Dedication

In recognition of his pioneering and continuing contributions to nutrition, this volume is dedicated to our colleague, our mentor, and above all our friend, Samuel Lepkovsky, who typifies the true spirit and service of science by an open, inquiring mind which promotes increase in natural knowledge, and a heart dedicated to amelioration of man's estate by furthering the application of scientific methods to all the problems of life. He is indefatigable in seeking the broad basic hypotheses governing nutrition in all its aspects and in testing these hypotheses by the most searching examination and severe criticism. His career has exemplified qualities of self-sacrifice, persistence, courage, accuracy, humility and hope, which Sir Richard Gregory (1916) stressed as the true nobility of science.

Dedicatory Foreword

It is fitting that this book, which deals with the discovery of the vitamins, should be dedicated to Dr. Samuel Lepkovsky. He was one of the pioneers in their discovery and in the understanding of the biochemical mechanisms of their actions on living animals. He has for many years occupied the position of Professor of Poultry Husbandry at the University of California at Berkeley, and this position serves to point up a feature of the discovery of the vitamins which is not generally recognized.

Especially in the modern world, it is taken for granted in many quarters that the vitamins were discovered by medical men whose primary motivation was to understand the causation and the control of disease in human beings. Actually, however, medical motivation was only part of the picture, and all too often, medical applications came after the main discoveries. Almost without exception, the work on the discovery and identification of the vitamins was *not* carried out in medical schools. Only with vitamin C, thiamin, niacin and vitamin D was the relationship to widespread human diseases the starting point for laboratory experimentation. The discovery of the other vitamins, and of many other features of the science of nutrition, was sparked by research work done largely in agricultural colleges. Dr. Lepkovsky's position in an agricultural college reminds us of this aspect of past history.

Sam Lepkovsky began his scientific career in the Department of Agricultural Chemistry at the University of Wisconsin—the site of much pioneering work in the field of vitamins. It was during the era of E. V. McCollum, E. B. Hart, H. Steenbock, and C. A. Elvehjem, who were there either as fellow graduate students or as staff members. It was the period just after the First World War, when the concept of the existence of the vitamins, and of the existence of deficiency diseases, was being established, and when the idea that there were fat-soluble and water-soluble vitamins was emerging. In other words, the concept of the multiplicity of vitamins was being formed, and it was to a great extent, by work being done for the first time in the department where Sam was fledging.

After finishing his graduate work at Wisconsin, he moved on to California and embarked on a long series of researches which dealt with many aspects of the biochemical features of the nutrition of animals. In the course of these studies he succeeded in the isolation, in chemically pure and crystalline form of the vitamin which is now called pyridoxin. By that time it had become clear to men eager to discover some of Nature's important secrets that the vitamins were among them. In several countries men were trying to separate and identify all of the members of the series. It is therefore not surprising that within a year of Lepkovsky's report of the isolation of pyridoxin (to give it its present name), two other laboratories, that of Keresztesy in New Jersey, and of Kuhn in Germany, also succeeded in reaching the same goal, but by different routes. Likewise, it was symptomatic of the age of discovery of the vitamins that the same compound had unknowingly been isolated several years earlier. In Japan, a crystalline substance had been found which separated out during attempts to isolate thiamin from rice polishings. This inactive substance had been quietly filed away. Only long after pyridoxin was identified was it possible to look backward and recognize that these crystals were, in fact, pure pyridoxin. Similar occurrences took place in the discovery both of vitamin C (ascorbic acid) and of nicotinic acid (niacin).

The compilers of the present book have done a noteworthy job of subtly capturing not only the factual content of the discovery of the vitamins, but also some of the other features of that great intellectual adventure. More than once, they have had to choose between rival claimants for the laurels of discovery. This, of necessity is so, because these discoveries do not spring fully armed from the head of Zeus, as Athene was said to have done. Instead, they slowly congeal from the work of several men. Often, there may be one individual who is far out in front, but even he has his predecessors. Usually, there is a small group of pioneers rather close at his heels; who gets there first is not easy to foretell. Especially is this true as a particular field of study grows older and attracts many more able investigators because of its manifest importance. Dr. Lepkovsky, to whom this book is dedicated, was one of the few who led the field.

Finally, a few words should be said about the ongoing character of discovery. The heyday of identification of the vitamins is past and gone. This book reproduces the accounts of some of its great moments. The problem was solved, and the fashions have changed. Now, in nutrition, men seek for applications to public health or for biochemical uses, or they look for other problems.

Dr. Lepkovsky, like many others, turned his attention to the applications to public health. After several years, however, he saw that it was

a field in which social customs, politics and economics, as well as scientific fact vied for attention. Although not unaware of the importance of these aspects, he also recognized that the wheels of the gods grind slowly in such matters, and one of the reasons for this is the scarcity of basic understanding. At an age when most men are content to pass quietly into administrative or editorial positions, he returned to active experimentation with his own hands in the laboratory and is now doing what he can to understand more of the basic principles. His interests in what determines appetite and satiety have led him to studies of the hypothalamus and those other parts of the primitive brain which are the seats of emotion and fundamental behavior. It is not unlikely that in these regions he may encounter such exciting compounds as serotonin, epinephrin and acetylcholine (i.e., the so-called biogenic amines) which act on the central nervous system and which constitute the biochemical center of one of the most fascinating fields of present day discovery. If he should do this, he will have passed from the frontier of the "vital amines" (the vitamins), as Funk called them, to that of the biogenic amines which somehow control behavior.

D. W. Woolley
The Rockefeller Institute
New York

University of California: In Memoriam, 1985

Samuel Lepkovsky, Poultry Husbandry: Berkeley

1901-1984
Professor Emeritus

Dr. Samuel Lepkovsky, a renowned nutritionist, died peacefully at 83 years of age, following a sudden stroke on April 12, 1984. Born in Poland, he came to the United States with his parents as a very small child. He attended schools in Wisconsin, and obtained the B.S. in 1920 and the Ph.D. in 1925 in biochemistry at the University of Wisconsin at Madison. He came to Berkeley in 1928 to work with Professor Herbert M. Evans of the Anatomy Department. He remained there for seven years, and then served as Professor of Nutrition in the Department of Poultry Husbandry at Berkeley until his retirement in 1967.

Lepkovsky worked in many aspects of nutrition, neurophysiology, biochemistry, and neuroanatomy, and was known for his innovativeness and many "firsts." He did pioneering work on riboflavin, and isolated, crystallized, and purified several hundred milligrams of this vitamin from several hundred thousand gallons of milk. He distributed the results of his labors freely and generously to other scientists throughout the world in order to encourage further studies in this field. This action was a clear indication of the type of man he was.

His work on riboflavin and the filtrate factor on egg production and hatchability was the foundation of teratology. This was reviewed in 1938. He also initiated studies on the sparing action of fats on the B vitamins.

No doubt the work for which he was best known was the crystallization and isolation of pyridoxine (Vitamin B6). 1938 was an exciting year for nutrition and Lepkovsky was very active during this time and right in the middle of all the excitement. "The race" for the isolation of the filtrate factor was on, and Lepkovsky was one of the leaders. It was, indeed, a competitive situation, for five laboratories reported isolation of Vitamin B6 in that year. There was an abundance of competitors, with scientists associated with such organizations as the Merck Company, the Lister Institute, and I.G. Farben in Europe. Yet, this remarkable man was the first to isolate xanthurenic acid, a metabolite of the amino acid tryptophan

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from the urine of Vitamin B6-deficient animals. The xanthurenic acid excretion test in Vitamin B6-deficiency following ingestion of tryptophan remains to this date the best means of assessing Vitamin B-nutriture.

Among more recent contributions was an atlas of the chicken brain, done with one of his colleagues, Dr. Sanford Feldman, a noted surgeon in San Francisco. Lepkovsky was also the first to completely pancreatectomize the chicken.

Lepkovsky served this country in two wars, first as a "doughboy" in World War I, and later as a nutritionist for the Army Quartermaster Corps in World War II under General Doriot. It was typical of Lepkovsky, who always sought answers in the laboratory, that he went into the field with the troops to test rations, sharing with them the rigors of the Arctic and mountain climates as well as their diet.

His observations and innovativeness contributed greatly to the development of various combat rations, and also the so-called life-boat ration. It was during World War II that Lepkovsky's keen powers of observation led to recognition of the importance of the central nervous system in nutrition and the role of stress in nutrition and food acceptability. Thus, when he was nearly 50, Lepkovsky began nutrition research anew and began to learn neuroanatomy and physiology. After World War II he returned to Berkeley to pioneer this new field, that is, the

relationship and the role of the central nervous system in nutrition, appetite, and satiety, which led to his studies of the pituitary and hypothalamus and their involvement in nutrition.

In his Babcock Hart Address in 1954, he pointed out that "we are witnessing the end of an era of nutrition--the era of the essential nutrients. A new era is in the making, and the dim outlines are beginning to emerge." He then went on to describe the new work on which he had embarked--the role and impact of the central nervous system in nutrition. Thus, at an age when most men are content to pass quietly into administrative or editorial positions, Sam returned to active experimentation with his own hands. He went (as Wayne Woolley stated) "from the frontier of the vital amines (the vitamins), as Funk called them, to that of the biogenic amines which are involved in behaviour."

Lepkovsky characteristically did not rush to print his observations. As Dr. Goldblith of M.I.T. put it, "he was like a master tailor finishing a garment before putting it on public display." As a result, he was not given full recognition for some of his outstanding findings, although he discussed them freely and helped others in the field.

He had tremendous powers of observation and imagination, which he utilized to the fullest. While cleaning his wire-mesh cases housing Vitamin B6-deficient rats, he observed a green pigment in the urine (due to the reaction of xanthurenic acid with iron rust of the cages). Pursuing this

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observation, he isolated xanthurenic acid and showed it to be an aberrant metabolite product of tryptophane in B6-deficient rats. This observation proved to be very important and useful. Another example was that of teratologic phenomena in riboflavin-deficient rats. He had no time to pursue this, but suggested it as a new and possibly intriguing field. It did develop into the new field of teratology--the credit, of course, going to others.

Lepkovsky's career exemplified qualities of self-sacrifice, persistence, courage, accuracy, humility, generosity, and hope, which Sir Richard Gregory stressed as the "true nobility of science." Lepkovsky received a number of awards, among which were the Honorary LL.D. from the University of California at Davis, the Babcock Hart Award of the Institute of Food Technologists, and the fellowship of the University of Rehovoth, Israel.

He had many friends and many interests. He was an excellent dancer, an incomparable oenophile and gourmet, an amateur stock-market analyst, a world traveler and raconteur. He was an avid mountain climber, and loved to escape to the mountains where, as he put it, both he and God could relax. He will certainly be missed by legions of friends all over the world.

Emil M. Mrak B. S. Schweigert F. X. Small
