

## **THE WAKSMAN FOUNDATION FOR MICROBIOLOGY**

The Foundation for Microbiology is a private, charitable organization, established in 1951. Its purpose, as expressed in its Certificate of Incorporation is “to promote, encourage, and aid scientific research in microbiology; to provide and to assist in providing the funds and facilities by which scientific discoveries, inventions, and processes in microbiology may be developed...all to the end that the science of microbiology shall progress in the service of mankind.”

The pivotal event which made the Foundation possible was Selman A. Waksman’s discovery in 1944 of streptomycin, the first specific agent effective in the treatment of human tuberculosis. The streptomycin patent has justly been acknowledged as “among the ten patents that shaped the world: since the establishment of the U.S. Patent Office in 1823. For his discovery of streptomycin, Dr. Waksman was awarded the 1952 Nobel Prize for Physiology and Medicine.

Selman Waksman dedicated half of his personal royalties from the patents on the development, manufacture, and sale of streptomycin, actinomycin, and other antibiotics to create the Foundation for Microbiology in 1951. In addition to, and separate from the Foundation, he also established the Institute for Microbiology (which now bears his name) at Rutgers University; the Institute received the major portion of the funds derived from royalties. He inspired the formation of similar foundations in France, Italy, and Japan by suggesting that foreign pharmaceutical companies producing streptomycin donate royalties to support microbiological research.

The Foundation for Microbiology is both a family and professional heritage. Its second president was Byron H. Waksman, son of the founder. He is a distinguished immunologist who has held posts at Harvard, Yale, and New York Universities and was Vice President for Research and Medical Programs of the National Multiple Sclerosis Society from 1980 to 1990. The Founder's granddaughter, Nan Waksman Schanbacher will assume the position of Chairman of the Board of Trustees in June of 2007.

The current president is Frederick C. Neidhardt, who assumed office on January 1, 2001 concomitant with a change in the organization's name to the Waksman Foundation for Microbiology. Dr. Neidhardt, a noted microbiologist, is currently a Professor Emeritus at the University of Michigan, where he served most recently as Vice President for Research.

## SELMAN A. WAKSMAN (1888 – 1973)

Selman Abraham Waksman, whose insights and discoveries had so profound an effect on the well-being of people around the world, was born of Jewish parents in the village of Novaya Priluka, Russia (now the Ukraine), on July 22, 1888. His childhood experience with anti-Semitism and with the abortive revolution of 1905 convinced him that he could not fulfill his dreams or realize his potential in Czarist Russia.

Waksman emigrated to the United States in 1910, settling in Metuchen, New Jersey. In 1915 he graduated Phi Beta Kappa from Rutgers University. The next year, he became a U.S. citizen and received his M.S. degree in agriculture from Rutgers. His crucial decision to enter an agricultural rather than a medical course was guided by Dr. Jacob G. Lipman, a bacteriologist who was dean of the College of Agriculture and himself an immigrant from Russia. Courses in bacteriology with Lipman and summer projects with Dr. Byron D. Halsted, a plant nutritionist and geneticist, helped to define Waksman's future career. He carried out his master's project at the New Jersey Agricultural Experiment Station, the institution where he spent essentially his entire scientific life, studying soil fungi and especially soil actinomycetes, organisms almost entirely neglected by others that became a mainstay of his subsequent work. His first public presentation, with R. E. Curtis, another graduate student was "Bacteria, Actinomycetes, and Fungi of the Soil," to the Society of American Bacteriologists (later to become the ASM) at Urbana, Illinois in December 1915.

Waksman obtained a Ph.D. in biochemistry in two years, working with T. Brailsford Robertson at the University of California at Berkeley, and returned to Rutgers in 1918 as a lecturer in soil microbiology. He married his childhood sweetheart, Bertha Deborah Mitnik (Bobili), on 4 August 1916. She went with him to California and they returned to live, first in New York, then in New Brunswick, N.J. close to Rutgers. Their only child, Byron Halsted, was born 15 September, 1919.

When Waksman began work in his own laboratory, microorganisms were of known importance in medicine as causes of disease, in public health in connection with sanitation problems such as water purification, in traditional food processing (making of bread, cheese, wine, beer and vinegar). They were responsible for food spoilage and, on a larger scale, for degradation of all animal and plant remains, returning the fundamental building blocks carbon, nitrogen and oxygen to the air and soil in the great cycles of Nature. They were yet to show their value in industrial production of vitamins, enzymes and antibiotics.

The first phase of Waksman's research dealt with the extension of his work on actinomycetes and with organisms involved in sulfur oxidation, carried out with Jacob S. Joffe and later continued with Robert L. Starkey, who became a lifelong associate and friend. He regarded the isolation of *Thiobacillus thiooxidans* (Waksman and Joffe, 1922) as his most important scientific discovery before the antibiotics. In his later work, he was aided by a growing and ever-changing group of graduate students and postdoctoral fellows.

Waksman traveled widely in the 1920's and 1930's and carried out systematic studies of peat bogs and composts throughout the United States, Europe and the Middle East. He became an

adviser on the commercial development of composts, particularly for mushroom growers. He developed a consultative relationship with many industrial concerns that produced enzymes, vitamins and other products from fungal and bacterial sources. He was thus a forerunner of the entrepreneurs in today's highly developed biotechnology industry.

In 1931, Waksman developed a laboratory for the study of marine microbiology at the Oceanographic Institute in Woods Hole, Massachusetts, where he and some of his students worked each summer over the next twelve years. His work on protecting ship bottoms against fouling, in collaboration with the U.S. Navy represented a significant contribution to the U.S. war effort. Waksman served as chairman of the War Committee on Bacteriology, under the aegis of the Society of American Bacteriologists, and was elected president of this society in 1941.

In 1939 Waksman and his colleagues undertook a systematic effort to identify soil organisms producing soluble substances that might be useful in the control of infectious diseases, what are now known as antibiotics. Waksman was stimulated to initiate this program by the discovery of tyrothricin by his former student René Dubos. His own profound knowledge of all classes of soil microbes, the actinomycetes in particular, made such a move almost inevitable, and the growing threat of World War II provided an additional rationale for his involvement. He developed simple screening techniques and, guiding graduate students and postdoctoral fellows, applied these to a variety of samples of soil and other natural materials. Within a decade ten antibiotics were isolated and characterized, three of them with important clinical applications: actinomycin in 1940, streptomycin in 1944 and neomycin in 1949. Eighteen antibiotics were discovered under his general direction.

Waksman was an extraordinary scholar and bibliophile. He was author or co-author of over 400 scientific papers and various obituaries and reviews, as well as twenty-eight books. His most notable books include *Enzymes* (1924), with W. C. Davison; *Principles of Soil Microbiology* (1927); *The Soil and the Microbe* (1931) with R. L. Starkey; *Humus* (1936); *Microbial Antagonisms and Antibiotic Substances* (1945); *My Life With the Microbes*, and autobiography (1954); *The Conquest of Tuberculosis* (1965); and the posthumous *The Antibiotic Era*. His scholarship as a scientist and teacher was embodied in a massive compendium, the second edition of his *Principles of Soil Microbiology*, published in 1932. This book, refused by many publishers who could not believe that it had a market, became a best-seller and dominated the field for several decades. He later wrote biographies of two of his scientific heroes: Winogradsky, a lifelong friend he regarded as the true founder of soil microbiology (1953) and W.M.W. Haffkine, a Jewish scientist whose contributions some decades earlier were turned into tragedy by bigotry and persecution (1964).

The many awards and honors that were showered on Waksman after 1940 culminated in the Nobel Prize and the Star of the Rising Sun, bestowed on him by the emperor of Japan in 1952. Other notable honors included membership in the U.S. National Academy of Sciences; the Legion of Honor (Commander) of France, the Order of the Southern Cross (Commendatore) of Brazil; the Grand Cross of Public Health of Spain; corresponding membership (later foreign associate) of the French Academy of Sciences; the Lasker Award; the Amory Award of the American Academy of Arts and Sciences; and the Trudeau Medal of the National Tuberculosis Association (U.S.).

Selman Waksman died in 1973 and is buried in the local churchyard in Woods Hole where many of his scientific peers also lie.

## ORGANIZATION AND EARLY HISTORY OF THE FOUNDATION

The creation of the Foundation for Microbiology is best introduced in the Founder's own words:

During the nearly half century that I have been concerned with the study of microbes, first those of the soil, then of the sea and finally their utilization in the treatment of infectious diseases, I have experienced on several occasions the great lack of funds for the publication of certain monographs that had only limited appeal. There were no foundations or societies to which one could appeal for such assistance. Two illustrations will suffice.

When I completed, in 1919, my first extensive series of studies on the actinomycetes and submitted the final report for publication, it was accepted by the journal *Soil Science*. Although nearly two full issues of the journal were devoted to this monograph, the publication of six colored plates that would have contributed greatly to the recognition of some of the newly described species was refused. The publishers requested an additional sum to make this possible. Neither my department nor the University was in a position to supply such additional funds. These plates remain unpublished to this day.

In 1938, I paid my last prewar visit to the venerable microbiologist Sergei Nikolaievitch Winogradsky, who had reached at the time the age of 82. He was still actively engaged in certain scientific studies of soil bacteria at his laboratory, Brie Comte Robert, which served as a designated branch of the Pasteur Institute. He complained to me that his scientific work of more than 59 years duration would remain uncollected and unpublished.

"Who will do it?" he asked. "I am an emigrant of my own country [Russia], I am a guest of a foreign country [France], I have no former students. All my work has been published in Russian, French and German. It has to be collected and translated. Who will attend to it all?" I urged him to organize and translate his work himself, and that when the time came for publication it would somehow be managed.

Since that conversation with Winogradsky, eight years passed before I came again to Paris to visit him. He was then 90 years old. He had accomplished the task in spite of the difficult war years. He was now anxious to see his collected work published. He discussed it with the Director of the Pasteur Institute and with Masson & Cie., the publishers. They were willing to undertake the task, but a subsidy was required. More than that, the paper itself was lacking. I promised to see what could be done. I returned home and discussed this matter with various organizations that could supply the required paper. Finally, the National Academy of Sciences offered to help with the required supply of paper, but no financial subsidy.

I went again to Paris in 1947 to make the final arrangements for the publication in French, *A Half Century of Soil Microbiology* by S. N. Winogradsky. Meanwhile, streptomycin royalties began to accumulate. The first assignment to me made by the Trustees of Rutgers University was used as a subsidy to Masson & Cie. to publish the comprehensive volume. What greater satisfaction could there have been than the smile on the face of the old scientist to live long enough to see his work in print. Winogradsky convinced me of the nature of the Foundation to be established.

On June 11, 1951, I addressed the following letter to Dr. René J. Dubos of the Rockefeller Institute and Dr. Harry Eagle of the National Institutes of Health:

"I am planning to turn over certain funds coming to me from the Rutgers Research and Endowment Foundation, derived from royalties on the manufacture

Of streptomycin and other antibiotics, toward the establishment of a Foundation for Microbiology...I would like to have you join me in forming a Board of Trustees which is to us to incorporate this Foundation. This Foundation need not be limited to the funds which I am personally planning to turn over to it.”

Both Dr. Dubos and Dr. Eagle agreed to serve as Trustees for the purpose of Incorporation of the Foundation for Microbiology.

*Selman A. Waksman, 1961*

The actual assignment of moneys between Dr. Waksman and the Foundation was dated 17 August, 1951, and the first meeting of its Trustees was held on 7 November, 1951 at 2:00 p.m. in the offices of R.E. and A.D. Watson, Esqs., New Brunswick, N.J. Selman A. Waksman was chosen as President, René Dubos as Vice President and Harry Eagle as an additional Trustee. Mr. Van Wie Ingham of the New Jersey Agricultural Experiment Station and Mr. A. Dudley Watson were asked to serve as Secretary and Treasurer respectively.

Deborah Waksman replaced Van Wie Ingham as a member in 1954 and, over the succeeding years, many additional distinguished scientists have served as member and Trustees. Byron H. Waksman of Yale University was elected President in 1970, and the Foundation's office was accordingly moved to Yale University at the time of Selman A. Waksman's death in the summer of 1973. Other changes in the roster of Foundation Officers are described below.

On November 30, 1964, the Internal Revenue Service of the U.S. Treasury Department ruled that the Foundation for Microbiology was exempt from federal income tax as an organization operating exclusively for charitable, scientific and educational purposes.

In the first discussions among the Trustees as to the purposes of the Foundation and the type of research in microbiology to be supported, it was decided that the Foundation should not try to operate in those areas covered by existing sources of support, but rather in areas where little or no funding was available. In particular, support of individual research projects was not felt to be feasible, by reason of the limited funds available, the absence of a mechanism for evaluating large numbers of applications, and the fact that other sources for substantial grants-in-aid were not lacking in the United States.

The thrust of Foundation granting for a decade was in support of publications. However, by 19y65, the emphasis had shifted appreciably. “The granting agencies of the U.S. Government are now permitting the use of some of their funds for publication purposes; therefore few requests are being submitted for the publication of important manuscripts in the field of microbiology. For this reason, the Trustees have decided to use some of the available funds for the support of certain laboratories doing important research work in microbiology, but not necessarily for the support of specific projects. Such support will carry them through a crucial period, and may be considered as “seed” money. The Cold Spring Harbor laboratory in Long Island, and the Laboratory for General and Industrial Microbiology at the Technion in Israel were the first laboratories selected for this purpose.

Further shifts in granting policy are detailed below. The overarching theme has been to support projects/programs that benefit Society as a whole rather than a single individual. The Foundation has addressed successively the problems of communication between scientists by support of journals, publications, lectureships and meetings; the education and training of young scientists by support of courses, fellowships, graduate student travel; and the use of

contemporary communication between scientists and the public with programs to improve the reporting of science in the media and to improve K-12 science teaching; finally the status of microbiology among the sciences by underwriting prestigious prizes for accomplishment in microbiologic research and teaching.

## OFFICERS AND TRUSTEES

A number of America's leading scientists have served as Foundation Trustees over the years. From the start, they included representatives of the principal subdisciplines of microbiology. The size of the Board of Trustees has increased and its membership has changed over the years to reflect the continuing evolution of the field. A rotation policy was instituted in 1975 to facilitate the process of change.

Broad policies laid down by the Board have been carried out by the President in his role as the Foundation's chief administrator. Each President has worked in close consultation with the other officers. In 1993, the Trustees established a new position: Chairman of the Board of Trustees. The first incumbent was Dr. Alice S. Huang, at the time, Dean for Science at New York University. Byron H. Waksman assumed that title when he stepped down from the Presidency in 2001. It is now held by Nan Waksman Schanbacher, Selman's granddaughter, who is also the Vice President of the Foundation.

Over the years, the Board has been served by various committees of Trustees: a *Planning Committee* chaired by Dr. Keith Bostian; a *Committee on Computerized Teaching in Microbiology* chaired by Dr. Alice Huang; a *Committee on K-12 Education*; co-chaired by Dr. Byron Waksman and Nan Schanbacher from 1997 to 2000 and by Mrs. Schanbacher alone until 2006. This committee was assisted by a *Working Group* made up of K-12 science teachers, microbiologists, and administrators who reviewed applications in education and made recommendations to the Board. In 2003 the Board established a permanent *Finance Committee*; and in 2006 created a *New Projects Committee*, chaired by Dr. Byron Waksman.

### **Past and Present Officers**

#### **President**

Selman A. Waksman (1951-69), Byron H. Waksman (1970-2000),  
Frederick C. Neidhardt (2001-present)

#### **Vice President**

Rene J. Dubos (1951-59), Byron H. Waksman (1968-69;  
2001-present), Alice Huang (1988-92), Nan Schanbacher (1993-present)

#### **Secretary**

Van Wie Ingham (1951-54), R. Edward Townsend (1988-present)

#### **Treasurer**

A. Dudley Watson (1951-54), Nan Schanbacher (1988-92), Keith A.  
Bostian (1993-present)

## **Secretary-Treasurer**

A. Dudley Watson (1954-69), Selman A. Waksman (1970-73),  
Harry Eagle (1974-81), Harlyn O. Halvorson (1981-87)

## **Counsel**

A. Dudley Watson (1951-73), Max H. Schwartz (1973-81), R. Edward  
Townsend (1981-present)

## **Past and Present Trustees**

Selman A. Waksman (1951-73);  
Rene J. Dubos (1951-59);  
Harry Eagle (1951-81);  
Deborah B. Waksman (1957-74);  
William J. Robbins (1957-69);  
Rollin D. Hotchkiss (1959-82);  
Kenneth V. Thimann (1960-91);  
Byron H. Waksman (1968-present);  
Harlon O. Halvorson (1972-87, 1993-96);  
A. Dudley Watson (1973-84);  
Arthur Pardee (1974-84);  
Bruce Alberts (1975-77);  
P. Roy Vagelos (1977-81);  
Edward A. Adelberg (1981-88);  
J. Oliver Lampen (1981-90);  
Herman Eisen (1982-88);  
Arnold L. Demain (1985-92);  
Alice S. Huang (1985-present);  
Nan Waksman Schanbacher (1985-present);  
Keith A. Bostian (1988-present);  
Jean E. Brenchley (1988-95);  
Jonathon G. Seidman (1988-95);  
Sherwood L. Gorbach (1990-2002);  
Betty H. Olson (1991-96);  
Harold Amos (1992-96);  
Peter Waksman (1992-present);  
John A. Breznak (1996-present);  
Barbara H. Iglewski (1996-present);  
Frederick C. Neidhardt (1996-present);  
Moselio Schaechter (2000-present);  
Amy Cheng Vollmer (2001-present)  
Cynthia Needham (2006 – present)  
Graham C. Walker (2006 – present)

## **FINANCES**

### **Current Foundation Information**

The Waksman Foundation for Microbiology is a private, family foundation (EIN: 226057913) incorporated in the State of New Jersey.

#### **• Financial Information (Year Ended 12/31/05)**

Assets (12/31/05): \$1,254,300 (Estimated Market Value)  
Expenditures, excluding grants and contributions: \$41,262  
Grants and contributions: \$88,376

No. of Grants: 15  
Largest Grant: \$18,000  
Smallest Grant: \$200

## GRANTS

The Foundation's early grants (15 out of 19 applications in the first 10 years) funded a variety of publications for which support could not easily be obtained from other sources. These included symposium proceedings, books, monographs, and translations and covered a wide variety of topics (e.g. a New York Academy of Sciences symposium on *The Effects of ACTH and Cortisone on Infection and Resistance*) to more basic areas of the field, with an especial emphasis on unusual groups of microorganisms (e.g. a monograph on *Cercospora*), taxonomy and systematics. Other early grants supported travel (e.g. of Hans Krebs to a symposium on *Metabolism and Infection* at the N.Y. Academy of Medicine), a fellowship for a visiting scientist (J. Marmur) at the Institute of Microbiology of Rutgers University, and an institutional grant to the Hebrew University of Jerusalem.

For a brief period, after 1960, a number of grants were made to help microbiological societies, such as the Theobald Smith Society, the Association of Microbiologists for Latin America, the International Association of Microbiological Societies, the National Tuberculosis Association, the American Society for Microbiology (ASM), and the American Institute for Biological Sciences, or to support lectureships offered by MIT, NYU, Sigma Xi, and the ASM. This somewhat random allocation of funds to support societies and lectureships was soon abandoned in favor of more focused support channeled through a single society, the ASM, as described below. Support of publications continues, however, to the present day at a level of no more than one or two grants per year.

Foundation granting, in the next period, emphasized the fulfilling of departmental/facilities/equipment needs in a few favored institutions. Between 1957 and 1972, the Hebrew University in Jerusalem received grants (totaling \$22,000) to support development of a department of microbiology, and the Technion in Haifa, \$15,000 for development of a laboratory of industrial microbiology (actinomycetes). A grant to the Institute of Microbiology at Rutgers in 1962 provided \$5,000 towards construction of an animal facility. Between 1964 and 1974, the Foundation gave substantial support (\$45,000) to the Cold Spring Harbor Laboratory. Smaller grants were made, over several years, to the W. Alton Jones Cell Science Center, The American Type Culture Collection, the Jenner Fund, the Biology Department of Spelman College, the Dana Farber Institute, and Ben Gurion University.

More recent facilities grants have been limited to those which might be expected to play a significant role in enhancing the level and quality of microbiological science in developing countries. The Pan-American Health and Education Foundation received grants totaling \$83,500 over 11 years (1975-86), both for facilities (e.g. purchase of microscopes for veterinary schools throughout Central and South America) and for technology transfer (e.g. a course in hybridoma technology in Sa Paulo in 1986).

The MIRCEN (Microbiological Resource Center) developed in 1983 under the aegis of UNESCO/UNEP/ICRO at Bambey, Senegal, also received Foundation help. The function of this center, directed by Mamadou Gueye, has been to develop, maintain and distribute cultures of mycorrhizal strains (N-fixing organisms) particularly suited for use in the Sahel (actually a 6-state area, including Senegal, Cote d'Ivoire, Mali, Sierra Leone, Togo and Nigeria); also to organize regional reunions of interested officials and scientists. The Foundation underwrote the

expenses of a consulting microbiologist (L. Bordeleau, a francophone Canadian), who visited the center and monitored its activities on a continuing basis between 1983 and 1988 (\$16,500). Foundation support was mediated (politically and otherwise) by J. Gritzner at the NAS/National Research Council. The program was judged to be partially successful, in spite of the massive political and other problems besetting the region, among them population pressure, destruction of vegetation, and progressive impoverishment of the soil.

The Foundation's support of the ASM's Latin-American Visiting Professorships Program between 1971 and 1991 and of the Downs International Fellowships (Yale University), starting in 1981 (both discussed below), have been additional important contributions to the teaching and application of microbiological sciences in the Third World.

The Foundation, with a series of grants between 1964 and 1980, established the funding base for the national Academy of Sciences' Selman A. Waksman Award in Microbiology, a medal and cash prize presented every two years in recognition of excellence in microbiologic research. Twenty years later, a similar award was established, also with Foundation funding, by the Society for Industrial Microbiology to recognize excellence in the Teaching of microbiology: the Waksman Outstanding Teaching Award, presented at the Society's Annual Meeting in alternate years.

An important new granting policy was introduced in 1963 with the Trustees' decision to initiate and support a long-term program through the ASM, the Foundation for Microbiology Lectureships, which would pay the travel and local expenses of speakers at annual meetings of the Society's local branches (initially one speaker a year). The speakers would be chosen from a panel of highly regarded investigators provided by the national office of the ASM. The grant, which in 1963 was \$4,000, rose to \$20,000 annually by the mid-80's. This program, which is still active in 1995, has proven to be a highly effective means of communicating "cutting-edge" science to working microbiologists country-wide (the ASM's current membership is over 40,000) and of strengthening the relationship between this working population and the Society's administration. At the same time it showed the advantages of a cooperative partnership between the Foundation and the ASM, in which ideas originating on either side could, if approved in principle by the Foundation's Trustees, be put into effect by the ASM and its committees of working scientists.

The FM Lectureships paved the way for other programs funded by the Foundation and implemented by the ASM. The Latin-American Professorships Program, started in 1971, provided funding for microbiologists planning trips to Latin America, who were prepared to spend 1-4 weeks teaching and/or conducting research in selected academic institutions. The LAPP budget, in an average year, was \$6,000. The program was managed by a devoted committee of ASM scientists, in close cooperation with the Organization of American States. The program was recently suspended, as a result of illness among the scientist members of the responsible committee. The Foundation has been unsuccessful in implementing a similar visiting professorship mechanism for Africa or SE Asia, though this purpose is fulfilled in some measure by the Downs Fellowships program at Yale.

The support provided initially for an ASM Predoctoral Fellowships program was transferred in 1980 to a new program for Minority Fellows, with an annual budget of \$10,000. This initiative at the predoctoral level paralleled other efforts to support promising students from minority groups at the college level, e.g. the MARC program (governmental) and programs of the

Danforth and other private foundations and of certain pharmaceutical companies like Merck. The ASM program was fully funded from other sources by 1988,

The ASM was one of the first scientific societies to appoint Congressional Fellows, stating in 1977 (Cathy Reed, working with Congressman David Obey). This program, initially funded by the Foundation at an annual level of \$10,000, was successful in attracting funding from other sources within three years.

Between 1976 and 1993, Foundation grants permitted the ASM to provide \$400 (later \$600) grants to departments with graduate programs but lacking conventional training grant support. This amount could be used to help one or more graduate students travel to scientific meetings, usually the Annual Meeting of the ASM. The grant (initially \$4,800) was awarded each year to 12 departments randomly selected among 300-odd qualifying departments. The program was highly successful and was able to obtain complete funding from other sources in due course.

The ASM has received a number of smaller grants from the Foundation over the years for specific projects, such for example as development of an examination and certification procedure under the American Board of Medical Laboratory Immunology, small contributions to the ASM's Science Education Fund, and "institutional" contributions. Possible new long-term cooperative projects are being explored, among them a Student Journalism honors Program, funded at a level of \$6,000 in 1994-5.

The Foundation's expenditures through the ASM have totaled more than \$900,000 over the 30 years since the first cooperative project began. During much of the last decade, the ASM contribution has approximated half of the Foundation's total granting in a given year.

The Foundation moved next to develop a cooperative relationship with the Marine Biological Laboratory (MBL) in Woods Hole, Massachusetts, a world center of research and instruction in fundamental aspects of biology. A course in Microbial Ecology, started at the MBL by Holger Jannusch in 1971 with NSF support, was provided with continuation funding by the Foundation in 1975. After a 3-year trial period, the course became established as one of the MBL's core summer course offerings, carrying the name Microbial Diversity, with continuing Foundation support till the present. The annual cost to the Foundation has varied between \$10,000 and \$19,000, the total over 20 years amounting to close to \$300,000. This course, directed by a series of outstanding microbiologists, is widely regarded as the intellectual heir to general microbiologic concepts propounded in the early part of the century by Martinus Willem Beijerinck and his successors, Albert Jan Kluyver and Cornelius B. van Niel. It is in many ways a worthy extension of the latter's famous summer microbiology course offered at the Hopkins Marine Station in Pacific Grove, California in the 1940's, 50's, and 60's. It incorporates a sense of the history of microbiology, the origin of important ideas, and many extraordinary, even "thrilling" aspects of the field. Because of the financial crunch affecting university departments, this has become one of the few remaining places where microbiology is really taught in the United States.

The Foundation has worked in partnership with the MBL to develop other innovative programs, discussed below, notably a Science Writing Fellowships Program (19680present) and a week-long microbiology workshop for regional middle and high school science teachers, beginning in 1995.

An attempt was made in 1978 and 1981 to develop a course in Microbial Ecology, similar to that at the MBL, at the Wetlands Institute of Lehigh University, in Stone Harbor, N.J. The attempt elicited limited student interest and was abandoned. Similarly, a course in Clinical Tropical Medicine, offered in 1992 by Louisiana State University in Costa Rica proved to be a short-lived effort.

Fellowships, of course represent the obverse of courses. While the Trustees proclaimed as early as 1970 that the Foundation's resources were too limited to permit funding of conventional research grants or travel awards, the fellowship theme has been revisited repeatedly. Predoctoral Fellowships were offered, as we have seen, through the ASM between 1973 and 1978, but these were "converted" into Minority Fellowships from 1989 to 1987. A small number of conventional Postdoctoral Fellowships were offered through the Rutgers Institute of Microbiology at various times in the 1960's and 1970's.

A Minority Postdoctoral Fellowship in Tropical Disease Research, administered by the national Foundation for Infectious Diseases and funded jointly by the Rockefeller Foundation and the Foundation for Microbiology between 1982 and 1993 (total outlay \$112,333), proved to be a valuable and effective contribution. The Fellows trained included young black and Hispanic scientists and a few from the Pacific Islands.

Even more durable has been the program of Downs Travel Fellowships in International Health conducted by Yale University with Foundation funding since 1981 (total to date \$84,000). This program actually dates from 1963 and was supported in its early phase with Rockefeller Foundation money and private donations. With matching funds provided by Yale, this program has been successful in sending M.D., M.P.H., Ph.D. and nursing students in substantial numbers to carry out carefully supervised research on basic or clinical microbiological Topics, each for one to three months in a developing (usually tropical) country. Projects have ranged from molecular biologic studies of parasite epidemiology to aspects of public health policy. A high proportion of participating students, on follow-up, are found to have moved into careers determined in a significant degree by this experience, i.e. in public health or international health.

Communication among working scientists, whether about their science, their teaching methods, or their publication and funding problems, has always seemed an area worthy of Foundation support. Some of the earliest Foundation grants indirectly supported meetings and such support has been a constant theme of Foundation granting over the 45 years of its existence. However, the rapid increase in the number of meetings, workshops and symposia in the 70's and 80's, combined with increased fund-raising efforts on the part of the Gordon, FASEB and Keystone conferences, the New York Academy of Sciences, international associations such as the international Union of Immunological Societies, and the Cold Spring Harbor Laboratory, as well as the more traditional initiatives of individual scientists and university departments, resulted in an intolerable pressure on this segment of Foundation funding. In the late 80's, the Foundation began to restrict its support to non-recurrent meetings with demonstrable national or international impact. The size of individual grants diminished to token levels, e.g. \$1,000 or less. The "monster" of meeting support grew in spite of these measures: 5-year expenditures in support of meetings were \$60,000 and \$80,000 between 1981 and 1990! In 1994, the Trustees reluctantly agreed that this aspect of scientific funding was no longer within the Foundation's means and all meeting support was stopped.

In the last decade, scientists have become increasingly concerned with the apparent lack of science literacy of the public. The Foundation has responded to this concern at several levels.

First has been systematic and continued support of an MBL initiative (the Science Writing Fellowships Program) that provides hands-on laboratory experience for science journalists, from all branches of the media and all parts of the U.S., for periods of up to 8 weeks. This program, initiated in 1986 with a seed money grant (\$3,000) from the Foundation, has “trained” over 100 journalists in 10 years. It has become a respected component of the MBL’s summer activities, is known throughout the journalistic community, and is supported by more than a dozen biomedical and scientific societies and by several major journalistic foundations. The Foundation contribution over this 10-year period has been a modest \$50,000 in a total budget of over \$550,000 for the same period.

An unanticipated dividend of the Foundation’s support for the MBL’s SWFP has been the creation of a comparable program for European science journalists, the European Initiative for Communicators of Science (EICOS), under the aegis of the Max Planck Society at the two Max Planck Institutes (Biochemistry and Psychiatry (Fundamental Division)) in Martinsried, near Munich. This program, with sponsorship from the European Community, the European Science Foundation and the European Union of Science Journalists’ Associations, “trained” 30 journalists from over a dozen European countries in its first 3 years (1993-95). Dr. Byron Waksman, who served as Director of the SWFP in Woods Hole during the period 1990-95, played a key role in the creation of EICOS, while visiting Martinsried as a Humbolt Professor during 1991 and 1992.

Second has been support of SIPI (the Scientists’ Institute for Public Information) initiatives directed to “media gatekeepers,” in particular TV news directors. The Foundation contributed \$42,000 between 1985 and 1991 toward support of a series of programs entitled Seminars for Media Gatekeepers and TV News: The Cutting Edge.

Third was the attempt to facilitate computer-based teaching of microbial genetics to college undergraduates initiated by J. Jungck of Beloit College. The Foundation provided seed money (\$29,400 in 1986-88 for this effort, which has now evolved into Bioquest, a library of college-level software teaching modules covering a wide range of topics in biology and medicine, adapted for both IBM and Mac computers. In October 1992, Bioquest received the EDUCOM “Distinguished Natural Sciences Curriculum Innovation (Biology)” award.

Fourth, the Foundation has provided support for a series of local initiatives concerned with enhancing the quality of science teaching at the high school/middle school level. Unfortunately, most of these have been scattered in time and place and short-lived. Examples include a Summer Program in Biochemistry for High Ability Secondary Schools Students at the Loomis-Chaffee School in Windsor, CT (\$5,000 in 1980); Applied Laboratory Experiments in Microbiology, directed by J.E. Frey (Mankato State University) to high school students in several Midwestern states (\$15,000 in 1985); Microbe Hunters, a summer program for high school students, run by M. Matties of SUNY Binghamton (\$4,000 in 1988-91); Connecticut Young Science Scholars at Choate-Rosemary Hall (\$2,000 in 1989); grants to the Children’s School of Science in Woods Hole, MA (\$10,000 in 1992 and 1994) to develop one or more microbiology courses. The ASM’s Student Journalism Honors Award, also supported by the Foundation, is another venture in the same field.

A different approach is exemplified by the Microcosmos Project, developed by D. Zook of the Boston University School of Education (\$12,000 in 1977 and 1978, \$13,000 in 1993). Unlike the programs mentioned above, Microcosmos is directed to middle and high school teachers (and more recently, grade school and college teachers) from all over the U.S. A series of simple

microbiology exercises, field-tested by participating teachers in a series of training workshops, are now embodied in a widely used laboratory manual, *The Microcosmos Curriculum guide to Exploring Microbial Space*. the teacher workshops are continuing and replicating themselves, both countrywide and abroad. The Foundation, in 1995, is supporting a further venture in the same area, a regional “teacher enhancement” workshop at the MBL entitled, Living in the Microbial World which, if things go well, will be repeated annually.

The Foundation’s grants program has not been selective among the subdisciplines of microbiology. The Foundation for Microbiology Lectures, the single most important program, both in terms of cost to the Foundation and influence on the scientific community over the long-term, has always provided lecturers covering a wide range of active areas of microbiologic research. Thus the 50 participating Lecturers in 1994-95 address topics related to infectious disease, clinical laboratory diagnosis, pollution and bioremediation, microbial diversity, agriculture, even new educational strategies (school and college). The Microbial Diversity course at the MBL, on the other hand, emphasizes fundamental aspects of microbiology. Programs directed to developing areas of the world have tended to emphasize medical and veterinary, but also agricultural issues, while the LAPP program has been concerned with all aspects of the field, from the most basic to the applied.

## EPILOGUE

The public view of microbiology inevitably tends to be dominated by the small number of species that cause disease. In the last two decades, we have had to face Legionnaire's disease, AIDS, the toxic shock syndrome, *Helicobacter* species as the cause of gastric ulcer (and perhaps gastric carcinoma), and now the threat of old organisms that have become resistant to all our drugs and antibiotics, the most notable example being tuberculosis. One must remind oneself that there is a lot more to the microbial world than the diseases a few of them cause:

Microorganisms have the greatest diversity of all living creatures.

Microorganisms, though invisible, represent the single largest mass of living matter on earth.

Microorganisms were the first life forms on earth.

All present-day life is descended from microorganisms. It is literally true that humans have evolved from bacteria.

Life could not exist on earth today without continuing interactions with microorganisms. They live on us, in us and around us in countless billions. They are the basis of the food web. They maintain the biosphere. The earth without microbes would be totally barren and lifeless like Mars.

(With thanks to the American Society for Microbiology, 1995)

*“...out of the Earth shall come thy Salvation...”*

Selman A. Waksman