Prospects for Tomorrow

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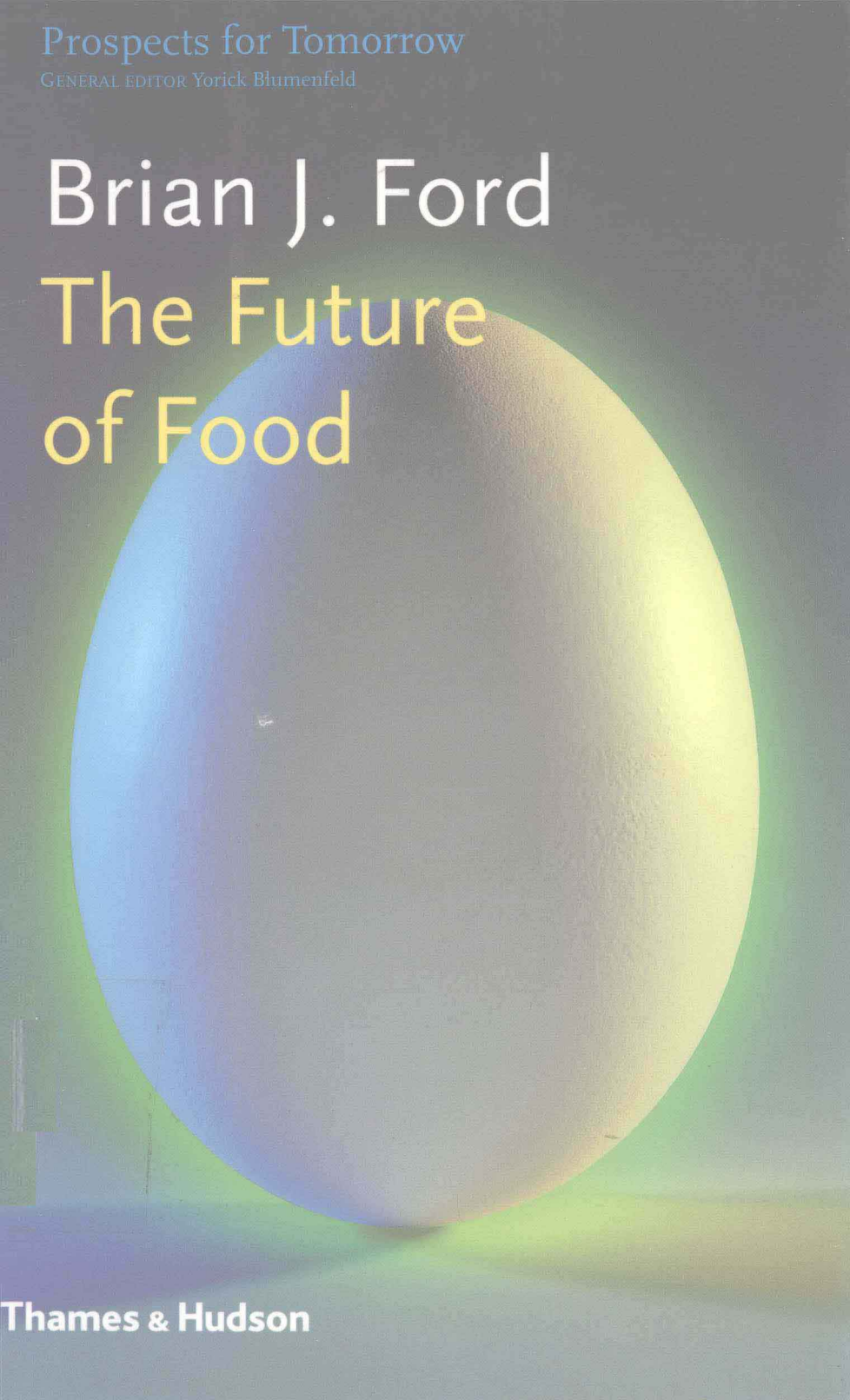

Thames & Hudson

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First published in paperback in the United States of America in 2000 by Thames & Hudson Inc., 500 Fifth Avenue, New York, New York 10110

Library of Congress Catalog Card Number 99-66983
ISBN 0-500-28075-4

Printed and bound in Slovenia by Mladinska Knjiga

Contents

When we plan for the future, food will pose some of the greatest problems. Our daily diet is rapidly changing, new food-borne diseases are appearing and ideas on safety are in a state of flux. In Britain 55 per cent of our meals are prepared outside the home, in the USA 75 per cent, and yet the amount we spend on food is falling. In the 1950s families spent a quarter of their income on food; by 2000 it was an eighth.

We now produce enough food for everyone, yet a third of the world is still hungry.We are faced with global climate change, mostly caused by the industrialized world, yet threatening some of the most populous nations.Organic farming is becoming more popular among the wealthier nations, while genetically modified crops – heralded as a great leap forward – have been widely rejected. Monsanto, whose research attracted so much opprobrium in 1999, found by 2000 that GMOs had been banished from their own kitchens by their caterers. The future of food is a matter of dispute that will affect us all.

Many friends in Europe, the Middle and Far East and the Americas have helped me over the years. My lectures as Vice-Chairman of Nutrition at the Royal Society of Health and at the Mosimann Academy in London have brought me into contact with many learned minds, and I am grateful to Doug Kentish, executive producer of our TV series *Food for Thought*, for complete immersion in the food industry.

Drafts of this book were reviewed by Professor Alan Malcolm, chief executive of the Institute of Biology, where it has been my privilege to serve as a Member of Council, by Dr John S. Slade, former chief virologist at the Thames Water Authority, and Professor David Conning, former director general of the British Nutrition Foundation. To them, to my family for all their help and to the many friends around the world who have taught me about food and culture, I am very grateful.

Chapter 1

What Do We Eat?

This book is for everyone who eats food. Of all the people I have met on my travels only one had never bothered with it.

Food strengthens the body, energizes our actions, employs farmers, boosts the bureaucracy of governments and makes mighty giants of supermarkets who overcharge the public. Food kills incalculable numbers of people every year, spreads epidemics, destroys landscapes and cultures, and clogs our arteries. It perpetrates cruelty and creates contentment, pacifies or enrages children and eases social interaction.

For centuries people were content to exist on a diet that was slow to change. In recent decades that has altered: new products (like hamburgers and hot dogs) have spread across the world. People whose parents regarded curry as a craze regularly patronize Indian restaurants. Oriental cultures have spread eateries from Korea, Japan and Vietnam across the nations who fought deadly wars against them. New international dishes like chop suey, tikka marsala and chicken nuggets have been created, and the creations of working people, from Cornish pasties to baked beans, have gained a broad popularity.

School meals have changed out of recognition within a generation. Pizza and lasagne, once confined to Italy, are now major commodities across the developed world. This book steps warily into the future, looking at the extraordinary changes we can expect to see and presenting some of the novel foods on which our descendants will depend.

The Basic Diet

Our diet will change dramatically in the future, although the essential components that we need to eat in order to stay healthy remain the same. We evolved to subsist on a mixed intake of foodstuffs, and a traditional varied diet provides everything we need. Problems arise

because we now eat a diet where the components are chosen by producers, so we can now be attracted to foods that are rich in sugar or salt, or contain far more saturated fats than anything for which we evolved.

To stay alive and grow, the main groups of components needed are:

- Fats – our cells depend upon oily and fatty compounds to function properly. Cholesterol, an excess of which can block blood vessels, is actually a vital component of every living cell. Fats are not inherently 'bad'. Some recent research has given us synthetic fats which are not utilized by the body as an energy store. How they could ever be removed from the tissues (once deposits had been laid down) remains a mystery.
- Carbohydrates – the starches and sugars in our diets which provide the energy for life. These compounds can burn in air with a flame. Within our bodies, they combine with oxygen just as they do when they burn, but as part of the cells' chemistry. They release heat energy that helps regulate our inner temperature.
- Proteins – made from amino acids. Proteins are the substances that make up the living matter of all cells. The diet must contain a suitable range of proteins and amino acids. Human beings developed for an omnivorous diet, eating both animal and vegetable foods, but a purely vegetarian diet is possible if we take care that all the essential amino acids are present in our food.
- Minerals – like cobalt and chromium, iron and magnesium, are involved in the complex chemistry that keeps us alive. Cows eating spring grass may consume too little magnesium, for instance. They collapse and can die within hours – but a single injection of magnesium salts provides an immediate return to full health. Calcium is important for the making of teeth and bones. They probably evolved as a reservoir for extra calcium, and can become weak and spongy if too much calcium returns from the bones to the bloodstream.
- Vitamins – first recognized by Sir Frederick Hopkins in England in 1906, when he discovered that there were some crucial accessory factors that food must contain for a healthy diet. Casimir Funk, a Polish biochemist, coined the term vitamines in 1912. The existence of vitamin deficiency had been recorded long before vitamins were recognized, and successful treatment had already been introduced.

TABLE OF VITAMINS

	Name	*Identity*	*Soluble in*	*Source*	*Effects*
A	Retinol	alpha-and beta-carotene	fat	butter, fish oil	vital for sight; excess causes hair and skin loss, nausea
B_1	Thiamine	thiamine pryophosphate and carcoboxylase	water	cereals, pork	aids nerve function; lack causes beriberi
B_2	Riboflavin	flavin mononucleotide and flavin adenine dinucleotide	water	liver, dairy produce	vital for cell membranes, tongue, skin
B_3	Niacin	nicotinamide (nicotinic acid)	water	meat	prevents pellagra
B_6	Pyridoxine	pyridoxal phosphate or codecarboxylase	water	meat, nuts	important for blood and nerve transmitters
B_{12}	Folic acid	pterolic acids and their esters and cobamide coenzymes	water	egg, meat, milk	lack causes pernicious anaemia
	Coenzyme A	pantothenic acid	water	offal, yeast	none known
B_{12a}	Aquocobalamin				
B_{12b}	Hydroxycobalamin		water	offal, egg, fish	vital for DNA synthesis
B_{12c}	Nitrocobalamin				
B_{13}	Not yet confirmed				
B_{15}	Not yet confirmed				
C	Ascorbic acid		water	fruit, parsley, peppers	prevents scurvy
D	Calciferol	ergosterol, 7-dehydrocholesterol	fat	action of sunlight in skin, milk	lack causes rickets
E	Tocopherol	alpha-, beta-, gamma-, delta-, epsilon-, and eta-tocopherol	fat	plant oils, leaves	antioxidants promote health
H	Biotin	1-N carboxybiotin-	water	egg, liver, yeast	essential for metabolism
K_1		phylloquinone	fat	green vegetables	vital for blood coagulation
$K_{2\,(20)}$		menaquinone-4	fat	—	—
$K_{2\,(30)}$		menaquinone-6	fat	—	—
K_3	Menadione	menaquinone	fat	—	—

Beriberi was the first vitamin-deficiency disease to be recorded. The term means extreme weakness in the Sinhalese language of Sri Lanka, and it is due to a lack of vitamin B. It was first documented by Chinese physicians in 2600 BC. Scurvy (due to a lack of vitamin C) was described in Ancient Egypt around 1500 BC. The first treatment of a vitamin deficiency was recorded by the French explorer Jacques Cartier, who sailed for North America in 1534. His crews were ravaged by scurvy, and Indian tribes showed him how to use an infusion of pine needles to help control the disease. The English physician James Lind finally showed that citrus fruits were rich in the vital ingredient, and during the voyages of Captain James Cook between 1768 and 1771 supplies of limes were issued to the men. These were the first long voyages that were not marked by the scourge of scurvy. The use of these fruit gave rise to the term 'limey', the nickname by which the English have long been known. Beriberi was first successfully treated in 1885, when a doctor in Japan supplemented a traditional diet of polished rice with meat and vegetables. Sufferers from beriberi dramatically improved, once their diet contained these extra sources of vitamin B.

Another vitamin in the B group, folic acid, has recently been associated with the campaign against neural tube defects, such as spina bifida. The claims that folic acid can end this scourge may be premature. Publicity encouraging people to take the vitamin has increased substantially. The Medical Expert Advisory Group in the United Kingdom recommended in 1992 that women who were trying to conceive should take 0.4 mg folic acid each day, and these recommendations were soon headline news in all the magazines. Folic acid featured on TV, and was splashed across the newspapers. All the chemists' shops stocked up, ready for the stampede.

The statistics were initially very impressive. In the early 1970s there were more than 200 cases of spina bifida out of every 100,000; it fell to less than 40, a drop of 80 per cent. What's interesting is that it fell by 1990, before folic acid was popular. A team in London, headed by Dr Rezan A. Kadir at the Royal Free and University College Medical School in London, inspected the figures and found – since

folic acid has been widely available – the rate of decrease has actually slowed down, and not (as one might expect) increased. Over-the-counter sales of folic acid in chemists' shops went up dramatically between 1990 and 1994, but they actually declined in from 1995 to 1996. Thus, the incidence of spina bifida decreased most dramatically when folic acid was not widely purchased. When it was being bought in large amounts, the rate of improvement decreased. Whatever conclusions may be drawn, it is clear that simple notions of cause- and-effect do not always work where these vitamin supplements are concerned.

Similar controversies surround vitamin C, ascorbic acid. As we have seen, this compound is found in citrus fruits like lemons, limes and oranges, and also in vegetables ranging from sweet peppers to parsley. Ascorbic acid is important for the formation of collagen in the body, the fibrous material that helps hold cells together. A lack of ascorbic acid leads to a failure to maintain collagen, and the body can actually come apart. Old healed scars reopen, and the muscles of the heart lose their strength. Although we think of scurvy as a disease of former centuries, it is sometimes found in the Western world among old people who do not eat enough fruit.

More recently it has been said that ascorbic acid helps protect the body against colds and 'flu. Much publicity has been given to the idea that a gram of vitamin C every day helps to ward off such virus infections. It has to be said that repeated research trials have failed to prove the point. However, like a great many people, I always take some supplemental vitamin C tablets when the first symptoms of a cold appear, and have not suffered seriously from those infections for over a decade. It may be that some subtle relationship does, after all, exist.

Vitamin D, calciferol, is centrally involved in calcium metabolism and is necessary for the proper formation of teeth and bones. A deficiency of vitamin D results in rickets. Fatty fish, margarine and eggs provide a plentiful supply of calciferol, and it is also synthesized in our skin by the action of sunlight. In the UK signs of rickets can still be found among some immigrant ethnic groups who keep themselves swathed in robes.

The tocopherols (vitamin E) are found in plant material, and have long been associated with sexual prowess. They act as antioxidants, helping to mop up potentially dangerous free radicals in the body.

'Vitamin F' was the name given for a time to the prostaglandin precursors like gamma-linoleic acid, found in evening primrose oil. It is now downgraded to the vitamin-like compounds.

Vitamin K is the group of quinones that are abundant in leafy vegetables and beef liver, and, like the bioflavinoids once known as 'vitamin P_c' are crucially important for successful blood coagulation.

The last true vitamin to be discovered was vitamin B_{12} in 1948. Its introduction led to the conquering of pernicious anaemia. Between 1929 and 1975 thirteen newly discovered vitamins were synthesized. Since then, research has continued into the benefits of vitamins in the diet. Attention was initially focused on their role in conquering deficiency diseases, but in recent years we have begun to investigate how they might delay the onset of degenerative diseases and cancer.

We now also recognize compounds which are similar to vitamins, and they are listed in the table below:

Table of Vitamin-like Compounds

Name	*Occurrence*	*Function*
Choline	egg, liver, wheat germ, spinach	part of acetylcholine (neurotransmitter) and crucial for fat transport
Myoinositol	phospholipids	growth factor vital for yeasts and fungi
Para-aminobenzoic acid	part of folic acid molecule	vital for some microorganisms
Carnitine ('vitamin B_T')	synthesized in animals	essential for mealworms; may assist cardiac patients
Gamma-linoleic acid ('vitamin F')	evening primrose oil	prostaglandin precursor, may mollify ezcema
Lipoic acid	potatoes	antioxidant, essential for some microorganisms
Bioflavinoids ('vitamin P_c')	coloured fruit	may help to regulate control of bleeding

Now that we can produce vitamins industrially, they are readily available and cheap. They will become an important ingredient of tomorrow's food. Some foods (like breakfast cereals) have been fortified with vitamins for many years, and for the foods of the future the need will be to ensure a balanced intake of vitamins and other vital constituents for people with varying lifestyles and at every stage of life.

Rectifying vitamin deficiencies has been the main priority for the past half-century, but we can now look to the possible value of vitamins in larger than normal amounts. Some research has suggested that extra vitamins can help to maintain good health in the elderly, and there are many people who pop vitamins every day and swear by the benefits they confer. However, we have to take care to avoid overdosage. An excess of vitamin D can cause tiredness and weakness, loss of appetite and vomiting. Yellowish deposits appear in the skin and fingernails, and calcium deposits appear in organs like the kidneys. Young children consuming too much vitamin D fail to grow normally. Children face the greatest risk. A daily intake of 400 units of vitamin D is reckoned to be adequate for a child and children eating five times this dose can be damaged by the excess. In adults, effects appear when the dose is 50,000 units – so we need to bear in mind that children are much more sensitive to excesses of the vitamin than adults.

A raised intake of vitamins and other supplements may prove to help maintain health in the world of the future, but diets will have to be carefully planned if harmful excesses are to be avoided.

Deficient Diets

Everyone knows that deficient diets are found in developing countries, but it is surprising to realize that we can also find widespread evidence of a poor diet in the developed world. Many adults are fat because of the amount of saturated fat in the diet combined with a lack of exercise. We exercise far too little, and fast food can lead us into habits that leave important items, such as fresh fruit and vegetables and soluble fibre, out of our daily food intake. A lack of energy is not the problem: a lack of food quality, however, is.

During the last decade of the twentieth century, almost one person in ten of the global population had a diet with fewer calories than is needed for normal growth and activity. Sixteen per cent of the world's infants were born underweight and 38 per cent of children under five in the developing countries were underweight for their age. Twelve per cent of the people in the world suffered serious iron deficiency, and a quarter of the world's population was actually anaemic. Four per cent suffered mental deficiency due to a lack of iodine in the diet, many of them officially classified as cretins. Every year, as the millennium drew to a close, half a million children became permanently blind through a lack of vitamin A in their diet.

What will the future say of these scandalous figures? Essential dietary constituents like iron, iodine and vitamin A are cheap and readily available. A source of food that provides such essential components can easily be developed. One goal for the future must be to ensure that, whatever is said about the lack of food (see Chapter 6), the supply is of sufficient quality to help fight against the cruelty of deficiency diseases.

Throughout South America and in parts of Africa, malnutrition has not increased in recent decades. Indeed, a great swathe across the East, from Arabia through India and Pakistan to Indonesia and the Philippines, has shown steadily decreasing levels of malnutrition. Most of Africa, however, is witnessing a steady increase in dietary deficiencies, and this problem will become more severe as population levels continue to rise. We will examine the future of food supplies in Chapter 6, but we must understand that food quality has to come to the forefront of debate. Our current policies are creating a food supply that, even when it is abundant, is often far from healthy.

The Prophet Motive

Looking into the future is a dangerous practice. Futurologists imagine that they are being innovative, but most futuristic scenarios are either extrapolations of the present or objections to fashionable views. Most attempts are embarrassingly wide of the mark. Thomas Malthus, (1766–1834) was the English philosopher who in 1798 anonymously

published *An Essay on the Principle of Population as it affects the Future Improvement of Society, with Remarks on the Speculations of Mr Godwin, Condorcet, and other Writers.* It began as a pamphlet, but by the time of the sixth edition in 1826 it had grown into a massive volume.

Malthus claimed that the growth in population would always outstrip food supply, until starvation and essential misery were the lot of humankind. He has become famous for his vision of global starvation, but in fact his book began as a young man's challenge to the views of his father, who, following Godwin and Condorcet, foresaw a glowing and optimistic future round the corner. Malthus's analysis was superficial, and it was also wrong. Population has increased much faster than he could have anticipated, yet the 1990s have been distinguished by our producing more than enough food to feed everyone, if only we could distribute it. The decades since Malthus's time have seen progress of a kind that flies in the face of everything he foresaw.

More recent, but equally influential was the report *Limits to Growth* from the Club of Rome, published in 1972. It, too, was essentially pessimistic. The events of the three decades since then have been far more complex, more responsive, much more unexpected and generally more positive than that report predicted. The control of population and the astonishing increase in agricultural productivity (notably in China) have shown how human technology can adapt. We have never been good at looking ahead: in the same year, 1972, the BBC produced a two-hour television documentary warning of the effects of emissions into the atmosphere. Accumulating smoke was threatening our planet with cooling, and the near future would condemn much of the industrialized world to a subterranean existence in malls that could protect us from the cold. Much of the discussion in the 1970s was preoccupied with global cooling, not warming.

Today's concerns about the greenhouse effect show how quickly our views can change. Throughout the 1970s there was a widespread belief that we were on the point of running out of food, energy and resources. Jet travel seemed doomed to become unendurably expensive; paper would run out; oil was in short supply; pollution would soon swamp us all. Large organizations suddenly began to circulate