



# ANNUAL REVIEW OF NUTRITION

VOLUME 4, 1984

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# PREFACE

The contents of the first four volumes of the *Annual Review of Nutrition* reflect the categories of most active research and current general interest. Additionally they identify and define subject areas that constitute the modern science of nutrition. The definition of this science has been much discussed and debated, owing in considerable measure to popularization of misconceptions through public media and politically oriented forums, as well as by the writings of nonscientists in semiscientific and pseudoscientific publications. The narrow, albeit detailed, interest of some members of the scientific community unacquainted with the extensive centuries-old history and the broad scope of the science of nutrition has sometimes furthered these misconceptions.

All of the scientific and scholarly activities that constitute nutrition have not been fully represented in the initial four volumes. Future volumes will gradually add legitimate subject areas and expand the comparative aspects of nutrition to include greater attention to domestic, marine, and aquatic animals; poultry and other avian species; nonhuman primates; and wild animals, especially those species in zoological gardens. Subsequent volumes will seek to identify more clearly the importance of the history of nutrition science.

Other *Annual Reviews* (e.g. of *Biochemistry*, *Physiology*, *Medicine*, *Public Health*, *Pharmacology and Toxicology*) similarly depict the current concepts of their sciences and the active areas of advance. It is of interest to reflect that today's biochemistry, yesterday's physiological chemistry, evolved from physiology and from chemistry. Classical nutrition in the grand manner of Graham Lusk, H. C. Sherman, Lafayette B. Mendel, Sir Frederick Gowland Hopkins, and E. V. McCollum was a product of earlier contents of these sciences. Many of the basic nutrition interests and concepts emerged from application of chemistry to agriculture, which greatly influenced the classical period of the Wisconsin and Johns Hopkins developments in nutrition.

As noted by J. Murray Luck in his Foreword to Volume 1 of the *Annual Review of Nutrition*, the earlier volumes of the *Annual Review of Biochemistry* devoted appreciable space to nutrition. Subsequently, the chapters primarily concerned with nutrition disappeared. Nevertheless, a perusal of other current *Annual Reviews* reveals that related sciences continue to consider various aspects of the science of nutrition. This is evident from the related articles page that appears after the contents pages of each *Nutrition* volume, where we list reviews of interest to nutrition scientists but appearing in other *Annual Reviews*.

During the past two decades, a remarkable acceleration of the application of nutrition knowledge in medicine has stimulated interest and involvement

in nutrition by physicians in all clinical specialties. This upsurge accounts for the diversity and number of chapters in the category of clinical nutrition included in the *Annual Review of Nutrition* series. The extent to which sophisticated nutrition knowledge is now continuously utilized by patients even in free-living situations is impressively demonstrated by the chapter on "Home Parenteral Nutrition" in this volume. At the same time, the excitement of discovery of new basic dietary essentials is illustrated in the reviews of trace elements.

The *Annual Review of Nutrition* was introduced in 1981, the 75th anniversary of the enactment of the Pure Food and Drug Law, during a time of heated debate concerning food and environmental protection. In his inaugural Foreword, J. Murray Luck noted those who "urge that our great uncle in Washington guarantee for us an environment that is totally risk-free, including the food we eat, the water we drink, and the air we breathe. I doubt that even Heaven provides a risk-free haven." Without addressing specific issues or the emotional politics of controls and regulatory activities, the prefatory essay in the present volume provides a scholarly, historical perspective on the evolution of regulatory activities pertaining to food. This essay by Peter Barton Hutt, one of the nation's most distinguished food and drug lawyers, formerly Chief Counsel of the Food and Drug Administration, can profitably be studied in conjunction with the prefatory essay in Volume I, "The Moral Dimensions of the World's Food Supply," by Professor Samuel E. Stumpf, a leading philosopher.

The reception accorded these volumes by the scientific community is a source of satisfaction to the Editorial Committee and other consultants responsible for their planning. The quality of the volumes has been established by the excellence of reviews prepared by the many authorities who have generously and most pleasantly cooperated in their production.

As I complete my five-year term as Editor of the series, I express appreciation to all whose efforts have made these volumes possible, especially to my Associate Editors, Harry P. Broquist and Robert E. Olson. The continuity of scope and quality under the continuing editorship of Dr. Olson is certain. The addition of corresponding editors to our Editorial Committee will assure inclusion in subsequent volumes of appropriate authors from outside the United States and continuing treatment of international scientific developments.

Finally, the validity of the prediction by J. Murray Luck is now apparent. "Eventually," he wrote of the *Annual Review of Nutrition*, "it may be threatened with the obesity that has plagued its parent [the *Annual Review of Biochemistry*] but, of all people, those of you who are contributing to the science of nutrition will surely know how to maintain the pristine beauty and health of this new *Annual Review*".

Again, I thank my associates on the Editorial Committee, the consultants for the various volumes, the authors who have generously given of their time and accepted our editorial suggestions, as well as the staff and Board of Directors of Annual Reviews Inc. for affording me a most pleasant five years of rewarding editorial responsibilities. I look forward to continuing association with the Editorial Committee and wish Bob Olson an Editor's term as enjoyable as my own.

WILLIAM J. DARBY



## OTHER ARTICLES OF INTEREST TO NUTRITION SCIENTISTS

From the *Annual Review of Biochemistry*, Volume 53 (1984)

*Molybdenum in Nitrogenase*, V. K. Shah, R. A. Ugalde, J. Imperial, W. J. Brill

From the *Annual Review of Pharmacology and Toxicology*, Volume 24 (1984)

*Mechanisms of Teratogenesis*, D. A. Beckman, R. A. Brent

*Mechanism of Action of Vanadium*, B. R. Nechay

*Gossypol: A Potential Antifertility Agent for Males*, S.-Z. Qian, Z.-G. Wang

From the *Annual Review of Medicine*, Volume 35 (1984)

*Very Low-Calorie Diets in the Management of Obesity*, D. H. Lockwood, J. M. Amatruda

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From the *Annual Review of Public Health*, Volume 5 (1984)

*Genetic Epidemiology*, M.-C. King, G. M. Lee, N. B. Spinner, G. Thompson, M. R. Wrensch

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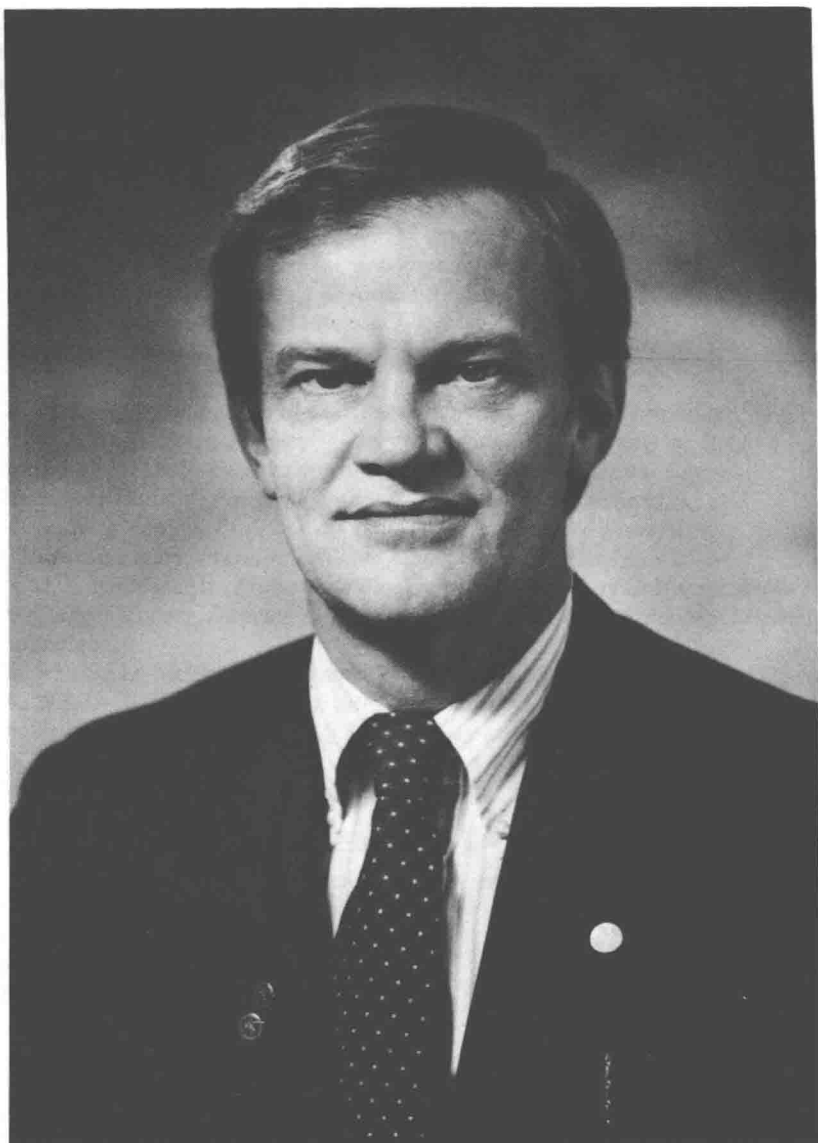
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*Peter Barton Hutt*



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# GOVERNMENT REGULATION OF THE INTEGRITY OF THE FOOD SUPPLY

*Peter Barton Hutt*

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## INTRODUCTION

Throughout history, civilized societies have reflected a deep interest in, and concern about, the integrity of the food supply. Long before the development of the distinct scientific discipline of nutrition, philosophers and physicians paid close attention to the role of the daily diet in individual and public health.

For at least 2000 years, indeed, from the time of Hippocrates to the dawn of modern medicine, there was little distinction made between food and drugs. The practice of medicine itself consisted largely of the wise choice of natural food products.

With the beginning of modern therapeutics and nutrition a century ago, and the eventual discovery and understanding of the biochemical role of discreet

nutrients, the overall importance of the role of diet in human health was temporarily obscured. More recently, however, this factor has come back into focus and now commands as much attention as it did in years past.

For centuries, government has had an essential role in assuring the integrity of the food supply. The focus of the regulatory function has, of course, evolved over the years. It originated essentially as a means to protect against fraud in the marketplace. Very quickly, it expanded into a mechanism for preventing the sale of unsafe food. As the science of nutrition has developed, it has assumed the role of protecting the nutritional integrity of the food supply as well.

This chapter traces these historical developments and places them in the context of related scientific advances. It concludes with thoughts about the future collaboration of regulation and nutrition in the light of new scientific knowledge.

## ANCIENT TIMES

Hippocrates (circa 460 BC) clearly recognized the essential relationship between food and health, pointing out that "differences of diseases depend on nutriment" (24). He stated that it is necessary to know "the power possessed severally by all the foods and drinks of our regimen, both the power each of them possessed by nature and the power given them by the constraint of human art" (25). He urged close study of the daily dietary regimen associated with good health: "So in fixing regimen pay attention to age, season, habit, land, and physique, and counteract the prevailing heat and cold. For in this way will the best health be enjoyed" (26). Hippocrates concluded that either too little or too much food "harms the man just as much" (27).

The first great botanical treatise on plants as a source of food and medicine, the *Enquiry Into Plants* written by Theophrastus (370–285 BC), reported on the use of artificial preservatives and flavors in the food supply even at that early date. Theophrastus noted that "even uncompounded substances have certain odors which men endeavor to assist by artificial means even as they assist nature in producing palatable tastes" (58). He reported that items of commerce, such as balsam gum, were mixed with adulterants for economic reasons (57). The treatise *On Agriculture* by Cato (234–149 BC) recommended the addition to wine of boiled-down must, salt, marble dust, and resin, and included a method "to determine whether wine has been watered" (10).

Pliny the Elder (23–79 AD) found widespread adulteration throughout the food supply. He described, for example, the adulteration of bread with chalk, vegetable meals, and even cattle fodder (45). He pointed out that pepper was commonly adulterated with juniper berries (43). Indeed, his *Natural History* is replete with so many references to adulteration of the natural food and drug supply that he observed: "So many poisons are employed to force wine to suit our taste—and we are surprised that it is not wholesome!" (44). Pliny, describ-

ing "the remedies that are in the control of a man's will," stated that "the greatest aid to health is moderation in food" (47). He urged the value of a kitchen garden for "harmless" market supplies (46). Galen (131–201 AD), a renowned Roman physician who followed the philosophical tradition of the School of Hippocrates, similarly warned against the adulteration of common food products, such as pepper (17).

Pliny reflected the layperson's distrust of medical practice that has existed throughout the ages:

Accordingly, heaven knows, the medical profession is the only one in which anybody professing to be a physician is at once trusted, although nowhere else is an untruth more dangerous. We pay however no attention to the danger, so great for each of us is the seductive sweetness of wishful thinking. Besides this, there is no law to punish criminal ignorance, no instance of retribution. Physicians acquire their knowledge from our dangers, making experiments at the cost of our lives. Only a physician can commit homicide with complete impunity (48).

In contrast, Galen, a physician, reflected complete confidence in the knowledge and ability of physicians to establish sound diets that would advance the public health. Indeed, Galen was the first to emphasize the difference between the art of cookery and the science of nutrition:

Therefore, as I said a little while ago, as the trainer is the attendant of the gymnast, so the cook is of the physician; and this has now been demonstrated. For the cook prepares either beans or lentils or barley, sometimes in one way sometimes in another, but does not know the effect of the preparation, or which of the preparations is best. But the physician, though not able to prepare any of these things as well as the cook, knows the effect of every preparation (16)

Galen advocated moderation as the principal rule for sound dietary habits: "And in the nature of eating and drinking, in quantity, quality and faculty, the objective again there also is moderation, so as to take neither too much nor too little, but as much as, digested and distributed and nourishing the body well, if need be will supply symmetry to the still growing parts, and leave nothing superfluous or lacking" (18). Despite all the advances in medical science and nutrition during the intervening eighteen centuries, it is doubtful that anyone has improved materially on that fundamental rule of sound nutrition.

The Roman civil law reflected the concern expressed by these early writers about preserving the integrity of the food supply. Fraud in the sale of merchandise not only gave rise to a private right of action, but also constituted the offense of *stellionatus*, which included the adulteration of food: "And, where anyone has substituted some article for another; or has put aside goods which he was obliged to deliver, or has spoiled them, he is also liable for this offense" (52). Although *stellionatus* was technically not a crime, it was comparable to a civil offense under present law, subject to government prosecution, and resulted in such punishment as condemnation to the mines or temporary exile.



## THE ENGLISH EXPERIENCE, 1200–1875

Following Galen and the fall of the Roman Empire, nontheological scholarly writing lapsed into disuse for roughly a millenium. At the end of the Dark Ages, however, concern about the food supply once again emerged. Nowhere is this more evident than in the experience reflected in the laws of England at that time.

Initial governmental concern came in the form of regulating the price of bread, and perhaps other staple food products as well. It did not take long for the English government to realize that the price of food could be regulated only in relation to the quality of that food. Accordingly, the early English regulatory statutes prohibited the adulteration of any staple food that was also subject to price controls.

These regulatory enactments, called assizes, were codified by Parliament in 1266 (80). The 1266 statutes prohibited the sale of any “corrupted wine” or of any meat, fish, bread, or water that was “not wholesome for man’s body” or that was kept so long “that it loseth its natural wholesomeness.” These laws, with periodic amendments, continued in effect throughout England until 1844 (82). They were supplemented, from time to time, with additional statutes directed at other food commodities that became a source of commerce, such as butter, cheese, and spices (75–79, 81).

In addition to the statutes enacted by Parliament, local cities enacted their own ordinances to prevent food adulteration (49, 50). The judicially-created common law, reflecting the principles underlying the statutes and ordinances, created both a civil cause of action for damages for any aggrieved party, and a criminal offense as well (8, 12). Numerous examples of early enforcement actions against the purveyors of adulterated food may be found in the records of the City of London. (49).

Finally, the trade guilds, which had their origins as early as the Norman conquest, also performed a major regulatory function. These guilds covered every important food category, including the bakers (59), butchers (31), cooks (41), grocers (22), fruiterers (20), poulterers (30), and salters (73). Using their power to search all premises and to seize all unwholesome products, the guilds exercised a relatively strong regulatory power in policing the marketing of food to the public.

## THE DEVELOPMENT OF CHEMISTRY AND THE ACCUM TREATISE

As the Renaissance emerged out of the Middle Ages, a few pioneers in the newly developing discipline of “chymistry” broke away from the philosophic mysticism of alchemy and initiated modern scientific inquiry. While earlier