FOOD AND THE CONSUMER

REVISED EDITION

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Preface to The Revised Edition

Just a few years ago we wrote "now that the food producer and vendor are in the minority, the consumer can dictate to the food industry. . . . (and therefore) . . . get the food that he wants." How interesting that today, while powerful voices are accusing the food industry of denying the consumer his rightful and needed nutrients, it is only now that both food producer and consumer are beginning to recognize the all-important fact that there is a huge gap between what the consumer *wants* and what he *needs*. It is recognized that many of us want more information about the food we need. This evidences itself in universities wherein non-science majors seek courses of an essentially non-technical nature covering the subject. This book is my attempt to fill this need.

During the last decade we have seen the rise of food and health advocates who proposed, on the basis of limited knowledge, frequently incomplete, at times dangerous, and usually biased and often expensive, faddist diets. Yet the outcome of this ferment stimulated a host of activities beneficial to all of us.

Goverment now no longer limits its role in this area to regulations involving fair trade and protection of consumer's health, but it is also beginning to provide consumers with information concerning their nutritional needs. Similarly, the food industry, while continuing to develop new foods that are more appealing and convenient to the consumer (what he wants) is educating him—directly and indirectly—about nutritional requirements and food safety.

Although assessments of the first results of these efforts by government-consumer-industry, which became evident in terms of more complete label information on packaged foods, have been disappointing, the efforts may yet prove to be more beneficial than one might expect.

The first edition was written at the time that the "Club of Rome" had then just published *The Limits to Growth*, which forcefully warned that continuing trends of uncontrolled population growth and wasting of

nonrenewable resources would result in hunger and mass starvation soon, not in future millennia. While the general theme is unfolding according to these predictions, it is not food but energy, however, which is evidently now the first constraint on growth, and the expected global exponential rate of population growth has apparently reached its asymptote. It appears that by controlling our environment in such a way as to maximize food resources, we have the opportunity for an orderly, steady progression toward a peaceful and prosperous global era that has heretofore only been dreamt of—barring man-made or natural holocaust.

Yet throughout man's long advance, food facts have always been confused with myths, and although science may become ascendant, myths associated with specific mystical powers of foods may, like the poor, always remain with us. It is becoming increasingly apparent that the overwhelming majority of consumers are not motivated to learn more about the science of food and nutrition and therefore have little use of information provided. Most consumers merely wish to have some authority (governmental?) provide them with the assurance that *any* food they *want* will not only be safe, but will also keep them healthy. Obviously such assurance cannot be provided for everything one might eat. There must be a continuous effort by scientifically-oriented institutions in government, industry and the consumer movements not only to protect consumers but to attain nutritional support for all mankind.

AMIHUD KRAMER

July 1980

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Preface to The First Edition

We all know that until the last generation or two, provision of food was the major occupation of practically all humanity. We also know that even today in the vast majority of the tribes of man, the major obsession is finding enough to eat. How many of us realize, however, that even in this most powerful and affluent society of the West, we are still occupied with the provision of food to the extent of one-fifth of our resources, and obsessed with food problems to a much greater extent?

In past and present societies, on much of the earth's surface, the food producer was also the consumer. Today, in the United States, the food and allied industries engage less than one-fifth of the consumers. The others provide other material and aesthetic goods (or are unemployed). The food industry today is drastically reduced (proportionally) in manpower requirements, but tremendously increased in quantity and variety of products. It no longer consists merely of the collection, or even production, of raw food materials, but has developed into the largest and most complex single industry providing, not only immediate nutritional requirements, but also many labor-saving, food-preserving, and aesthetic services, all of which are demanded by an increasingly more affluent society. Production of food nutrients for all mankind could be accomplished by less than 1% of the world's labor force. Yet, because of the additional services required, no less than 18% of the U.S. consumers' resources are utilized to provide food and all its ancillary services.

Thus, the food producer and vendor are now in the minority, and the consumer can now dictate to the food industry exactly what his wishes are. It is therefore an inescapable fact that the consumer gets the food that he wants. If he purchases food that does not provide him with his essential nutrients, or food that is in fact harmful, he has only his own apathy and ignorance to blame. To survive, a food manufacturer, as any vendor, must meet the specifications which the buyer dictates.

Where does science get into the act? The term implies much that is beyond common understanding when in fact science specifically is nothing more than proven knowledge. Science, or facts about food have been in existence from pre-history, but have proliferated tremendously in recent generations. At this time there is no excuse for any consumers or consumer representatives not to have available the real knowledge, that is, the science which will provide them with facts to enable them to purchase their daily bread to satisfy their need of essential nutrients, to keep them from harm, and to provide them with aesthetic satisfaction.

Although food science, that is, food facts, should be the basis of the specifications upon which the food manufacturer should design the food for consumer satisfaction, there is in the human ethos the craving for the Deus ex Machina who will make all things well so that he will obtain his unobtainable total satisfaction, not on the basis of facts, but on the basis of belief. Just as food science existed well before recorded history, so has food mythology. And why should it not? We pray for our daily bread, but at the same time we do not live by bread alone. Deeply ingrained in the human psyche is the belief that anything produced by nature cannot be improved upon, but only contaminated or desecrated, or at best diluted. This belief in the supreme quality of the undisturbed natural product is only one of the many strange and wonderfully imaginative myths divined by men of good will or evil. The main purpose of this modest effort is to sort out food facts from food fancies. If in the process we should point out that cooked soybeans are more wholesome than raw, or that it is perfectly normal and of considerable nutritive value to consume two-, four-, six-, or eight-legged animals, we do not intend in any way to offend those whose mythology dictates otherwise. After all, those of us who call ourselves scientists, including physicians, nutritionists, even Nobel prize winners, have our share in the creation of myths which we cannot defend on the basis of proven facts.

Strange as it may seem to the non-scientist, even conclusions based logically on indisputable facts may be contradictory to other conclusions similarly derived. This may occasionally result from an investigator's willful suppression of the data that do not fit his premise. More usually it is the result of practically all experimentation being incomplete in that some influencing parameters have been omitted. Data, particularly interpretation of data, are also subject to many forms of bias, not the least of them being some degree of subjectivity in the eye of the observer. The more complex the material studied, the more difficult is complete objectivity of its evaluation. Practically all food is or was living matter. Thus, in dealing with the effect of foods on the physiology and psychology of man, the most complex form of life, any experimental data are limited so that logical, yet conflicting conclusions may be drawn by different researchers who are entirely scientifically honest.

Recognizing these limitations, we shall attempt to the best of our knowledge, to sort out food facts from food fancies for the general reader. At the same time we shall attempt to provide introductory material to the student of Food Science and Nutrition. It is our hope that this volume may also serve as a summary of educational material for the general consumer as well. Our hope is that we have not attempted too much.

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"Earth Has Finally Made It"

Judah and Israel were many, as the sand which is by the sea in multitude, eating and drinking and making merry.
I Kings, IV:20

It has always been the first need of humanity to have enough to eat and drink for all. Only in this century has this need been technically attainable. It has taken a long time—some 4–5 billion years—and it has taken some doing. It was something over 2 billion years before man—who is the first form of life capable of modifying the environment to suit his needs—made his appearance. It is now generally agreed that during all these eons of time there was continuous evolution of the environment. As the environment changed, so did the forms of life.

Before man dominated the earth, as the environment changed, the various forms of life either adapted to the changes or became extinct. Along came man; and for all but very recent history he, in his own manner, attempted to adjust to environmental changes, but he usually failed. It is only during recent millennia that man has succeeded in modifying his environment to suit his needs. Through science he has learned to modify his immediate environment and to create a micro-environment to protect him from otherwise insurmountable extremes of temperature, and from other predatory competitive species. As he developed the art of weaponry and the social science of pack-hunting, he vastly improved his food resources. Thus, the beginning of food science arrived with the thrown stone or spear, the tribe, and the controlled use of fire.

The Stone Age hunter was the first food scientist. He was also the first mythologist who based his mythology on food. As a scientist he knew that the flesh and blood of the animal he slaughtered would sustain his life. As a mythologist he believed that eating the warm heart of his victim would transfer to him the beast's courage.

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A great advance in food science was made when the kill was heated. Without knowing it, primitive man did accomplish by this heat treatment detoxification of some naturally occurring toxins and the sterilization of the product, that is, the inactivation of microorganisms that may have made him ill. At the same time the heat treatment changed his microclimate to such an extent that the smoke and other volatiles undoubtedly affected his health adversely. More millennia passed during which some tribes survived and prospered because of their greater success in overcoming environmental problems, while others perished.

New sciences were added, and the old improved. Being omnivorous, man learned through tribal experience which animals and which plant materials provided him with sustenance, and which were detrimental to him. At the same time some of these animals, and particularly plant materials, were of value not only in providing nutrients, but also appeared to have healing properties. Thus medicine and pharmacy were born, closely allied to agricultural development. The practitioners of these skills were also credited by their fellow men with supernatural mysterious powers.

THE AGRICULTURAL REVOLUTION

The sciences of animal and plant husbandry then appeared, making it possible for the first time for man to utilize other species not only as sources of food and energy to sustain his own life, but also as means of transportation and labor-performance. Although animal husbandry provided the opportunity for man to accumulate and improve his food resources "on the hoof," it was plant husbandry that made it possible for him to reduce his complete reliance on the hunt and on the nomadic type of existence. The cornerstone of all civilization to come was therefore the first person who knew how to plant a seed and eventually harvest a crop. Again, as in previous stages on the road to modern civilization, the man who knew how to fold a seed within the earth to produce a bountiful supply of food was thought to be endowed with supernatural knowledge, which he used to aid as well as to dominate his fellow man.

Thus agriculture came into being, and as it developed, it released the energies of man in other directions, permitting him to create cultures and civilizations. One of the earliest developments of agriculture, and the beginning of food science as we think of it today, was the rapidly expanding knowledge of food preservation. The beginnings of dehydration and fermentation are lost in antiquity. Drying of meat, milk, fruit, and their controlled fermentation made it possible to store substantial quantities of food supplies for an agriculturally based sedentary population, who could thus survive from one season to the next under various and

frequently adverse environmental conditions. At the same time the accumulation of such granaries provided nuclei for the construction of cities and empires where the population concentrations contaminated the urban environments and made these rapidly developing, previously impossible huge populations easy victims of other competitive forms of life. Yet breaking out of the confining city walls exposed the population to the most predatory competitor—man himself.

To gain some measure of control over this abuse of nature, man had to organize his newly developed urban centers. One method of combating such problems was the development of chemicals, certainly not originally in pure form, but as components of plant and in some instances animal materials. Such "spices" not only controlled food-born diseases, but also masked the naturally undesirable putrid flavors developing from spoiled foods. Thus the ancient arts of dehydration and (largely uncontrolled) fermentation were joined by chemical additives in the form of salts, drugs, and spices to maintain and preserve the food resources.

THE INDUSTRIAL REVOLUTION

A tremendous leap forward in human development was the Industrial Revolution of the late 18th and early 19th centuries, in which mechanical energy was first exploited for the needs of man. In a comparatively short time human efficiency increased astronomically, not only in food production but in manufacturing, transportation, and related areas. Thus man's comfort and material wealth increased to an extent beyond the wildest dreams of preceding generations. Among the amazing and far-reaching industrial developments that were born within this period of less than a century—including the loom, the cotton gin, and the steam engine—was the discovery of preservation of food by heat processing.

ROLE OF SCIENCE

Science cannot state what is or is not moral or what is or is not aesthetically acceptable, however. The palatability of foods for any group of men is dictated by past habits and customs. Regardless of what new intriguing foods are devised by refined scientific techniques purportedly for their greater enjoyment, they nostalgically crave those foods dictated by their immediate cultural-ethnic leaders. Very early in life, human preferences for food become established by education or example, so that one is satisfied only with the food to which he is accustomed and which he was told was proper—at times not only for his health and welfare, but for his immortal soul. Convincing a population group that their customary food is not adequate and that they should change or

modify it in any way is a most difficult problem. It applies primarily, though not exclusively, to emerging and developing populations, to whom "adventures" in eating are as rare and hazardous as other adventures into the unknown.

During the earth's history, at no time has man been at peace with his environment. He has constantly strived to achieve a modus vivendi in a changing environment. Ice ages came and went. Variations in temperature resulted in changing shorelines, as did slippages of the earth's crust and emissions of thermal and nuclear substances from within it. No sooner did one society gain ascendancy over its immediate environment than gradual or cataclysmic changes caused its destruction, movement to a more favorable location, or replacement by other groups that were more competitive under the new environmental conditions. At all times, however, the innate desire "to multiply and replenish the earth" dominated the collective effort. Each civilization and each culture had its scientists as well as mythologists who attempted to gain ascendancy over the environment, to enable man to live in an orderly way with himself, and to allay the fears of the unknown.

All science can be divided into the empirical and the theoretical—the how and the why. Gifted inventors of all ages have discovered empirically, or deduced from theoretical considerations, ways of increasing the food supplies, thereby providing man with more leisure and opportunity to multiply. It is usually after the how that the why is attempted. Thus, at every age as man becomes more inventive and the mass of knowledge accumulates, he may "prove" that the earlier theoretician was wrong and that his new interpretation of the truth, that is, the "why," is correct. At this stage in the evolutionary process we recognize that the former theories or doctrines were not necessarily false, but merely explanations, based on the best knowledge available at the time, of the nature of environmental forces as they were then observed, while philosophers and mythologists completed explanations of the "why" by ascribing mystical powers to the unknown.

MALTHUS VISITED AND REVISITED

Two centuries ago came the first prophet of global doom—Malthus (1766–1834). In *An Essay on the Principle of Population* (1798), he showed mathematically that, regardless of continuing advances in agricultural and food science, population growth would eventually outstrip food production capacity, resulting in mass starvation, pestilence, and death. The essence of his theory was that populations expand by geometric progression, whereas agricultural production can increase only by

arithmetical progression. But even as he announced this conclusion, new developments were occurring. One of these was the opening of the Western Hemisphere with its vast agricultural capacity; others were the work of creative scientists, e.g., Appert, the empiricist, and Pasteur, the theoretician, who established what we now consider the science of food preservation which vastly increased not only food reserves but their safety for human use.

As is usually the case, the empiricist came first. Appert (1750–1841) demonstrated that by placing a perishable food in a hermetically sealed cannister (can) and heating it sufficiently, it could be preserved indefinitely while maintaining much of its nutritional value. Half a century later, Pasteur (1822–1895) explained why Appert's method of canning was successful by demonstratig the heat-labile nature of the microorganisms responsible for the fermentation or spoilage of foods. Pathogenic microorganisms were demonstrated to be the causal agents of most food-borne diseases. Thus, the explorers of the 15th to 18th centuries and the scientists of the 18th to 19th centuries, although not invalidating Malthus's theory, nevertheless successfully postponed its inevitability. At the same time the scientists, particularly the microbiologists, provided yet another powerful weapon, sterilization, for man to assert his control over the environment. As a result, population growth entered its grand period shortly after the mid-19th century. However, in less than a century it seemed that Malthus was essentially right, and that there are limitations to planetary resources which, if not voluntarily conserved, largely through population control, would lead to catastrophe even sooner than originally anticipated. By the middle of the 20th century the prophets of doom and despair were again in the ascendant.

Typical of such despairing statements is the following (Kramer 1966): "It is conservatively estimated that by 1986 U.S. population will be above 250 million and income in terms of 1960 dollars will increase to 1500 billion dollars. At the same time, available land is being reduced by about one million acres annually so that farming will have to continue to improve in efficiency to meet the increasing demand for food from a decreased acreage. On the basis of past performance, it is estimated by some authorities that this can be done. However, it is also estimated that food surpluses of all kinds will vanish by 1970. In 1976 total world food reserves were down to a one-month supply. Considering the food situation in the world at large, food production, although increasing annually, is not quite keeping up with population growth so that within the next 10–20 years, if not sooner, chronic hunger and malnutrition of large parts of the world's population will deteriorate to mass starvation which in turn will result in violent upheavals in many parts of the world."

Within the last two decades this pessimistic attitude has again required revision, in some measure due to a basic fallacy in the Malthusian theory which contends that exponential population growth is limited only by food resources. It has been demonstrated time and time again by many civilizations that population growth is attenuated as the standard of living is improved. The urge to multiply and replenish the earth appears to diminish as societies and individuals gain in material wealth and well-being. Their biological urge to increase is tempered by other needs that are not basic, but are recreational rather than procreational. Thus, the more comfort and security there is from want, the smaller the family. This trend to limit population growth was greatly assisted by vastly improved birth control techniques, so that by 1977 even developing countries can approach zero population growth. Globally, the "grand" period of growth seems to have ended.

The other recent development contributing to the modification of predictions of doom is outstanding advancement in food science. Much attention has been given to the "miracle" grains which, together with relatively favorable climatic conditions, very substantially increase food resources—particularly those of rice, the staple food in the most populous regions of the earth.[1] Of even greater value in ultimately increasing food resources are current developments in total utilization of plant foods, particularly proteins, with soy protein leading the way.

ENVIRONMENTAL POLLUTION

Although the dramatic energy crunch of the winter of 1973–1974 modified it somewhat, concern over environmental pollution is still one of the subjects holding general public attention today, although its presence in the microenvironment (caves) of primitive man is acknowledged to have been far more serious than any pollution today. From a global standpoint, however, the problem is only now coming into its own. As usual, it took a big dose of exaggeration and dramatization to bring to this problem the attention it deserves. The prophetess of doom in this instance was Rachel Carson (1962) and from the standpoint of bringing this most important subject to general attention, she deserves a Nobel Prize. Over the last decade, not a month has passed when new learned journals on the subject of environmental protection did not make their appearance. Add to this the many learned and not-so-learned volumes and literally thousands of articles appearing in the press, the public is by now so completely alerted to the problem that it is a major political issue. At least one major federal agency, the Environmental Protection

[1] In 1970, the Nobel Peace Prize was awarded to an American, Dr. Norman Borlaug, for his work on wheat.

Agency, competes and conflicts in power and authority over the food industry with the old-line agencies.

Certainly release of atomic energy and pollution of the atmosphere with radioactive substances, increasing problems of water purification, and effects of polluting wastes on the welfare of man and of his cohabitators on earth should cause great concern. The following is a relatively moderate and positive statement on this subject (Kramer *et al.* 1971): "Rapid and efficient disposal can remove the hazard of disease and pollution of the environment. Maximum utilization, particularly of food wastes, would not only reduce the waste disposal problem, but would at the same time increase the food resources available to the rapidly expanding population. Only 20–30% of the nutrients produced for human consumption are utilized directly. If the remaining 70–80% of material could be converted into nutrients for man and animals or plants as food, feed, or fertilizer, respectively, total nutritional resources could be vastly increased, and at the same time the waste disposal problem could be minimized."

At this time, therefore, our concern appears to be not so much to meet the challenge of a constantly changing environment as to stabilize it for the improvement of human comfort and welfare and to maintain existing environmental balances, simply because we are most comfortable with what we know and expect. The larger framework has been aptly summarized by Haagen-Smit (1972): ". . . the whole system seemed to have a kind of comfortable stability. Looking at an astronaut's view of the Earth, we begin to realize that the Earth is actually not so large at all, and that the stability applies only to our time period, which is infinitely small compared to the time scale of geological and evolutionary happenings. A continuous flow of events leads from the origin of life some 2–3 billion years ago to the elaborate structures that we represent. For evolutionary processes, changes in the environment were essential; however, for the continuation of an evolved species, the constancy of the environment was of great importance. Even small changes in the environment will eventually lead to the disappearance of a species, or its replacement by others more suitable to new conditions."

This wish for stabilizing the environment or even returning to simpler ways of living is certainly not new. What is new is the global concept, and the "systems" approach to arrive at a constant, balanced environment of which "zero population growth" is only a part. Serious efforts have already been made (Meadows *et al.* 1972) to demonstrate mathematically that growth for its own sake is not necessarily desirable, and that the basis for achieving a stable environment totally controlled by a stable human population is scientifically feasible. Although a good case can be made for accomplishing this on a scientific basis, the odds against

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