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EDWARD ARTHUR STEINHAUS

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A Biographical Memoir by

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Biographical Memoir

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Edward A. Steinhilber

EDWARD ARTHUR STEINHAUS

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BY E. F. KNIPLING

FEW MEN have had a comparable record of dedicated service and achievement for the betterment of society than did Dr. Edward Arthur Steinhaus, one of the nation's outstanding biological scientists. As a pioneer scientist working in the field of pathology of invertebrate pests, Dr. Steinhaus had an extraordinarily productive career during his fifty-four years of life. He was an outstanding research scientist in the fields of insect microbiology and insect pathology, an inspiring teacher of many of the world's leading insect pathologists, an able educator who was instrumental in the formation of the innovative "new biology" curricula, the author of a great body of scientific publications, and the organizer of the new scientific discipline of invertebrate pathology. All this he accomplished in spite of severe multiple congenital health handicaps, knowledge of which he determinedly and successfully kept from all except his family and closest associates.

Dr. Steinhaus was a man who looked at life "whole" and attacked the "specific." He was deeply and sensitively concerned over man's relationship to man, man's relationship to his environment, and man's relationship to science. It was these concerns in a broad sense which perhaps led him to his many specific contributions to mankind, which in turn earned for him recognition as a leading scientist of the twentieth century.

Central to all his work were two basic concerns: "What goes wrong with life?" and the need to recognize the interrelationships of man, nature, and science.

Recognized by the scientific community as the "father of insect pathology," Dr. Steinhaus founded a new field of science that can provide acceptable biological means of dealing with many insect and other invertebrate pest problems. His work in this capacity will continue to have an impact on scientific thought and technological advances for many years to come. The world is now in an era when there is universal concern over the adverse effects of the use of nonselective chemical pesticides on the quality of the environment. Thus, the role that pathogenic insect microbes might play as effective and safe ways to control destructive pests is a subject now under intensive investigation by insect pathologists the world over.

Edward Arthur Steinhaus, who became known merely as "Ed" to his family, close friends, and associates, was born in Max, North Dakota, on November 7, 1914. The influence of a proud, talented, and industrious family, combined with his early life and experiences in the small economically depressed rural community of Max, had much to do with Ed's choice of a career, as well as with his concern for his fellow men, especially those who might be underprivileged. In North Dakota Ed became painfully aware of the dilemma of man when he is not in a position to cope with the destructive forces of nature.

Of German extraction, Ed's grandfather came to America in 1857; he first settled in Wisconsin and later moved to Minnesota. Ed's father, Arthur A. Steinhaus, moved from Minnesota to central North Dakota in 1906 at the age of twenty-five. Limited in formal education, Arthur first worked as a tinsmith. Later, together with his brother, he established a general merchandise store to service the people of the community of Max. He also operated a farm, as did most of the people in the rural community.

In 1910, Alice Blanche Rhinehart, a beautiful auburn-haired

young lady, came to Max from the nearby town of Sheldon, North Dakota, to teach elementary school. Arthur Steinhaus married Alice in January 1914. They had four sons: Ralph, John, James, and Edward, Ed being the oldest. Alice Steinhaus's father was Pennsylvania Dutch, and her mother was of English-Scottish descent. She established, after considerable effort, that one of her ancestors, Richard Warren of London, came to America on the *Mayflower*.

Ed Steinhaus had varying duties to perform as a youngster. He did odd jobs on the farm, but most of his time was devoted to clerking in his father's store. He had learned to operate a printing press, and among his duties he printed handbills and did other printing work for the store. In addition, he edited and printed a small local news bulletin. This interest in writing, editing, and publishing remained with him throughout his life. Work in his father's store brought Ed into close association with all segments of the people in the community—farmers, farm workers, business people, and town “intellectuals” among others. The opportunity to know people in all walks of life and to obtain their views on subjects relating to religion, politics, and social problems gave Ed an insight about people and their problems that governed his philosophy of life and motivated him to serve mankind. Ed often told of the lively discussions on religious, political, and social issues that took place around the large coal stove in the back of the store during cold winter days.

Ed's own writings reveal that his mother had a major influence on his interests, personality, and general philosophy of life. She introduced him to the joys of reading. Ed especially enjoyed books by Huxley and Darwin, which stimulated his interest in science. He himself related that his interest in science was raised to “white heat” by Paul de Kruif's *Microbe Hunters*. His interest was also intensified by his high school science teacher, Miss Alice Paulsen.

While scientific subjects seemed to be Ed's primary concern,

he had almost equal enthusiasm for other kinds of literature, including poetry. Had he not elected to follow science as a career, it is almost certain that journalism and the business of editing and publishing would have become his lifetime pursuit. In actual fact, however, his interest in journalism and his ability to write so well explain in large measure why he was able to make such great and lasting contributions to science.

Even though he was not a student of music and painting, Ed had a deep appreciation for these arts. His liking for singing, music, and painting could also be attributed to his mother. She was an accomplished amateur pianist who reportedly could play virtually any tune. Moreover, at the age of seventy, Ed's mother took up painting as a diversion and won local prizes for her work. Ed's opinion: "She was as good as Grandma Moses ever was."

The years of the depression, coupled with a serious drought in the thirties, made a deep imprint on Dr. Steinhaus's outlook on life. It is probable that the hardships experienced by people of the farming and business community of Max during this trying period were the motivating forces behind Ed's strong desire to help the oppressed. The economy of the community was affected not only by the general depression and droughts but by a fire which destroyed most of the business section of Max. When relating the effects of the depression and natural disasters on the people, Dr. Steinhaus stated, "The 'Grapes of Wrath' were evident all about them." He marveled that his father was able to keep the general store open during the years when farmers profited little from their crops and could not pay bills. His father eventually had to "write off" thousands of dollars owed him for clothing, farm machinery, general supplies, and other items. Yet he continued to extend credit even though the chances for payment were nil.

Steinhaus entered the North Dakota Agricultural College (now called North Dakota State University) in 1932. For a time he had difficulty deciding whether to major in entomology or

bacteriology, but finally elected the latter. Later, as a graduate student, he consolidated his interest in both subjects when he recognized the opportunities for new research on the interrelationship of insects and their associated microbes.

In 1936, after graduation from the Agricultural College, Dr. Steinhaus was granted an assistantship in bacteriology at the Ohio State University. His requirements for a Ph.D. degree were completed in 1939, with a major in bacteriology and a minor in entomology.

Dr. Steinhaus's decision to enter into a career of scientific investigation of the microbes of insects was made in 1939 after winning a postdoctoral Muelhaupt Scholarship. I had occasion to hear him speak of the difficulty he had in deciding to enter a field of study that most members of the scientific community felt was of little practical consequence. Yet, his interest and vision prevailed, with some encouragement from Dr. Alvah Peterson, Professor Emeritus of The Ohio State University and one of the leading teachers of entomology of our era.

In this period of growing worldwide concern over the deterioration of our overpopulated and misused environment, all of those who are engaged in dealing with pest problems and who, at the same time, are striving to alleviate environmental pollution caused by pesticides can appreciate fully the good fortune of fate that made Dr. Steinhaus elect to undertake a career investigating insect pathogens. This line of investigation, which only a few years ago seemed so inconsequential, is now recognized as one of the great hopes for the eventual development of safer alternative means of dealing with many insect pest problems. Moreover, the increasing need for food, fiber, and other essential agricultural crops to feed the ever-expanding world population will demand the availability of effective as well as safe ways to control insect pests—man's greatest competitor for the food that the environment is capable of producing.

During the days of Ed's initial research in the early forties,

certainly no one, including Ed, could have foreseen the breadth and scope of the interrelationship of microbes and insects. Yet, when we consider that insects exceed all other animals of the world and that every insect will no doubt be found to harbor microbes, either for their benefit or as deterrents to their welfare, one begins to appreciate the scope of the scientific field that Dr. Steinhaus brought to the forefront. Previous to his time, a few investigators had carried out superficial studies of the microbes associated with insects and other invertebrate animals. In this effort, several largely abortive attempts had been made to utilize pathogenic organisms to control insects, but these generally had failed. Considerable success had been achieved by investigators with the U.S. Department of Agriculture in the control of the Japanese beetle with a microorganism. But, as Ed himself stated, research in the general field of insect pathology was a "lonely field" in the early years, since there were so few scientists to talk to who were knowledgeable and interested in research on insect microbes.

Dr. Steinhaus began his investigation by undertaking a systematic compilation of the microbes reported to be associated with insects. In 1940 he published an article reviewing his work. He continued compiling information and making observations in his own studies, and his efforts led to a compendium of microorganisms associated with insects which was published in 1946 as a book entitled *Insect Microbiology*. In 1940 Dr. Steinhaus joined the U.S. Public Health Service staff at Hamilton, Montana, where he carried out research on diseases affecting man and on vaccines for controlling those diseases.

The year 1940 was also the beginning of a new phase in the personal life of Ed Steinhaus. This is the year he married Mabry Clark. Mabry was born and grew up in Mississippi and graduated from Mississippi State University. She entered graduate school at The Ohio State University and while there met Ed. After receiving her master's degree in bacteriology, she taught

at North Dakota State University, Ed's alma mater, for a year and a half before marrying Dr. Steinhaus. During their marriage, Mabry devoted most of her time to caring for the home and their three children: Margaret Ann, now Mrs. Steve Goetz, Timothy Clark, and Cynthia Alice. In addition, however, she worked professionally outside the home as a bacteriologist for a few years and inside the home as Ed's "nonprofessional" research assistant. Her activities such as searching literature, proofreading, and indexing for Dr. Steinhaus helped him to record his many important contributions in the field of insect pathology. She is continuing to bring together writings of Dr. Steinhaus that are to be published in the future. Having the understanding, support, and able assistance of one so close to and so familiar with his interests and goals must have added immeasurably to Ed's many achievements.

One of Dr. Steinhaus's great disappointments in life came in 1942 when he was unsuccessful in his persistent efforts to enlist in the armed forces. His general philosophy concerning wars was definitely antimilitaristic and he deplored the United States involvement in Vietnam. But he viewed the defense of our country when under direct attack in a different light and was anxious to help defend it. It was during his half-dozen attempts to enlist in one or the other of the three branches of the armed forces that the seriousness of Dr. Steinhaus's physical defects was revealed. The series of rather thorough physical fitness examinations revealed a large number of serious internal physical defects, any one of which could have disqualified him for military duty. Subsequently, more detailed and refined medical examinations were made in attempts to offer the explanation for his many health problems which surfaced over the years. The true complete explanation did not come, however, until the year of his death. He was born with a damaged and nonfunctional hypothalamus on the left side. This accounted for missing or abnormal organs, including the absence of one

kidney, incompletely formed baselar vertebra, a shortened leg, and an upside-down stomach. The physician who finally diagnosed the cause of his many ills expressed wonderment over the fact that Dr. Steinhaus had lived so long and could not even imagine how any man could have been so creative and productive with so many defects. It is equally amazing to others that a person could so effectively submerge his discomforts and pains, yet carry on with enthusiasm, vigor, and efficiency many scientific activities day after day, month after month, and year after year. One can imagine that even Ed himself, not knowing what it was like to be well and healthy, did not know the extent of his defects. This situation magnifies the stature of a man who earned the admiration and respect of so many people even in the absence of knowledge of the obstacles with which he had to contend each day of his life.

Dr. Steinhaus's eminence as a scientist and pioneer research worker, which earned him recognition as the "father of insect pathology," emerged at the University of California, Berkeley. There he received an appointment in the Department of Bacteriology in 1944 and was soon transferred to the College of Agriculture and the Agricultural Experiment Station as Assistant Professor of Insect Pathology and Assistant Insect Pathologist, respectively. His advancement to higher positions came steadily. By 1954, he had become Professor of Insect Pathology with the University and Insect Pathologist with the Experiment Station. He organized and directed the Laboratory of Insect Pathology, the first in the world. Later, in 1960, this small laboratory was elevated to the position of Department of Insect Pathology. In 1963 the Department became the Division of Invertebrate Pathology within the Department of Entomology and Parasitology.

With the establishment of the University of California, Irvine, in 1963, Chancellor Daniel G. Aldrich prevailed upon Dr. Steinhaus to organize the School of Biological Sciences and

become its first Dean. In relating the selection of Dr. Steinhaus for this post, Dr. Aldrich stated: "He was my first appointment (to the new University), and what an example he set for us! He was a tireless administrator, an indefatigable researcher, and a concerned and understanding teacher, admired by undergraduates and graduates alike. Dean Steinhaus organized, staffed, and developed a program in the biological sciences that is unique in this country today."

Dean Steinhaus trained and developed most of the senior insect pathologists of the world today. His graduate students came from all parts of the globe. The number was limited only by the available facilities and resources. After completing their training, the students returned to their countries or accepted posts in other parts of the world to establish new centers for teaching or research in a new scientific discipline. It is evident from the many sincere and eloquently stated letters of condolence received by Mrs. Mabry Steinhaus that Dr. Steinhaus's former students had an intense love, admiration, and respect for him, not only as a teacher, but also as a personal adviser and counselor. Dr. Steinhaus demanded of his students thoroughness, accuracy, and efficiency, but he had seemingly unlimited patience in considering their problems. His secretary was instructed by Ed to budget his time so that he could give primary consideration to the needs and problems of his students. He made himself available for counseling with students even during his busiest times.

Ed, a prolific and articulate writer of scientific publications, was described by his secretary as a scientific writer with "soul." His bibliography consisted of more than 150 technical articles and books. It contains research papers on bacterial, viral, fungal, and protozoan diseases of insects. In his research dealing primarily with insect viruses, he found that two different types of viruses occur in insects—the granulosis and the non-inclusion viruses. In his research on viruses he recorded or

described fifty new viruses in insects. In addition to the many individual articles, he authored two books, *Insect Microbiology*, published in 1946, and *Principles of Insect Pathology*, published in 1949. At the time of his death, he was writing a book on the history of insect pathology and its development in North America. He had planned a book on "invertebrate pathology." Dr. Steinhaus also edited and contributed substantially to a two-volume work entitled *Insect Pathology: An Advanced Treatise*.

In addition to his many publications, Dr. Steinhaus founded and edited the *Journal of Invertebrate Pathology*, initially called the *Journal of Insect Pathology*. Moreover, he organized the Society for Invertebrate Pathology and served as its first president in 1967 and 1968. His contributions to entomology were not limited to insect pathology; it was largely through his efforts that the *Annual Review of Entomology* was established in 1955, and he was its co-editor for the first six years. This is now regarded as the world's most important serial publication dealing with all aspects of the subject of entomology, to which hundreds of leading entomologists and associated scientists have contributed.

Even though Dr. Steinhaus modestly expressed regret in not contributing more to applied insect pathology, he was the first to demonstrate that an insect could be controlled under field conditions by the use of a virus spray containing the nuclear polyhedral virus of the alfalfa caterpillar. Although the insect pathogen *Bacillus thuringiensis* was known for years, he recognized its potential for controlling insects and investigated its pathogenic characteristics, including the associated endotoxin. His study of this organism included field tests which demonstrated the effectiveness of the organism for the control of several economic insect pests. Such results stimulated further work by other investigators and by industrial firms. This biological

organism is now produced and marketed as a highly selective biological insecticide for controlling a number of insect pests.

Few scientists have attained the high level of admiration and respect of associates and peers so early in their professional careers as did Dr. Steinhaus. In 1959 he was among the first of the entomologists to receive the Founders' Memorial Award given each year by the Entomological Society of America for outstanding contributions to this field of science. In 1963 he served as the president of this society. His recognition as an outstanding entomologist was not limited to his associates in the United States. It was worldwide, as attested by his election to the Entomological Society of the USSR and several other foreign or international organizations.

Recognition of his ability and stature in the field of science grew steadily, as evidenced by the demands for Dr. Steinhaus's services and by the many honors he received. His alma mater, North Dakota State University, awarded him an honorary Sc.D. degree in 1962. He served as visiting lecturer at a number of universities and declined many more invitations. In 1963 he delivered the principal address at the Second International Congress of Insect Pathology, held in Paris. He was a Fellow of the Entomological Society of America, the American Association for the Advancement of Science, and the American Academy of Microbiology; in addition, he was an honorary member of the Society of Science and Technology, India, and the Entomological Society of the USSR. Members of the National Academy of Sciences (Applied Biology Section) elected him to membership in 1968.

In addition to his many contributions to scientific societies, Dr. Steinhaus contributed much of his time and talent to the advancement of science by serving on many national and international committees and as a consultant to many scientific institutions and organizations, including the Public Health Ser-

vice, Pacific Science Board, National Research Council, World Health Organization, Office of Science and Technology, and U.S. Department of Agriculture.

Dr. Steinhaus recognized the importance, and encouraged the exchange, of ideas and viewpoints among scientists as a means of advancing scientific developments. His role in the establishment of the *Journal of Invertebrate Pathology* and in organizing the Society for Invertebrate Pathology has been cited. However, he was also the leading force in the establishment of a recognized new scientific discipline, invertebrate pathology. Quoting from his own statement, Dr. Steinhaus brought together "loose strings of scattered thrusts in the study of diseases of insects and other invertebrates, molding it into a discipline called invertebrate pathology." This molding of a new scientific discipline was accomplished in the span of less than a dozen years. It is apparent that his next goal was to develop closer interrelationships between scientific disciplines. As he advanced to positions of greater responsibility, his obvious goal was to create a "new biology" that could deal with scientific problems on a broader, more solid front and thereby contribute even more to science and human welfare. This he did as Dean of the School of Biological Sciences at the University of California, Irvine. He organized the school into departments concerned with "organismic biology," "population and environmental biology," "molecular and cell biology," and "psychobiology."

Also, while serving as Dean of the School of Biological Sciences, he continued his interest in invertebrate pathology, establishing and later electing to direct a new center for pathobiology. In establishing the center, he had in mind a program of study encompassing diseases of all forms of life. At the core was his lifelong interest in determining "what goes wrong with life." A manuscript by his colleagues entitled "In Memorium" states, "The formation of the Center for Pathobiology in 1968, with Professor Steinhaus as its first Director, was the culmina-

tion of a lifelong aspiration to centralize information and research facilities dedicated to the advancement of the understanding of disease in all forms of life. Confirmed by the University of California as a new development in biology, the Center for Pathobiology will grow as a memorial to Edward A. Steinhaus."

Emphasis thus far has been given to Dr. Steinhaus's contributions to science per se and to the development of scientists, rather than to how he himself was more concerned with science as a means of benefiting the welfare of man in every aspect of life. He expressed concern over the lack of appreciation of the close interrelationships of science and other developments. Some of his last written words in his unpublished autobiographical manuscript were ". . . society has been led by our institutions—educational, religious, communications . . . into wrong relationships with the natural world. Considerations of culture have been separated too greatly from nature, and the idea that man's relations to nature is a moral one has often been forgotten." He went on to say that he believed with Albert Schweitzer that "the great fault of all ethics hitherto has been that they believed themselves to have to deal only with the relations of man to man." Concerned with the relation man has with nature, Dr. Steinhaus also wrote that he viewed "the pollution of the air, soil, water with the wastes of man's technological advances as nothing less than a sin, in the classical meaning of the word." He also regarded as sin and poor economics "the indiscriminate use of chemical insecticides, the destruction of animal species to a point where they either have or are about to disappear from the Earth, the cutting of forests without reforestation, the attempts to dam and flood parts of the Grand Canyon—a creation of God's which cannot be duplicated."

The plight of the underprivileged was a matter of grave concern to Dr. Steinhaus. He himself wondered whether he "was

miscast as a scientist" and should not have been a social worker. He believed that the social sciences were not keeping pace with the "hard sciences" and expressed the feeling that technical ills could be corrected "if only the political scientist, the economist, the social scientist, and the humanist concerned with communication would do his share in leading the way."

A biographical account of an individual of Dr. Steinhaus's stature would be incomplete without some reference to his religious philosophy. He regarded himself as a religious man, but not necessarily in the classical sense. To him religion should be a way of life and not just a way of believing. As a youth he was exposed to the traditional concepts of religion existing in a Protestant community consisting principally of German Lutherans, the denomination to which his father belonged. His mother was originally a Presbyterian but after marriage became affiliated with the Lutheran church. One of his brothers became a Lutheran minister after serving as a navigator in World War II. After reaching adulthood, Dr. Steinhaus became affiliated with several different denominations, but eventually joined the Congregational faith.

His views on religion were liberal and he was strongly in favor of freedom of religion. He had little patience for the pomp often attendant upon religious ceremonies and was more interested in the basic principles of religion. This is perhaps why he admired the practical approach to religion of the Salvation Army.

Dr. Steinhaus had no difficulty in compromising his basic concepts of science and religion. Once when asked by a graduate student why he believed in a supreme intelligence or a God, Dr. Steinhaus replied, "Just look out of the window—why, He's all over the place—in the trees, the grass, the people, here in these bacterial cultures, here in the insects, in the molecules and atoms of this chemical, and out there in infinite space—it's all God." Characteristically, it was his view that people should

not dwell on conflicts between religion and science but rather that the two philosophies should team up in their approach to a solution of "what goes wrong" in the world. His viewpoint on this subject was in keeping with his philosophy of life that motivated him to accomplish so much through science and education for the welfare of mankind.

IN PREPARING this biographical memoir, I am especially indebted to Mabry C. Steinhaus for providing me with reference material not otherwise available. This was largely in the nature of manuscripts of biographies written by others, including those prepared by E. Gorton Linsley and Ray F. Smith of the University of California, Berkeley; James L. McGaugh, Howard A. Schneiderman, and John E. Smith of the University of California, Irvine; John D. Briggs, Ohio State University, and Mauro Martignoni and Ken Hughes of the U.S. Forestry Sciences Laboratory, Oregon State University, Corvallis. I also drew from biographical information obtained from the National Academy of Sciences. An unpublished document prepared by E. A. Steinhaus himself contained most valuable autobiographical information, which was kindly included in the material supplied by Mrs. Steinhaus. I wish also to express my appreciation for the assistance by my daughter, Edwina, in the organization and editing of the biographical memoir.

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KEY TO ABBREVIATIONS

- Bacteriol. Rev. = Bacteriological Reviews
Bull. Entomol. Soc. Am. = Bulletin of the Entomological Society of America
Calif. Agr. = California Agriculture
J. Bacteriol. = Journal of Bacteriology
J. Econ. Entomol. = Journal of Economic Entomology
J. Insect Pathol. = Journal of Insect Pathology
J. Invert. Pathol. = Journal of Invertebrate Pathology
J. Parasitol. = Journal of Parasitology
Public Health Rept. = Public Health Reports

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