage kidney function (DOH, 1991). Animal studies suggest that at high levels animal protein increases the risk of some cancers, but this is not supported by human studies (WCRF, 1997). Mikkel Hindhede, who influenced Danish food policy at the time of the

First World War, pointed out that the brewery workers studied by von Voit tended to die young, in their 30s (Hindhede, 1915).

6 Humans are evolved to adapt to high and low intakes of many nutrients. Given the conditions of 200,000 years of palaeolithic life it would be strange if this was not so.

7 A condescending attitude to physically smaller populations, the assumption that to be big is superior and to be small is inferior, is I think one reason why the USA bungled the wars in Korea and Vietnam. The massive North Americans could not imagine that the small Chinese and Vietnamese could match them. But human intelligence is not a function of bulk.

8 Meat and animal products became identified as 'first-class' protein. Here is the explanation given in the official UK Manual of Nutrition: 'most animal proteins (from meat, fish, milk, cheese and eggs) have a high biological value. The reason for this is that humans are part of the animal kingdom' (FSA, 2001). The manual does not explain why this concept does not apply to vegetarian species such as gorillas, elephants or cows. True, all the 'essential' amino acids needed by humans are contained in eggs and milk, which as individual foods can be called 'complete'. So are combinations of grains and legumes, the basis for most traditional food systems. Experimental diets may be based on single foods. In the real world people eat food in combination.

9 Dr Friend's main claim to fame is that he noticed an association between consumption of unfortified margarine and limb fracture on the Christ's Hospital

rugby football fields. When butter replaced margarine (which not long before had replaced butter) rates of fracture decreased. This is a reason why margarine became 'fortified' with vitamins A and D.

10 Children and adults who are 'stunted' and 'wasted' are so-called because their heights and weights are well below standards originally developed in the USA (NCHS, 1977). Such loaded words should not be used to describe very small and thin people. By these definitions Voltaire was stunted and wasted. Also, it has been repeatedly noted that small thin active children and adults may be fitter and stronger than 'well-nourished' taller bigger people (FAO/WHO/UNU, 1985). I thought about this on a trip to Sri Lanka in 1984 with Caroline Walker. As we walked into a village, a girl of maybe 8 ran up a long incline to greet us, her brother of maybe 3 on her hip. Later we watched the grandmother in our rest-house, pounding herbs with a pestle as thick as her arm. The little girl and the old woman were both small and thin. But what they could do every day would be impossible for their equivalents in the North. This is a matter of physical health, and also of enjoyment of and participation in family and communal life.

11 The food of palaeolithic people were probably very high in animal protein (Eaton, Shostak et al, 1988), as are the foods of some surviving populations such as the Inuit and the Maasai. However, life expectancy in the palaeolithic period was low, perhaps because populations were programmed to die as soon as they passed their peak of physical ability. Also, the flesh of wild meat is usually very low in fat and relatively high in essential fats (Crawford, Marsh, 1989).

12 This argument is developed by a previous Caroline Walker lecturer, Michael Crawford. He also believes that diseases of the brain and nervous system are caused by food supplies artificially low in the essential fats found in marine food and also in wild animals, but bred out of domesticated animals (Crawford, Marsh, 1989; Crawford, 2002).

13 This is not to suggest that the later the age of sexual maturity, the better. Estimates of an average age of menarche of 17-18 in the early nineteenth century suggest communal food insecurity. Most historical records indicate that humans are evolved to become sexually mature between the ages of 12 and 15 and usually between 13 and 14, which gives some balance between physical, mental and emotional development.

14 At the time of writing this text, the 1985 FAO/WHO/UNU report remains the most recent published UN statement on protein requirements. It is remarkable that in these circumstances, the 1985 report is out of print. It is, after all, the most authoritative international document that nation states can use as a basis for food supplies and for labels on processed foods. A fuller account of the clash between US-based and other scientists that still prevents publication of a new report is given elsewhere (Cannon, 2003b, 6/6).

15 The story of kwashiorkor, 'the protein gap' and 'the great protein fiasco' is told elsewhere (McLaren, 1974; Tudge, 1979). Immediate causes of kwashiorkor probably include a cycle of semi-starvation diets, and infection and infestation (Golden M, 2000). Gross deficiency of protein is probably also another cause, but an infant prematurely weaned on to watery porridges or gruels will be deficient in many nutrients. Later

in young childhood, monotonous and inadequate diets mostly made from non-grain starchy foods including very low protein roots and tubers like cassava (manioc), yams, sweet potatoes and plantains, if prepared and eaten together with water and say some sugar and oil, with very little if any vegetables, fruits or animal food, might supply as little as 2 per cent of energy from protein (FSA, 2002).

16 These much lower estimates remain based on measurements of nitrogen loss in volunteers whose diets are designed to include no protein (FAO/WHO/UNU, 1985).

17 Protein requirements are usually calculated on the basis of consumption of milk and eggs. Availability of protein and of amino acids is somewhat less with 'mixed' diets, which may be allowed for by adding around 10 per cent to recommended requirements. In practice this is not an issue because practically all populations that consume enough energy also consume more than enough protein, with exceptions such as those mentioned in note (15) above and (19) below.

18 The ILSI textbook also suggests that humans have evolved so that breastmilk is deficient in protein (Heird W, 2001). ILSI is a singular organisation. Its name suggests, its literature states, and many scientists believe that it is an independent charitable science-driven foundation. Based in the USA with branches in many countries, it was set up in the 1980s by a number of transnational food companies, notably Coca-Cola, and gained observer status with WHO. ILSI is certainly not independent of the food manufacturing industry. The process of commissioning and editing documents linked with ILSI is in my view liable to produce results

sympathetic with food manufacturing policies.

19 Most settled populations seem to have consumed between 8 and 12 per cent of energy as protein, mostly from plant sources. Since the rise of the meat and dairy industries many Northern populations have consumed between 12 and 16 per cent, mostly from animal sources. The average figure for India is 11 per cent. Impoverished sub-populations, such as in West Bengal on 5.4 per cent, may be deficient - and not only in protein (Pellett, 1996; Millward, Jackson, 2003).

20 Ever since joining in the 'small but healthy' debate at the Congress of the International Union of Nutritional Sciences at Brighton in 1985, I have been aware that anybody who suggests that official figures of malnutrition might be overestimates, is generally regarded by the custodians of conventional wisdom as an idiot or a crook. But in reality, the only question is how great is the exaggeration. (See also chapter 4).

CHAPTER 4

Animal food, and vitamin A

1 Since Hindus do not eat meat for reasons of religion, and an estimated one billion people in the world are vegetarian, this is not a small issue. Mainstream books on nutrition tend not to distinguish clearly between different types of vegetarian diet. They also emphasise the dangers of deficiencies, particularly of vitamin B12 with vegans (vegetarians who consume no food of animal origin, usually for humane and environmental reasons). The WCRF report on food, nutrition and the prevention of cancer (WCRF, 1997) does have a two-page section stating that

various types of vegetarian diet decrease cancer risk, but that this is not a reason to avoid meat and animal foods altogether. I personally am not a vegetarian in any sense: I eat meat occasionally, as well as poultry, fish and dairy products. From the human personal and public health point of view, there is no good reason completely to avoid meat, dairy products and other animal foods, unless there is a risk of infection. Overall, the evidence is that plant-based diets reduce the risk of chronic diseases, and are generally beneficial to human health. It depends of course what is meant by 'plant-based': diets based on margarine and sugar white bread sandwiches washed down with whisky are not healthy. Again, see (WCRF, 1997).

- 2 As already stated, my point here is not to criticise the editors of and contributors to nutrition science textbooks and UN agency expert reports, but to point out the context in which they work and the general principles they still follow.
- 3 In Latin America, there are beginnings of an integrated approach (Bengoa, Torún et al, 1988, 1989; Ministério da Saúde, 2003), but there is as far as I know, no plan for any such approach within the UN system. A sufficient reason why not, is professional rivalries and intra-departmental jealousies. Nutrition professionals concerned with nutritional deficiencies and infectious diseases, live in a different world from those who are concerned with chronic diseases. In my view the only way to resolve this is appointment of a commission charged to make universal recommendations for all food-related diseases, whose authority should span all relevant UN agencies.
- 4 Recent studies indicate that the potency of carotenoids in dark green leafy

vegetables is on average around half that previously thought (Castenmiller, West, 1998). On the other hand, chemical analyses show that the amount of carotenoids in outer leaves is up to 50 times higher than the 'average' ranges (RSC/MAFF, 1991). Also, trials in India indicate that absorption of vitamin A from the beta-carotene in red palm oil is 90 per cent and that its potency is about twice that previously thought (Rao, 2001). There seems to be a correlation between findings on carotenoids and nationality of the investigator, with scientists from the North stressing low bioavailability and scientists from the South stressing high availability. If it is true that bioavailability from dark green leafy vegetables is lower than usually estimated, this is not in itself a reason to question a plant food-based approach to deficiency. This is first, because of the additional richness of outer leaves, and second, because of the exceeding richness of palm and other oils, agreed to be highly bioavailable. Also see note 10, below.

- 5 A recent report states 'almost one-third of children in developing countries are affected to some degree by vitamin A deficiency' (Ruel, 2001). Dissonance with the various estimates, which have tended to rise over time, comes from studies of clinical vitamin A deficiency in eight Asian countries, which found clinical deficiency, defined as night blindness and lesions in the eyes, of 0.3 per cent in Indonesia, 0.4 in the Philippines, 0.5 in Sri Lanka, 0.6 in Vietnam, and 0.8 in Myanmar. In three countries the rates were above the 1 per cent usually considered to define a public health problem: these were India at 1.4 per cent, Nepal at 1.5 per cent, and way higher, Bangladesh at 4.6. Projected as numbers of young children in these

countries, these are nevertheless big numbers. Global estimates of 'at-risk' populations, of pre-clinical and clinical xerophthalmia, and of incidence of blindness and death, are based on somewhat 'heroic' projections from studies of variable quality done in selected populations. Sub-clinical deficiency means serum retinol levels below an agreed cut-off point, without clinical signs of deficiency. Expert consensus decisions on such cut-off points have massive implications for estimated numbers at risk, and for the scale and nature of aid policies and programmes.

- 6 Supplementation programmes are rationalised with the argument that the immediate and urgent need is to treat existing clinical and sub-clinical disease, most of all in young children. Because vitamin A is stored in the liver, a one-stop approach can be efficient and effective. However, three randomised controlled trials carried out in Africa (Ghana), Asia (China) and Latin America (Peru) on high-dose supplementation of babies, showed no effect on rates of disease or death. One interpretation was that the doses may have been too low (WHO/CHD, 1998). However, in very high doses retinol is highly toxic and also teratogenic; for this reason pregnant women have been advised not to eat liver (DOH, 1991). Carotenoids are safe at any level. Also, supplementation does not touch the basic causes of deficiency, which include poverty and inequity. A general belief that supplementation works is likely to have the effect of enabling governments to neglect or evade systemic responses to destitution, such as land reform. Furthermore, malnourished infants, children and other vulnerable people are short of or deficient in all sorts of micronutrients. Cynics will say that

the main beneficiaries of food supplementation and fortification are the pharmaceutical industry, the sugar industry, and the aid business.

- 7 'Fortification' is a broad term. It may mean that the food contains more of specified micronutrients than naturally present in relevant ingredients of the food. Commonly, fortified products have only a proportion of the advertised nutrients added back, and so are inferior to the food in whole form. Alternatively, products whose main ingredients include fat, saturated fat, sugar and salt may be 'fortified' with vitamins and minerals in order to support health claims in advertising and marketing. (See chapter 2).
- 8 Impoverished people normally do not have the money to buy eggs and dairy products. However, the governments of many countries now operate schemes that give the person in the impoverished family who buys the food, small amounts of money with which to buy food of their choice; support is given by nutrition educators directly and in the form of media spots and leaflets. The Brazilian 'Fome Zero' programme is one example. If governments are led to believe that animal foods and fortified foods are the best choices, then mothers may be encouraged to spend the money they are given on fortified commercial products including vitaminised drinks, powders, and dairy products. Given that many people in impoverished communities are underweight by usual reckoning, official policies could also include cheap energy-dense foods: 'Let them eat liver pâté, ice-cream, vitaminised sugary milk drinks and biscuits - and cake'.
- 9 To be exact, in May 2002 the World Health Assembly approved a Resolution

that included expression of alarm that 'inappropriate infant and young-child feeding practices contribute to the global burden of disease... including blindness and mortality due to vitamin A deficiency' (WHO, 2002a). 'Inappropriate (etc etc)' means use of formula feed and premature weaning. The global strategy document itself does not refer to vitamin A deficiency. In most reports breastfeeding is mentioned towards the end of lists of other approaches including fortification and supplementation.

- 10 A footnote in 'The Composition of Foods' states that there is a great range of carotenoid content in mangoes, and the ripe fruit is highest in carotenoids. So in general, maybe locally grown vegetables and fruits, picked ripe and eaten fresh, are better sources of vitamin A than produce picked unripe and stored before delivery to shops. If so, then plant foods grown wild or in gardens and small-holdings will be richer - perhaps far richer - in vitamin A than indicated in food composition tables based on analyses of stored foods, and perhaps the plant foods of tropical countries, picked ripe and eaten fresh, are richer in vitamin A - and many other nutrients - than the plant foods of temperate countries, where most food composition analyses are carried out.
- 11 So why is red palm oil not advocated as the first line of approach to vitamin A deficiency for weaned children? You may well ask. One report said that people don't like the taste or the colour of the oil. Well, I remember that cod liver oil tastes disgusting, but this did not stop the government programme to manufacture and distribute it in Britain during the 1939-1945 war, nor did it stop my mother giving it to me. Indeed, it is currently advertised on British television.

As for adults, one of the two cities in Brazil whose people consume more than the recommended amounts of vitamin A is Salvador, the capital of the state of Bahia, where dendê is habitually used as part of Bahian cuisine, because the dendê palm was originally imported into Brazil from Africa by slaves whose descendants give the state its dominant culture. The other city is Rio, also influenced by African culture (Oliveira, Cunha et al, 1996). So some people like red palm oil. It is high in saturated fats but also contains vitamin E, and the amounts needed to prevent vitamin A deficiency are very small. If those with the power and the money really wanted to prevent vitamin A deficiency in tropical Southern countries, they should encourage production and consumption of red palm oil as the first-line priority.

- 12 During the time when José Serra was Minister of Health, a project named 'Alimentos do Brasil' was planned at federal level, whose message is: 'see, grow, and eat what you already have. Your good health is in the hands of your family and community.' After the presidential elections of 2002, 'Alimentos do Brasil' was put to one side, as tends to happen with projects associated with previous governments from other political parties. Its time may come. At state level such projects are co-ordinated by community leaders, and may be supported by state and municipal government (Estado do Tocantins, 2003). But a systemic approach will be needed, to recover and transform the agriculture systems of Brazil.
- 13 How can we be sure that native people knew the value of the foods they gathered and consumed? Questions like these are addressed by anthropologists (Lévi-Strauss, 1966). They are also

philosophical in nature. What do we think we are? We have been brought up to believe in progress and its prayer that every day in every way, things should get better and better. This implies that primaevial and modern gatherer-hunters, pastoralists and agriculturalists were and are stupid and ignorant, and the idea that ancient humans could know more about aspects of nutrition than is now known by nutrition scientists, is seen as absurd. But we should accept that our human ancestors and people who now live with nature, as a rule knew and know more about native foods than we do. The burden of proof is on anybody who asserts that the original Brazilians were unaware of the uses of plant foods rich in carotenoids - and, indeed, unaware of the value of all the native foods of plant and of animal origin that are rich in vitamins and minerals, and in other bioactive compounds whose relevance to human health is not yet understood by nutrition science.

- 14 Of course people who are suffering from deficiency diseases need treatment. But a price is paid by their communities and countries. When pharmacological doses of retinol are administered to children in impoverished communities whose food inevitably contains little food of animal origin, and commodities like sugar are fortified and perhaps also distributed as part of hunger relief programmes, the underlying message (apart from 'sugar is good for you') is that communities cannot find their own solutions. Such policies frustrate community-led sustainable recovery, and development of systems using indigenous plant foods that are rich sources of carotenoids. Instead, the communities become mystified and invalidated, and their dependence on urban and foreign elites is increased. In my view supplementation and

fortification should be clearly identified as short-term responses to severe malnutrition.

CHAPTER 5

The new world

- 1 I am not suggesting that all nutrition scientists cover all this ground! Much work will remain specialised. But the discipline itself should be recognised as a life and as a social science, as a theoretical and a practical discipline, as specialist and holistic, abstract and concrete, and technical and also political, with all this implies for teaching and practice, and the structure and scope of textbooks, conferences, and other frames.
- 2 This enlarged definition incorporates the 'eco-nutrition' concept, designed to connect nutrition science with its environmental and ecological impact (Wahlqvist, 1998, 2002). It also draws on the broader concept of 'nutrition ecology', which includes whole food systems within the scope of nutrition science, together with cultural, social, environmental and other dimensions (Leitzmann, 2003).
- 3 An example in Brazil is the Alimentos do Brasil project, which I and colleagues devised for the then Minister of Health José Serra. The concept includes identification, analysis, production and marketing of native and established Brazilian foods of plant origin. These may sustain rural populations, are often rich sources of nutrients (see chapter 4), and so can be marketed nationally and internationally. The government ministry most interested in the project has been not that of Health, nor that of Agriculture, but of Rural Development, concerned to find ways of keeping people

on the land. The potential of the project for Trade and Industry has also been recognised.

- 4 Useful statements of definition are similar in form to mission statements now conventionally used by all sorts of organisations to identify their nature and purpose, especially at times of development or change. The framing of such statements requires expert facilitation, broad discussion, and meticulous testing. With nutrition the task should not be left to nutrition scientists. Specialists in allied fields should be involved, and representatives of areas most affected: government, industry, producers and consumers, for example.
- 5 A broad approach is now beginning to be taken in expert reports that identify heavy marketing of energy-dense foods, and large portion sizes, as causes of obesity (WHO, 2003a) in which consumers are identified in effect as the victims of the marketing and advertising policies of fast food companies (Walsh, 2003). This type of thinking was at the heart of the epic 'McLibel' trial, in which McDonalds was accused of being a cause not only of rising incidence of cancer and heart disease, but also of littering, depression of wages, destruction of the Brazilian rainforests, and other abuses some of which are beyond any usual definition of nutrition science (Vidal, 1997; www.mcspotlight.org).
- 6 Again, I am not suggesting that all these fields be mastered by every individual nutrition scientist. Much good work and most great work is done by teams. The whole is greater than the sum of its constituent parts: as in society, political parties, and also creative work, so in research projects and expert committees, where the best work is done not despite

of but because of teams. DNA was not discovered by an individual, nor was the genome project the work of one person. The notion of the supremacy of the individual is historically very recent, being a product of the Reformation in Europe and its expression in capitalism and imperialism (Tawney, 1938). It is buttressed by the myth of 'Shakespeare' as the supreme individual genius. The idea that a relatively uneducated man with no Latin and less Greek could write plays and poetry that as well as their art, incorporate essences of all the disciplines of the period of the genius of England and its language, is absurd. Here is my theory, told by my father, so (Cannon J, pers. comm.). Francis Bacon is known to have been head of Queen Elizabeth's secret service, and to have recruited the best young minds of his generation to work in a house in Twickenham, dedicated to making England the supreme world power. Half the time they had nothing to do, because ships that carried the coded messages from Europe were either becalmed or blown off course. Bearing in mind the untimely and unruly death of Christopher Marlowe, probably murdered on secret service, they were discouraged from taking off and getting loaded, so at times of nothing to do for the monarch, they got together and yes, you have it - wrote plays and verse, which given the top secret nature of their work, were necessarily pseudonymous. Giving the name of a jobbing actor at the Globe as author was a joke. 'Shakespeare' was a team, like Monty Python. I concede John Donne, Henry Purcell, Isambard Kingdom Brunel and Bob Dylan as examples of individual genius, but all of these also stood on giants' shoulders.

- 7 Having written a book on dietary guidelines (Cannon, 1992) and helped to

devise others (WCRF, 1997; Ministério da Saúde, 2003) I think that recommendations addressed to individuals are counter-productive. These will increase the tendency for people to think of themselves not as community or family members but as essentially solitary, which in turn will increase purchase of fast foods and pre-prepared meals for consumption alone at home, in restaurants or in the street. Such foods are generally relatively heavily processed and high in fat, sugar and salt (WHO, 2003a). Further, this will also increase the tendency for the family meal to disappear, which will erode family life and increase social disruption and disintegration. A further implication is that industry will favour such guidelines because pre-prepared and packaged food is generally more profitable than fresh food and ingredients purchased to be prepared and cooked at home. These views are speculative simply because the tendencies that I see as accelerated by dietary guidelines addressed to individuals are as far as I know not being researched, either by nutritional scientists or any other investigators. Meanwhile I assert them as common sense and propose that the burden of proof is on anybody who wants to refute them.

- 8 Yes, I am questioning the concept that humans should reach their 'biological potential', if this means food systems high in animal protein that push growth and physical size. On average Northern populations are unnecessarily tall as well as unhealthily overweight. An example of the broadening of the collective nutrition scientific mind comes from my experience as head of the secretariat responsible for the World Cancer Research Fund report on food, nutrition and cancer. The expert panel initially felt that the epidemiological and other

evidence that food and nutrition is a causal factor with breast cancer was equivocal, apart from alcohol and postmenopausal obesity. However, the evidence that rapid growth, early menarche and greater adult height, increases the risk of breast cancer, is solid. Initially the panel felt that these are not nutritional factors. But then the question was put: what causes rapid growth, early menarche, and tall adults? And one answer is energy-dense food supplies and diets. This encouraged the panel to suggest that the main nutritional determinants of breast cancer are early in life. Implications for nutritional guidelines and also for social policy are vast (WCRF, 1997).

- 9 Does such conscious planning sound sinister? Well, this is what we live with now. Most people in the world are the creatures of food policies based on nutrition science. Infant and young child growth curves derived from observation of US children given formula feeds, is just one example. There is no escaping the impact of nutrition science on the size and shape of human populations. What is needed now is more consciousness of those policies and practices that will have the most beneficial effect on population and planetary health.
- 10 Decisions that vitally affect the health and livelihoods of populations in the South continue to be taken on the basis of food composition tables devised in and for the UK and the USA. Textbooks, reference books and technical reports are usually compiled in high-income countries whose food supplies were shaped in response to the pressures of the Industrial Revolution and capitalism and imperialism (see chapter 1). These books are used as basic texts in the South, in countries many of whose common foods

have not been analysed (see chapter 4). The general effect is to ignore indigenous and established tropical foods, and to replace traditional staple and other foods with those best-known in the North. In Brazil for example, indigenous and traditional staples, rice, corn, cassava (manioc), sweet potatoes, yams and beans, are now positioned in the shops as food for lower class people, and are being rapidly replaced by bread, pasta, cakes, biscuits and a vast variety of manufactured products made with wheat. The climate and terrain of Brazil generally is unsuitable for wheat, and Brazilian bread made from wheat flour is disgusting. However, it is wheat and its products that are most heavily promoted. The Food and Agriculture Organization of the United Nations (FAO) INFOODS programme is now compiling composition tables for foods from all over the world. By the time this work is done, many traditional foods will have disappeared.

- 11 At a meeting held in 1984 at which the UK National Food Alliance (now Sustain) was planned, Tom Burke, then Director of the Green Alliance, asserted that conventional democratic structures no longer serve the public interest on environmental issues which by their nature are international, and that the citizen is best served by powerful international advocacy organisations such as Friends of the Earth and Greenpeace, which have forced respect from governments and industry, and which behind the scenes increasingly draft legislation and regulation. By analogy, decisions on food and nutrition are increasingly made by transnational industry or by international civil servants under pressure from the most powerful governments and industries; and so to be effective, organisations serving the public

interest need to be international, intelligent and militant. I agree.

- 12 Some of the thinking here comes from my own involvement in the Bellagio meeting and the Johannesburg meeting described in this chapter, in both of which I served as rapporteur; and also in the global Alliance for Peoples Action on Nutrition, on which I serve as a member of the steering committee. My thanks to some of the people involved in these initiatives are in the acknowledgements at the end of this text.
- 13 During his term as Minister, José Serra insisted that access to safe and effective medicines is also a human right, and for this reason set aside patent law for overriding reasons of public health, and instituted a national programme of cheaper generic drugs, one factor in the control of HIV-AIDS in Brazil, to the fury of the international pharmaceutical industry. He also strengthened the equivalent of the UK National Health Service, which gives communities in practically all Brazilian municipalities access to basic health services. He also aggressively and successfully challenged the World Health Organization 2000 annual report on 'health indicators' which ranked Brazil 125 in a total list of 191 countries. Relevant in all this, is that he is an economist by training with no background in medicine or health (Serra, 2002). In 2002 he was the centre-right candidate who lost the final election for the Presidency to the Socialist Luís Inácio Lula da Silva.
- 14 The WHO Executive Board (EB) consists of 33 member states appointed usually for three-year terms in rotation. The EB meets every year in January, considers resolutions in detail, and makes recommendations that are usually but not

always adopted after further discussion and revision by the WHO World Health Assembly (WHA) of all member states, which meets every year in May. The WHA is the WHO governing body and as such formally instructs WHO on its policies and programmes.

- 15 The Blueprint for Action on Breastfeeding is itself the result of a sustained campaign by women's groups in the USA, working in collaboration with the federal government and its agencies and with scientists and health professional organisations (www.4woman.gov).
- 16 One of the reasons for my being given these responsibilities was that Portuguese is not an official UN language, which means that Brazilians have to speak in English, there being no Portuguese translation facility in UN meetings, a disadvantage most of all in debate on technical and political issues. I was congratulated by one of the official translators, who told me that my English accent was practically perfect.
- 17 I cannot cite the name of the UN official, who was propagating a view opposed by WHO. At that time WHO and UNICEF were opposed to one another on the 'six or four to six months' issue, one of the reasons being that UNICEF has a broader conception of individual, family and community health.
- 18 I cannot say here why the Brazilian delegation knew that WHO had already received the systematic review. A requirement for success when the stakes are high in arenas like UN meetings of nation states, is unusually good intelligence not only on science but also on the political process.

- 19 In this debate the US State Department evidently over-rode the US Department of Health and Human Services. The US position, taken on the grounds of freedom of commercial expression, was denounced as outrageous by a number of nation states. Sympathetic delegates from European nations let it be known that the EC vote would support the US, if at least one non-European nation state also supported the US. In the event none did, so the US was isolated. Afterwards the US delegate from the State Department was observed in private conversations with the chairmen of the final plenary session of the Executive Board, who both described the drafting committee agreement as a fragile consensus'. In the event though, it held firm.

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The thesis of this lecture began with an invitation in 1992 from Colin Campbell and Michael Latham to give a series of lectures on 'The impact of nutritional science on world food and agriculture' to the Cornell University nutrition division faculty. A decade later, Mark Wahlqvist asked me to sketch a new paradigm for nutrition science and food policy, in two lectures in Melbourne and Auckland (Cannon, 2002a,b). And now, my thanks also to David Dickinson, Richard Watt and their fellow trustees, for their invitation to give the 2003 Caroline Walker Lecture, and for publishing this text, from which the lecture is extracted.

I started to work on food, nutrition and health policy in the early 1980s, then from the view only of Britain and other enriched countries. At that time I was influenced above all personally by Denis Burkitt (Trowell, Burkitt, 1981), Hugh Sinclair (Cannon, 1990), and Hugh Trowell (Trowell, Burkitt, 1981), and by the writings of other broad strategic thinkers: John Boyd Orr (Boyd Orr, 1936), T.L. Cleave (Cleave, 1974), Jack Drummond (Drummond, Wilbraham, 1991), René Dubos (Dubos, 1959), Ivan Illich (Illich, 1977), Robert McCarrison (McCarrison, 1982), and Thomas McKeown (McKeown, 1979).

Starting in the late 1980s, I worked for a number of British organisations whose views should be complementary. The National Food Alliance, now Sustain, is dedicated to better food and farming for the common good. The Soil Association stands for sustainable agriculture by traditional 'organic' methods. The McCarrison Society speaks for the 'unsophisticated foods of nature'. The Guild of Food Writers celebrates food culture and cuisine. And with Jonathan Aitken, Derek Cooper, Jane Grigson, John Rivers (Rivers, 1979), Maggie Sanderson and others, I am a co-founder of the Caroline Walker Trust.

In Britain, I moved from journalism to campaigning in the 1980s. The mid-1980s 'food scandal' we revealed was made manifest in a vast number of television and radio programmes and newspaper and magazine articles, and two books (Walker, Cannon, 1985; Cannon, 1987) which involved collaboration with John Cummings, Ken Heaton (Trowell, Burkitt, Heaton, 1985), Phil James (NACNE, 1983; WHO, 1990b), Jerry Morris, Geoffrey Rose (Rose, 1992), David Southgate and others, juggling their responsibilities as government advisors with that of socially responsible scientists. None of them have been knighted; this may in part be my fault. Later I was a witness for the defence in the 'McLibel' trial (Vidal, 1997; www.mcspotlight.org).

In the 1990s I worked as head of science for the World Cancer Research Fund, and director of the project that led to publication in 1997 of its first report on food, nutrition and the prevention of cancer (WCRF, 1997) of which I was chief editor. WCRF International has commissioned a second report on which I am now working. This has helped to give my own

work a global perspective. I thank my colleagues Marilyn Gentry, Kelly Browning, and Deirdre McGinley-Gieser.

Since the early 1990s I have worked as a national government and international agency advisor. In Britain, this has been thanks to previous Ministers of Health and of Agriculture William Waldegrave and John Gummer, and to David Nabarro then of ODA. In Brazil, this has been thanks to then Minister of Health José Serra (Serra, 2002), and Denise Coitinho, Elisabetta Recine, and João Yunes. Within WHO this has been thanks to then Director-General Gro Harlem Brundtland, and Elisabet Helsing, Pekka Puska (Puska et al, 1995), and Derek Yach.

My decision to move to the South followed an international conference on the global impact of chronic diseases organised by Prakash Shetty at the London School of Hygiene and Tropical Medicine (Shetty, McPherson, 1997). In 2000 I began to live and to work in Brazil. I owe thanks to many people in Brazil, Costa Rica, Guatemala and Mexico, and in the Brazilian states of Ceará, Minas Gerais, Rio Grande do Sul and Tocantins. Relevant writers on Brazil include Eduardo Galeano (Galeano, 1997, 1998), and John Hemming (Hemming, 1995).

In the early 1990s it was suggested that all issues once seen as ideological, from then on needed only a technical fix. This was never so - and obviously not now and for the future. Since the attack on the USA of 11 September 2001, and the evidence of a new age in which the imperialist history of the sixteenth to nineteenth centuries is being repeated, some of the books that seem to me most relevant to contextualising global nutrition science and food policy are by: Noam Chomsky (Chomsky, 1987, 2002), Mike Davis. (Davis, 2001), Susan George (George, 1986), John McMurtry (McMurtry, 2002), Sidney Mintz (Mintz, 1985), George Monbiot (Monbiot, 2003), Gabrielle Palmer (Palmer, 1988), Robert Proctor (Proctor, 1995), Eric Schlosser (Schlosser, 2002), Amartya Sen (Sen, 1999), Joseph Stiglitz (Stiglitz, 2002), and Daniel Yergin (Yergin, Stanislaw, 2002), together with two reports (UNCTAD, 2002; Oxfam, 2002).

In 2003 I have been writing 'Out of the Box', a regular column for Public Health Nutrition (Cannon, 2003b), which has enabled me to develop some of these concepts, thanks to Barrie Margetts, Colin Smith and other wise influences.

Some of the people mentioned here, are owed many thanks. I also thank, for insights, support, vision and debate, my partner Raquel Bittar, and some more friends and colleagues: Richard Body (Body, 1982), Junshi Chen, Michael Crawford (Crawford, Marsh, 1989), Hans Kolbein Dahle, Richard Doll (Doll, 1982), Rafael Flores, Maria Freire, Edward Goldsmith (Goldsmith E, 1988, 1992), James Goldsmith (Goldsmith J, 1994), C Gopalan (Shetty, Gopalan, 1998), Kirsten Hartvig (Hartvig, Rowley, 1997), Mark Hegsted (US Senate, 1977), David Horrobin (Cannon, 2003b/5), Alan Jackson, Michael Marmot (Marmot, 2001), Marion Nestle (Nestle, 2002), Haroldo de Oliveira, John Potter (Potter, 1994; WCRF, 1997), Srinath Reddy, Irwin Rosenberg, Nic Rowley (Hartvig, Rowley, 1997), Patti Rundall, David Sanders (Werner, Sanders, 1997), Nevin Scrimshaw (Scrimshaw, Taylor et al, 1967), Colin Tudge (Tudge, 1979, 1980), Ricardo Uauy (WHO, 2003a), Flavio Valente (APAN, 2003), Caroline Walker herself (Cannon, 1989), Margaret Wynn (Wynn, Wynn, 1979, 1993), and Walter Yellowlees.

Geoffrey Cannon affirms that 'the fate of nations is determined by what they eat'. Food and nutrition policy is a political issue. Food systems based on or backed by nutrition science have literally changed the size and shape of much of the human race. He identifies general principles of mainstream nutrition science and its application to global food policies, originally devised in previous times of industrial and imperial expansion. He proposes that these are now mostly useless or destructive, and should be set aside and replaced. He advocates a revolutionary 'new map': a new general theory designed to empower nutrition science to improve human health, and also that of the whole living and natural world.

Geoffrey Cannon has worked on nutrition and food policy since the early 1980s. He was married to Caroline Walker and is a founder of the Caroline Walker Trust. He now lives and works in Brazil, and has been a member of both UK and Brazilian government delegations to the World Health Organization. In Britain he was Chairman of the National Food Alliance (now Sustain), and Director of Science of the World Cancer Research Fund. He is a best-selling author, and a prizewinning journalist and campaigner.

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