Book Reviews

Success Story: Science at Its Best

Phage and the Origins of Molecular Biology. JOHN CAIRNS, GUNTHER S. STENT, and JAMES D. WATSON, Eds. Cold Spring Harbor Laboratory of Quantitative Biology, Cold Spring Harbor, N.Y., 1966. 351 pp., illus. $12.50.

In his contribution to this book, J. Weigle quotes Max Delbrück to the effect that "he supposed that in honor of his 60th birthday they will produce a Festschrift in which everyone will publish papers that have been repeatedly rejected by many journals." It can be reported that in this Delbrück was wrong. The editors set out to compile a personal history of the developmental phase of molecular biology (a period which they consider to have ended), and there is much here beyond a mere recounting of the history of the period. The contributors were chosen from among those responsible for the important developments, and the book gives a picture of science at its best. One can only regret the passing of an era in which events such as those described in this volume occurred and hope, somewhat wistfully, that the next in biology will be comparable.

Everyone who reads the book will have his own favorite piece. Mine is the charming contribution by André Lwoff entitled "The prophage and I." It is disconcerting to find that a Frenchman, and a scientist at that, can write English so well. J. D. Watson's account of his early associations with Delbrück and Luria is also fascinating, and we can look forward to his promised personal account of the events that culminated in the elucidation of the structure of DNA.

As a result of the personal nature of the individual accounts, the very great contributions of Delbrück emerge naturally, rather than in the forced fashion so common in more formal tributes. An appreciation of Delbrück's intangible as well as his tangible contributions to the development of molecular biology is readily gleaned. Here is the experimentalist, the theoretician, the organizer, the teacher. And yet at the same time, here is the devil's advocate—the debunker, the deflater, the person to whom no party line, even if he had a hand in establishing it, is sacred. George Streisinger relates that, after a seminar he presented at Caltech, Delbrück took him aside and informed him that "it was the worst seminar he had ever heard." Only later did Streisinger learn that Delbrück said this to almost all speakers. In this vein, I recall how throughout student seminars presented during the *Phycomyces* Course at the Cold Spring Harbor Laboratory of Quantitative Biology during the summer of 1966 Delbrück would interrupt his German protégés to correct their English. Their English was quite good, better certainly than that of some of their American fellow students, but Delbrück would seize every opportunity to point out to them more elegant ways of expressing a thought.

A major and continuing influence Delbrück has had on biology has been in imparting not just the desirability but the necessity of quantitation. And as T. T. Puck points out in his chapter, Delbrück's approach to biology was quite different from that of many physicists who have made excursions into the field and confined themselves to asking such questions as "Can living organisms manufacture negative entropy?" or "What are the implications of the uncertainty principle for living systems?" As Puck writes, "Delbrück instead focused on uncovering the intimate and basic phenomenology of the replicative process, and on expressing these as precisely as possible in terms of specific, time-ordered transformations of definite entities. His passionate rejection of vagueness in the building and testing of conceptual models has helped to change radically the entire philosophy of biological research." Delbrück has been responsible for many physicists' abandoning their fields to take up research in biology, and it is much to his credit that he has guided a number of them into more productive channels than their natural inclinations might have. The attraction to modern biology that is being felt by people who 10 years ago would have considered the physical sciences to be the only respectable outlet for their talents is very real, and the reason for it comes through clearly in this book. Biological questions, unlike most of those in the physical sciences today, can be formulated and followed up in short order with ingenious and frequently simple experiments that can answer, often decisively, the questions posed. A book that portrays the excitement of modern biology as vividly as this one does will undoubtedly contribute even further to the diversion of many of the ablest young scientists from the physical sciences into biology. I suppose I would find this more upsetting if I had not myself made the switch from physical chemistry into biology.

Many of the important ideas in molecular biology were formulated at the Cold Spring Harbor Laboratory, and many of the critical experiments were conceived or carried out there. Throughout the book the important role that this laboratory has played is made evident. Cold Spring Harbor has also served an important training function through its summer courses, unique affairs in which, in three weeks, nonspecialists are brought to the point where they can carry out meaningful experiments in phage, bacterial genetics, animal viruses and animal cells, or *Phycomyces*. The Phage Course that Delbrück organized there in 1945 has been one of the important channels through which he has influenced modern biology.

Several years ago Delbrück concluded that molecular genetics was in good hands and shifted his attention into the area of sensory perception in the single-celled fungus *Phycomyces*. In this he was attempting to repeat in neurobiology, by establishing a suitable model system, the phage-bacterium success story of molecular genetics. Whether or not *Phycomyces* will be developed into a model for neurobiological phenomena is very much an open question at this time, but it does seem clear that the establishment of a model system is a necessary prerequisite to

progress in neurobiology. In any event, this abandonment of a field that was so largely his creation, that just as obviously was to be enormously fruitful but had not yet even begun to mature, let alone to be exhausted, was characteristic of the man and, just incidentally, the mark of a rare and great scientist.

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Prexy and the Computers

The Managerial Revolution in Higher Education. FRANCIS E. ROURKE and GLENN E. BROOKS. Johns Hopkins Press, Baltimore, 1966. 196 pp. $8.

This book is a research monograph in disguise, reporting a study of "managerial innovation in higher education." Of the numerous "management tools" that characterize the "revolution," special emphasis is given to the electronic computer because the authors consider its introduction into campus life to be "the most dramatic symbol of the 'new science' in university management. . . ." In making the survey the authors had two principal objectives in view: (i) "that of gauging the extent to which new techniques of management have actually permeated American higher education" and (ii) "that of measuring—in a preliminary way at least—what impact the new science of management has had upon the academic community."

The methods used included a four-part questionnaire sent to 361 state-related, 36 nonstate public, and 36 private institutions across the country. The questionnaire also was submitted to ten statewide coordinating boards. In addition, interviews were conducted with 209 individuals at 33 colleges and universities in 16 states and with a number of individuals from the staffs of agencies having state, regional, and national responsibilities relating to higher education. The response rate for the questionnaire was about 80 percent. Although the sample of institutions was focused on those representing the public sector of higher education, the authors feel that with respect to internal administrative problems and practices, the results apply equally well to private institutions.

The data are reported and discussed within a framework of four different aspects of the "managerial revolution": (i) the use of computers in various phases of college and university administration; (ii) the growth of institutional research; (iii) the allocation of academic resources, particularly financial resources and space; and (iv) the collective impact of recent administrative innovations on the general style of university administration. Bracketing these four chapters are a short introduction, touching upon the rise of administrative "bureaucracy" in higher education, and a final chapter that briefly delineates what the authors believe to be "the meaning" of current managerial innovations for the future of higher education in the United States. There are four appendices covering the "research strategy," the details of the questionnaire, a discussion of administrative changes that are occurring in institutions of higher learning abroad (particularly Europe, Australia, and Canada), and a selected bibliography of literature bearing upon the management of higher education.

As to how far the new managerial techniques have permeated the institutions studied and the consequent impact of this development upon the respective academic communities, the findings show that the "real potential" of computers is still largely unrealized. Their current use is reported as being confined largely to increasing the speed of routine administrative operations, although their presence in some instances has effected new administrative organizations, as well as a redistribution of "authority" and "influence" in arriving at policy decisions. The data reflect a sharp rise in the number of institutional research offices during the past decade, although the role and influence of these offices are less determinate. Not surprisingly, it appears that the closer a bureau of institutional research is to the president's office, the more immediate and direct is its influence on university policy. With reference to the allocation of resources (financial and space) within the institutions, there is a trend toward more "rationalized" procedures (formulas, cost analyses, and so on), although this trend is a function of both the size of the institution and its degree of enmeshment in statewide relationships with other institutions. Smaller institutions and departments within larger institutions are found to still operate in a highly subjective administrative fashion with respect to resource allocation. The trend toward rationalized allocation schemes has, in some cases, shifted control from lower levels of administration to higher levels, or laterally "from one group of individuals to another, as for example, from deans to business offices."

Certain changes in the "style" of university administration are observed to have resulted from these managerial innovations. The four most significant changes are: (i) a shift from "secrecy to publicity in the general conduct of administrative and academic affairs"; (ii) the development of a "cabinet style" of governance in the institution, replacing the traditional presidential executive approach; (iii) the introduction of new and more rational forms of decision making; and (iv) the development of the multi-campus network of administration. The inroads of the new managerial techniques tend to be more impressive in newly established institutions; at the long-established and more prestigious institutions "the advent of scientific management cannot yet be said to have worked any fundamental alteration in the relationship between the faculty and administration."

In their interpretation of the data, the authors conclude that the most noteworthy feature of the "managerial revolution" is that "it has not led to the universal triumph of any Gresham's law of administration. The soft currency of quantitative standards has not in fact driven out qualitative criteria altogether in the management of colleges and universities." They note with approval the trend toward "candor" in policy making, believing that this trend offers the prospect of rationality in administrative decision making. They warn against the major pitfall, if the newer managerial techniques are adopted, of allowing the computer and all that flows from it to completely depersonalize university life. As a sort of last word the authors declare that in the governance of university affairs the "revolution on the management side of higher education . . . calls for a revolution in the academic sphere . . . the most effective response by the faculty . . . may well be the development of its own academic civil service, which will reflect faculty rather than administrative points of view in the management of the university."

In the foreword, the authors say it might be argued that they have stretched a point in referring to the managerial innovations they have surveyed and reported as a "revolution," inasmuch as institutions of higher learning, in the main, still reflect their