William D. McElroy, President-Elect

Louis Levin

Few will deny that the nation is confronted by a broad spectrum of problems, many of them science-related, and it is urgent for the scientific community to find its most effective role in contributing to the solution of such problems. At such a time, the leaders of the scientific community should have a realistic understanding of the societal potential of science, should be dedicated to the proposition that society should benefit from science and technology to the maximum extent possible, and should be able to serve as effective spokesmen for the scientific community in its dialogue with the general public and its representatives in government. William D. McElroy, the current president-elect of the American Association for the Advancement of Science, fulfills these specifications. As a researcher, educator, administrator, and communicator, and as an intermediary between the scientific community and society, he has served science and the nation successfully. Although his primary research interests have been in the field of modern molecular biology, he has also participated effectively in a broad spectrum of other scientific activities. Endowed with energy, enthusiasm, and curiosity, McElroy has had several careers, including research and teaching, scientific authorship and editing, governmental and academic administration, governance within the scientific community, participation in the affairs of civic and public organizations, and promotion of science to the general public as well as to the scientific community itself.

Education and Maturation

In a classical study of the origins of American scientists, Robert Knapp and Hubert Goodrich found that a large proportion had their beginnings in rural or semirural settings. This was the case with McElroy, who was born in January 1917 on a small farm near the tiny community of Rogers in central Texas. The family later moved to McAllen, far south in Texas, where he completed his high school studies and played football on the school team, becoming captain during his senior year. Graduating in 1935, and fortified with an award of $100 from a local service organization, he hitchhiked to California to enroll at Pasadena Community College, then well known for the quality of its academic programs as well as its athletic activities. McElroy took advantage of both and, at the end of his 2 years there, had achieved not only an abiding interest in science but also recognition as an outstanding athlete, being named right end on the All Junior College team for that year. No doubt his experiences at Pasadena contributed to his continued interest in the role of junior colleges, exemplified by his devoted service, from 1958 to 1969, first as a member of the Baltimore Board of School Commissioners and chairman of its subcommittee for the Baltimore Junior College and later as the first chairman of the board of the college. His work on behalf of junior colleges was honored in 1971, when he was named Distinguished Junior College Alumnus by the California Junior College Association.

On graduation from Pasadena in 1937, McElroy enrolled at Stanford University to complete his undergraduate work. There he came under the tutelage of C. V. Van Niel, Lawrence Blinks, George Beadle, and their colleagues. From Van Niel, the famed teacher of microbial biochemistry, he first learned about the role of adenosine triphosphate (ATP) and was introduced to bioluminescence, two phenomena that later were to play a central role in his major researches. Working with Blinks on an undergraduate research project, he learned of the excitement of original research. And by Beadle, who later received the Nobel Prize, McElroy was introduced to genetics, the second major area of his subsequent research. He also continued to play football at Stanford, as first-string end, during both of his years there. Many years later, from 1970 to 1973, he had the satisfaction of serving the Stanford athletics program again, this time as a member of its University Athletic Board and in 1973, he was presented the Distinguished Service Award of the Athletic Board.

Granted a bachelor's degree by Stanford in 1939, McElroy enrolled at Reed College, where he received a master's degree in biology in 1941. Under the eye of L. E. Griffin, he was indoctrinated into the broad aspects of biology. Here he also engaged in his first formal teaching, developing and teaching a course in genetics, a significant feat for a first-year graduate student. He continued his interest in football as line coach for the Reed team. Although at Reed it was usually difficult to find enough players to field a team of 11, that year the team won all of its four games. It was at Reed, also, that McElroy met and married Nella Winch, an undergraduate student. They had four children, now all adults.

McElroy next moved to Princeton University where he acquired his lifelong interest in bioluminescence from E. Newton Harvey, an authority in the field. Awarded the Ph.D. in biology in 1943 for a thesis on the mechanism of action of narcotics, he continued his association with Harvey for two additional years, working on an Office of Scientific Research and Development project related to gas bubble formation and "the bends." McElroy found time during this period to conduct his first actual research on the mechanism of bioluminescence, publishing (with R. Ballentine) a paper under that title in 1944.

Research and Teaching

In 1946, after a 1-year return to Stanford as a National Research Council postdoctoral fellow, McElroy accepted an instructorship in biology at Johns Hopkins University, an institution to which he devoted the following 23 years. There he soon returned to his studies of bioluminescence to make his most important research contributions, through which he and his students

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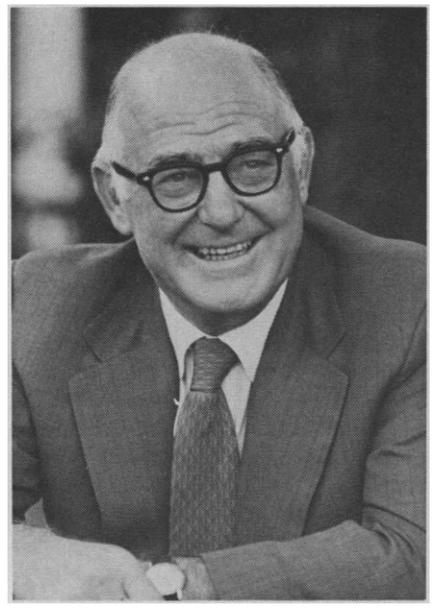
elucidated the mechanisms whereby living organisms produce light. Working initially with fireflies, they demonstrated that the previously postulated luciferin-luciferase reaction depends on activation of the substrate, luciferin, by ATP, whereby it is converted to luciferin adenylate, thus becoming susceptible to oxidation to the excited, light-emitting stage by the enzyme luciferase. In subsequent work, he and his colleagues isolated firefly luciferin in pure form and chemically identified it, ultimately prepared it synthetically, and so fully characterized it. They also isolated the firefly enzyme luciferase in pure form and, accordingly, were able to study many details of the full light-producing reaction in chemically discrete systems.

The discovery that firefly luminescence is dependent on ATP (it was later shown to be the only bioluminescent system so dependent) was of fundamental biological and biochemical significance. In addition, because the luminescent reaction provides the most sensitive known assay for ATP, it has had wide ramifications for other areas of biology and medicine, being applied to studies of life in space, muscle and cell kinetics, medical diagnosis of bacterial infection, cardiac infarcts, and even to bacterial studies in sewage systems. In recognition of the significance of his bioluminescence work, in 1964 McElroy was awarded the Rumford Prize of the American Academy of Arts and Sciences.

The Hopkins group also conducted many biochemical and genetic studies of microorganisms, including luminescent organisms and *Neurospora*. These studies included the application of rate theory to gene mutations, gene recombination, occurrence of intermediates during mutation, various types of metabolic mutants, and so forth. The excellence of these investigations was formally recognized when the American Society of Bacteriologists, in 1958, selected McElroy as recipient of its Barnett Cohen award.

McElroy advanced rapidly at Hopkins, achieving the rank of professor of biology in 1951 and the chairmanship of the department in 1956. In 1949 he became associated with Elmer V. McCollum in the planning and establishment of an institute for the study of the biological functions of trace metals. With McCollum's blessing, McElroy was appointed director of the institute, subsequently named the McCollum-Pratt Institute. He retained this position, as well as the biology chairmanship,



William D. McElroy

until he left Hopkins in 1969. Thus, for 20 years he directed the McCollum-Pratt Institute, and for the last 13 of these years he was simultaneously chairman of the biology department. Holding these two important administrative positions enabled him to build a very strong group of investigators and teachers, which achieved a wide reputation for its research achievements and the excellence of its instructional programs.

Scientific Communication

The directorship of the McCollum-Pratt Institute also provided McElroy with a vehicle for developing another of his major interests—scientific communication. Under his leadership, the young institute moved quickly to initiate the McCollum-Pratt symposia, which soon became world renowned. The symposia, dealing with such timely and important areas as metabolism, enzyme action, and biochemical genetics, were published in monograph form, carefully edited jointly by McElroy and Bentley Glass (a geneticist then at Hopkins), and were very favorably received. This experience led naturally into a number of successive editorial assignments for McElroy, who served the editorial boards of three major journals (*Bacteriology, General Physiology,* and *Comparative Biochemistry and Physiology*), was executive editor of *Archives of Biochemistry and Biophysics,* founded (with Howard K. Schachman of the University of California) *Biochemical and Biophysical Research Communications* and edited it for a 10-year period, and for 3 years was science editor for the publishing firm of Prentice-Hall. Under the aegis of this firm, McElroy (with Carl P. Swanson) organized and edited a series of textbooks under the general title *Foundations of Modern Biology*. The premise of this series was that the dynamic state of modern biological knowledge requires a new approach to the organization of the subject matter and its presentation in a form permitting each teacher to determine the level and structure of his particular course. The series has been well received and widely used. McElroy himself prepared the volume *Cellular Physiology and Biochemistry*, which has now been through three editions.

McElroy's interest in communication has encompassed not only that among scientists and between teacher and student but also exposition of science to the general public. As president of the American Institute of Biological Sciences (1968) he stimulated that organization to arrange an annual presentation of science—the National Biology Congress—for the general public. His concern for an enlightened public understanding of science was also exemplified later when, as director of the National Science Foundation, he worked to strengthen the NSF program dealing with this area. That this concern continues to the present time was indicated by his recent comment, when interviewed as a candidate for the office of President-Elect (quoted in the *AAAS Bulletin*, vol. 19, No. 2, June 1974), that "AAAS has a major obligation to continue to educate the American public as to what science is all about . . . most scientists should be concerned with the community in which they live. They should be prepared to interact with public officials, with the educational system, and with others . . . AAAS should facilitate this."

McElroy has served as an officer or a member on the governing boards of a rather large number of scientific organizations. Among the notable offices was the presidency of three major societies (Society of General Physiologists, American Society of Biological Chemists, and American Institute of Biological Sciences). He has served as a trustee of a variety of organizations dealing with science, education, conservation, population problems, and so forth. He has worked with all the major federal science agencies as a member of advisory panels, committees, and

councils, and has been a member of the President's Science Advisory Committee.

The breadth of McElroy's interests has taken him repeatedly beyond the boundaries of pure science. In 1962 he was asked by the National Academy of Sciences to chair a special committee on population problems, which produced two authoritative reports, one on U.S. population problems and one on growth of world population. These reports had an important impact and were among the major influences responsible for present-day U.S. government and United Nations concern about this problem. This work later led McElroy into an active role with the Planned Parenthood Association of Maryland. He has also worked, written, and spoken on problems in such areas as environment, pollution, food production, science education, and international science.

McElroy has been active in many scientific organizations, some already mentioned above. Noteworthy among these are the American Academy of Arts and Sciences, the American Philosophical Society, and the National Academy of Sciences. He was elected to the latter in 1963 and subsequently served as a member of its Council. He has received many honors and citations. Of special note, in addition to those already mentioned, are the Man of Achievement in Science Award, the President's Meritorious Award of the American Institute of Biological Sciences, the Contribution to Science Award of the Naval Electronics Laboratory, and honorary degrees from eight leading institutions across the country. He has been elected to the boards of many organizations in addition to those already noted, including Associated Universities, Inc., the Electric Power Research Institute, the Nutrition Foundation, the National Council of Christians and Jews, the President's Committee on the National Medal of Science, and several business corporations.

Administration and Scientific Statesmanship

All McElroy's varied activities contributed to the molding of a well-rounded administrative experience and to an intimate knowledge of academia, science, government, and their interrelationships. Therefore, in the spring of 1969, when the belated discovery that Franklin Long had espoused anti-ABM views caused his proposed appointment to the directorship of the National Science Foundation to founder in controversy, it was not surprising that President Nixon asked McElroy to assume the directorship. What was surprising was that the newly elected Nixon team had chosen a man who, 4 years earlier, had been overtly active in the Scientist's Committee for Johnson and Humphrey and, during Nixon's own campaign just 6 months before, had worked with the Scientists for Humphrey and Muskie movement. The scuttlebutt around Washington at the time was that the new Administration had failed to do its homework for a second time. Nevertheless, McElroy was quickly confirmed and became director of NSF in July 1969.

Although he served as director for only 2½ years of his designated 6-year term, there is no doubt that McElroy left a significant impression on NSF. From the beginning it was clear that his major ambition was to achieve much more generous federal support for scientific research. However, having been appointed to office by an Administration not overly friendly to science and seeking to hold down federal expenditures rather than increase them, he found the White House disinterested in providing more money for science and particularly for basic or "pure" science, the major area of NSF operation from the time of its inception. Most dealings with the White House had to be channeled through its Office of Management and Budget (OMB), and it is doubtful that the new director of NSF was allowed access to the President on more than one or two occasions throughout his tenure. Nevertheless, McElroy worked hard to establish rapport with OMB and with the President's science adviser (first Lee DuBridge and later Edward David) and particularly with the Congress, which appeared to be the only avenue whereby increased funding for research could be obtained. By playing a careful political game, he succeeded in increasing NSF appropriations by more than 50 percent during his tenure, from $400 million in fiscal year 1969, which ended just before he took office, to $619 million in fiscal year 1972, the year he left NSF. However, this achievement proved to be a severe test for even McElroy's flexible pragmatism, and a certain price was paid for the success. The trend at the time, in OMB and to a somewhat lesser degree in Congress, was toward greater emphasis on applied research directed toward the solution of societal problems. McElroy accepted and attempted to exploit this approach, not only because of his conviction that science has much to contribute but also because he concluded that this was the only way, during a period of increasingly hard times for basic science, to get it some additional, although indirect, support. Although some influential segments of the scientific community approved of this philosophy, others, particularly in some areas of academia, did not endorse it. On a number of occasions McElroy defended the approach. Acknowledging his dedication to basic research, he stressed the need for a balance between pure and applied research and for responsiveness to societal needs. For example, speaking at the annual meeting of the Society of Sigma Xi in 1970 he said, "Our challenge [as scientists] is to take cognizance of the emerging priorities of society and to make appropriate adjustments. It takes no great prescience to see that there will be increasing social imperatives in two pertinent directions: first, to mobilize science toward solutions of environmental and social problems; second, to subject technology to far more scrutiny as to its social consequences" (*American Scientist*, vol. 59, p. 295, May–June 1971). In consequence, although the total NSF budget rose, an increasingly larger proportion of it was assigned to applied or directed projects, with very substantial growth of the program which came to be known as RANN (Research Applied to National Needs). Several popular ongoing NSF programs had to be reduced or phased out completely and some, such as the effort in science education, had to be very considerably altered to satisfy OMB.

Another of McElroy's aspirations at NSF was to foster closer interaction between academic science and industry. He worked hard in this direction and a number of new initiatives were taken, including the offering of incentives for collaborative research between industrial and academic laboratories, for exchange of scientific personnel between them, for application of science and technology to the needs of state and local governments, and so forth. There were other changes, including modification of the science education and training programs and increased emphasis on certain large "directed" programs and on public relations aspects.

In sum, there is no doubt that the NSF changed considerably from the "pure" science image it had for its first 19 years. In part this was undoubtedly a consequence of the pressures of the times and of the perceptions of the nation's needs by the White House, OMB, and the Congress. But a large share of the responsibility was McElroy's. Although dedicated to basic research, he also appreciated the strategy of promoting the practical approach for solution of societal problems and, at the same time, securing funds for scientific research. It is apparent that the trend started then has continued and even accelerated. However one may view these changes, it remains evident that McElroy perceived the approaching events and the needs they reflected and that he successfully capitalized on them for the benefit of the nation and of science.

Academic Administration

In February 1972, McElroy resigned from the NSF directorship to become chancellor of the University of California, San Diego. Having spent his entire adult life in academia and being offered the opportunity to lead a young, high-quality institution of higher education, it is understandable that he found the opportunity irresistible. Furthermore, as he himself said, acceptance of this job took him "from the hectic environment" (of Washington politics), which he had not sought, back to an academic environment that was more compatible with his long-standing interests. In his 3 years at UCSD he has worked to balance the sciences and humanities, is overseeing an $80 million construction program, and has guided the establishment of a fourth college, a 50 percent expansion of the medical school, and the creation of several new academic departments. He has continued to strengthen the ties of the university to the San Diego community by establishing a community board of overseers, personally participating in many community civic activities, and fostering joint programs between the university and local corporations. He lives on the La Jolla cliffs overlooking the Pacific Ocean with his second wife, the former Marlene Anderegg, who is also a biochemist, and their young son Eric.

To those who know him, Bill (rarely Mac) McElroy is a vigorous, direct realist who knows and understands science and scientists and has definite ideas about their expanding potential societal roles. He is by nature an optimist, endowed with an agile mind, a quick sense of humor, and an infectious laugh. He retains the friendly informality of his native Texas and is impatient with protocol and stuffiness. Inherently competitive, he likes nothing better than a hot poker session, a tennis match, or a round of golf. Although he no longer plays football, he is an ardent fan and retains a figure not too much changed from that of the Stanford end of almost 40 years ago. A verbal, pragmatic, driving activist, restive with small detail, he has learned the ways of politics and is equally at ease with senators and undergraduate students. Impatient with immobility, his quick and facile mind is capable of improvisation when that becomes necessary and, when all else fails, he is inclined to revert to the old football dictum—when in doubt, charge through the center of the line. It is predictable that during the tenure of office of this likable, brilliant, and active man, AAAS will not sit still.

The Scientist and the Politician

Roger Revelle

In 1889, John Wesley Powell, explorer, geologist, and ethnologist, was the retiring president of the American Association for the Advancement of Science. Major Powell was the founder of the U.S. Geological Survey and the Bureau of American Ethnology; he was an enthusiastic advocate of the creation of a Federal Department of Science. In his monograph on the lands west of the 100th meridian he was the first to show that a shortage of water would limit the development of the West. One might have expected him to use this presidential platform to present his views on some broad issues of science and society, but the traditions were different in those days. His presidential address consisted of a dissertation on "Evolution of music from dance to symphony." It was only in the 1920's that retiring AAAS presidents began to talk about broader issues, usually in terms of science as a great human enterprise and the duty of our Association to defend it and spread its benefits among mankind.

Recognition of the social responsibility of scientists and technologists for the uses of their discoveries came after World War II when the terrifying threats posed by nuclear and thermonuclear weapons became clear to all. But science and technology were still thought of as essentially neutral. Their work could be used for good or ill, depending on the decisions made by other sectors of society. Scientists could try to influence these decisions, but, in their capacity as scientists mainly on technical grounds. Scientists and politicians should maintain an arm's length relationship with each other.

The Necessity for Cooperation

Today this comfortable arm's length relationship will no longer do. The threats to civilization are too real and too immanent for anything other than the closest kind of cooperation among politicians and scientists in the search for ways out of our present dilemmas, in increasing public understanding of the issues involved, and in mobilizing the confidence and will of the people.

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