Biology as Power

Controlling Life. Jacques Loeb and the Engineering Ideal in Biology. PHILIP J. PAULY. Oxford University Press, New York, 1987. iv, 252 pp. + plates. $24.95. Monographs on the History and Philosophy of Biology.

Few scientists of the past century have excited more passion and popular interest than Jacques Loeb. His experiments on artificial parthenogenesis commanded worldwide publicity and even inspired talk of a scientific basis of the doctrine of immaculate conception. His personality and values were the model for one of the most forceful, if simplistic, images of the scientist in popular literature: Max Gottlieb in Sinclair Lewis's *Arrowsmith*. He has entered mythology as a symbol both of ruthless reductionism and of German science transplanted to America. It is remarkable that Loeb has received little attention from biographers; it is more remarkable that this, the first book-length biography of Loeb, succeeds so richly in capturing not only the details of his life but also the meaning and implications of his work.

Pauly's theme is simple but powerful: Loeb stands at the fountainhead of a new tradition in the biological sciences—a tradition that places more emphasis upon the control of organisms than on a formal or complete understanding of their nature. Whereas his contemporaries, like Francis Bacon before them, believed that power and knowledge were inextricably linked, Loeb thought it possible to manipulate life without understanding it, to treat the organism as a black box from which all manner of behaviors could be coaxed by environmental cues. He was, Pauly suggests, an engineer in biologist's clothing.

Loeb's concern with control, Pauly proposes, evolved slowly during the course of his extended education in the 1880s and early 1890s. From his teacher of physiology at Strassburg, Friedrich Goltz, Loeb acquired the conviction that organisms were far more complex than mechanists suspected. From an associate at the University of Würzburg, the botanist Julius Sachs, he derived an interest in the tropisms of lower organisms. From visits to the Naples Zoological Station he obtained a familiarity with the techniques of marine biology. Most important, in the writings of the physicist and philosopher of science Ernst Mach and the Austrian engineer Josef Popper-Lynkeus Loeb discovered reasoned arguments for his own half-formed and inarticulate opinions. In particular, he found strong support for the notion that scientists, rather than searching vainly for true causes, should really be concerned with producing effects. By 1891, Loeb had come to see himself as an engineer of living substance.

Loeb's consuming interest in molding life found full expression in the work he did on embryology and development after moving to America in 1891. Following a brief interlude at Bryn Mawr, Loeb pressed ahead with experiments first at Chicago and then at Berkeley. The most famous of these, of course, was his production of fatherless sea urchins, but there were also experiments on artificial parthenogenesis in other organisms, on the production of mutations, and on the extension of life. These experiments, Pauly persuasively argues, were not efforts to reduce biology to physicochemical laws, although they have often been understood as such; rather they were attempts to manipulate life processes in the absence of an understanding of mechanisms. Loeb did not know exactly why changes in osmotic pressure triggered the development of sea urchin eggs and was not especially interested in finding out: that the cells could be made to divide was sufficient.

One might suppose, as Loeb initially did, that America, home of the supposedly practical, inventive, and impatient Yankee, would be a congenial place for a biological engineer. But, as Pauly reveals, Loeb discovered in the United States a belief in progressive evolution even more offensive than the mechanistic reductionism of his former colleagues in Germany. Isolated intellectually, repeatedly challenged to provide material explanations for the phenomena he studied, and frightened by the racist and militarist purposes to which evolutionism was being put, Loeb eventually stumbled into the camp of the mechanists. He ended his career at the Rockefeller Institute, where he became the symbol of a reductionism hardly distinguishable from that which he had once opposed.

Loeb's career touches upon such familiar issues in the history of science as the development of experimental biology, the conflict between mechanism and vitalism, and the rise of American universities as centers of research. Pauly handles these with a deftness and good judgment that inspire admiration. Even had his book ended with Loeb's death in 1924, it would have been a valuable addition to scholarship. But in a final chapter Pauly reaches beyond the limits of Loeb's life to address the larger question of Loeb's influence on the biological sciences, and in so doing makes a strikingly original and important contribution to the history of modern thought. Loeb's ideal of a technology of life influenced a younger generation of scientists, a remarkably influential group that includes the behavioral psychologists John B. Watson and B. F. Skinner, the geneticist Hermann J. Muller, and the inventor of the birth control pill, Gregory Pincus. Loeb's engineering ideal, Pauly suggests, survived him and, for better or worse, forms the background to the biotechnology of today. Readers may wonder about other sources of the engineering motif in modern biology; a biography is not the best vehicle with which to trace the elaboration of such a broad tradition of thought. Nevertheless, Pauly's ambitious and rewarding effort to understand the origins of biotechnology deserves applause and a wide readership.

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Small-Mammal Studies

The Ecology of Woodland Rodents. Bank Voles and Wood Mice. J. R. FLOWERDEW, J. GURNELL, and J. H. W. GIPPS, Eds. Clarendon (Oxford University Press), New York, 1985. xx, 418 pp., illus. $79. Symposia of the Zoological Society of London, no. 55 (London, Nov. 1984).

Considering the pervasive impact of small-mammal biology on a diversity of biological disciplines, from ecology, evolution, and behavior to physiology and genetics, a compendium of what we know about Europe's three most widespread woodland rodents should command our attention. The present volume contains 14 contributions from 16 invited participants, including four from outside the United Kingdom (one each from Poland, Sweden, Norway, and New Zealand).

The three principal subjects of this effort are the bank vole (*Clethrionomys glareolus*), the wood mouse (*Apodemus sylvaticus*), and the yellow-necked mouse (*A. flavicollis*), the last of which inhabits mature deciduous forests and is relatively poorly known. The geographic emphasis is on Great Britain, but the literature review and the integration of information with data on other relevant species, especially North American analogs, are extensive. In view of the widespread (Eurasian) distribution of these species, I sampled 435 literature citations and found that only 5 percent had non-English titles. I therefore suspect that considerable primary literature has been overlooked.