Case 15

TheDevelopment of Molecular Biology and the Discovery of the Structure of DNA

Rockefeller Foundation, 1933

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Background. In 1928, after a review of the activity of four different Rockefeller-endowed philanthropies, the trustees of each of the boards agreed that all activities "relating to the advance of human knowledge" would be absorbed by the Rockefeller Foundation. Among the program areas taken over by the Foundation was grantmaking in the natural sciences formerly administered by the International Education Board and the General Education Board. The Foundation organized these activities under a single division of Natural Sciences. After a brief period of organization of the Natural Sciences division, the Foundation recruited Warren Weaver, professor of mathematics at the University of Wisconsin, to become director of the new division. This newly-created division of the Rockefeller Foundation, and its newly recruited leader, would come to have a profound impact on the development of the sciences for many decades, and this impact would become one of the quintessential and widely discussed examples of foundation impact.[215]

Strategy. Weaver's first endeavor was to determine the area of science to which the Foundation might best apply its financial support to maximize the advancement of knowledge to benefit the welfare of mankind. He determined that the life sciences offered the greatest such opportunity, and in 1933, the board of trustees of the Foundation agreed to make experimental biology the field of primary interest for the Natural Sciences division. This was a relatively new course for the Foundation. The Foundation made grants in the early 1920s supporting the spread of knowledge in the biological sciences, but Foundation support of biology was far from systematic. Medical research, however, had been the Foundation's primary focus, and biology as a field was actually an outgrowth of the Foundation's prior work in that area. Weaver was able to draw broadly from the Foundation's experiences in medical research funding.[216]

Weaver's own intuition and expertise led him to emphasize the application of quantitative techniques of mathematics, physics, and chemistry to the field of biology, or the borders of biology with other research disciplines. While Weaver did not initiate collaboration between biologists and physical scientists, the Natural Sciences division made a large number of grants to individuals designed to promote such collaboration.[217] In addition to individual grants to scientists, the Rockefeller Foundation supported the development of molecular biology on an institutional level, funding programs to elite universities to support research programs in molecular biology, most notably among them the California Institute of Technology.[218]

The funding approach of the Foundation in the field of molecular biology was nimble and highly supportive of the grantee scientists. George Beadle, recipient of the 1958 Nobel Prize in Medicine, recounted approaching the Rockefeller Foundation as a young professor at Stanford in the early 1940s for a grant to support the genetics research for which he would be awarded the Nobel Prize. At the time, however, he and his team of researchers at Stanford had been working for only three years on a ten-year grant from the Foundation; one of the conditions of the grant was that the team could not reapply for additional funds for the ten-year period. Beadle was rightly undeterred when it became clear to him that his research should be accelerated and that more funding was needed. He met with an officer of the Foundation who promptly made the additional grant needed. Beadle labeled this story an "example of foundation flexibility and speed of decision."[219]

Impact. The precise role of Warren Weaver in the creation or development of the field of molecular biology during his long tenure at the Rockefeller Foundation has been the source of

substantial debate.[220] Still, few deny that Weaver's influence, and the influence of the Rockefeller Foundation, during the period in which molecular biology first began to shed light on the genetic makeup of life. Indeed, Weaver himself has been credited with coining the term "molecular biology."

Among the Natural Sciences division's early grants was a fellowship for biochemistry research to Hans Adolph Krebs to enable him to go to Cambridge from the University of Freiberg, which he was forced to leave for political reasons. While at Cambridge, Krebs discovered the Krebs Cycle, a description of the respiration process in human beings.[221] While the discovery would land Krebs a prominent and enduring place in life science textbooks, it was merely a precursor of the important scientific discovery financed by Weaver's Natural Sciences division.

In 1953, the culmination of a number of lines of research converged in Cambridge, England, where James Watson and Francis Crick, two young scientists, discovered the double helical structure of DNA. Watson and Crick were able to make their discovery with the aid of a number of lines of cutting edge research, virtually all supported by private foundations. At King's College, London, a group led by Maurice Wilkins was advancing X-ray diffraction imaging research. At Columbia University, Erwin Chargaff discovered the relative proportions of the four nucleotides in DNA. Both of these researchers were aided by Rockefeller Foundation grants.[222] As for the Cambridge Medical Research Council Laboratory of Molecular Biology, the laboratory from which Watson and Crick worked, laboratory researcher Max F. Perutz suggested that the entire unit owed its existence to the Rockefeller Foundation.[223] Rockefeller Foundation grants funded foreign researchers at the lab who would not have been able to study in England without the Foundation's assistance. Grants also made possible the purchase of X-ray diffraction equipment, critical to the discovery of DNA. Knowledge of the structure of DNA rapidly opened the way for genetic research and a better understanding of cell replication and mutation, and their discovery earned Watson and Crick a Nobel Prize.

Notes

215. Raymond B. Fosdick, *The Story of the Rockefeller Foundation* (New York: Harper & Brothers, 1952), 137–39.
216. Ibid., 156–58.
217. Ibid., 159.
218. George W. Beadle, "The Role of Foundations in the Development of Modern Biology," *U.S. Philanthropic Foundations: Their History, Structure, Management, and Record*, Warren Weaver (New York: Harper & Row, 1967) 226, 232; "M.I.T. Gets $500,000 for Biology Study," *New York Times*, 1/22/1953, 21.
219. Ibid., 228–30.
220. Ditta Bartels, "The Rockefeller Foundatin's Funding Policy for Molecular Biology: Success or Failure?" *Social Studies of Science*, Vol. 14 (1984), 238–43, for example, outlines some of the contours of the early debate.
221. Fosdick, *Story of the Rockefeller Foundation*, 161.
222. Beadle, "The Role of Foundations," 234.
223. Ibid.