Struggles of a Biologist

Black Apollo of Science. The Life of Ernest Everett Just. KENNETH R. MANNING. Oxford University Press, New York, 1983. viii, 397 pp. + plates. $29.95.

Kenneth Manning has created a remarkable portrait of a remarkable scientist. Ernest Everett Just was a black man, an American, an important biologist. In 1915 Just received the first Spingarn award for "service to his race." He quickly became the leading scientist at black Howard University and a leading black scientist in America. Yet Just sought more. He loved biology and wanted to gain his rightful place alongside whites as a major biologist. He recognized that success would require funds for research, a stable position in a research institution, and a support community of graduate students and assistants. But even his friends saw little prospect of Just's achieving these in the white community. His mentor, Frank Lillie, felt that Just must remain at Howard, that white institutions would not accept him. The influential Jacques Loeb felt that Just deserved support but only if he worked to help blacks; he should remain at Howard. Yet each of these men recognized the importance to any research scientist of a supportive research environment; each had himself changed jobs to achieve such support. Manning carefully illustrates why Lillie, Loeb, and others could not or would not help Just gain a proper position. Just remained at Howard, fighting for basic support and fighting unsympathetic administrators.

In his brilliantly sympathetic but skillfully tempered biography, Manning brings alive Just's battles to gain financial support for his research, his interactions with and dependence on scientific leaders, his personal difficulties in developing a comfortable social life in either the black or the white community, his intolerable situation at Howard, his health problems, and his search for a fully sympathetic wife. Not simply a biography, the volume also blends social, institutional, black, and political history with the history of science. Impressively, Manning succeeds with each of these separate threads and also manages to weave them together into a vibrant fabric.

The first of the book's two parts addresses Just's beginnings, the establishment of his hopes and aspirations. His mother, his graduate teacher Lillie, and Julius Rosenwald of the Rosenwald Fund and Rockefeller Foundation board exerted major influences. Lillie encouraged Just to carry out his research during summers at the Marine Biological Laboratory in Woods Hole, Massachusetts. He hoped that Just would thereby become part of the American research network, though he realized the limited employment opportunities that a black man would have. But Manning shows that a black man, no matter how personable, could not be accepted as an equal by Woods Hole society. He could not take his family there for the summers, which widened the gap between him and his wife. Yet no other white research institution would have him. Just continued at Howard during winters and at Woods Hole during summers through the 1920's, longing for improved working conditions.

Part 2 traces Just's disillusionment with American science and his turn to Europe. An increasingly hopeless situation at Howard, aggravated by Just's lack of success in acquiring satisfactory research funding, brought him near despair. The Naples Zoological Station and the Kaiser Wilhelm Institute in Berlin each offered sanctuary for this black American biologist. There, Just began to develop his theoretical work on fertilization and development, going beyond the descriptive and experimental studies he had pursued. His theory that the cell surface, or ectoplasm, plays a major role in directing development found expression in his 1939 volume, *The Biology of the Cell Surface*. In this scientific work, as in his racial heritage, Just opposed the current trends. He opposed both the successful genetics program and the dominant physiological theories of development of the whole organism such as Lillie's or Loeb's. Aggressive, even arrogant at times, Just began to blame American biologists and society for his difficulties. He moved to Europe in the 1930's. With a new German wife, Just finally made a happy home and optimistically settled to work in France, only to be interned by the Nazis. He and his wife finally escaped Europe through the intervention of friends. Broken and ill, Just returned to the United States, to Howard, and finally began to make peace with the world he had found so difficult.

Without preaching, this powerful volume presents a persuasive case that Just was an important scientist, that he suffered in many ways because of his race and social circumstances, and that many of the leading American biologists were narrow-minded in their views of what a black man could and should do. It offers

excellent portraits of such scientists as Lillie or Loeb, plus glimpses of numerous others. It reveals much about the nature of funding for science and about institutions such as the Marine Biological Laboratory. Only in the presentation of Just's scientific background and in the assessment of his particular contributions does the book falter at all. Even here the greatest problem is that Manning leads the reader to want more. Manning obviously understands Just and his work; he presents Just's ideas clearly and accurately. Yet when he steps outside Just's work to assess it within its context, the result lacks some of the depth that the rest of the study offers. Perhaps it is unfair to expect more. As it is, Manning's volume establishes beyond doubt that Just was an important and fascinating scientist, and in doing so it marvelously exemplifies what a superior scholarly history can be.

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Mathematics and Reform

Neohumanism and the Persistence of Pure Mathematics in Wilhelmian Germany. LEWIS PYENSON. American Philosophical Society, Philadelphia, 1983. xii, 136 pp. Paper, $10.

Most studies in the history of science concern either the evolution of scientific ideas or the context in which those ideas evolved, or both. Pyenson's learned monograph concerns neither; instead, his subject is the relationship between an ideology ("neohumanism") that became entrenched in 19th-century German academic life and the attempts to reform mathematics education in the secondary schools of Germany between 1890 and 1914. His treatment of this esoteric and complex subject should be of interest to students of the history of science, mathematics, education, and culture.

To help us understand his subject, Pyenson recapitulates the meaning and function of the neohumanist ideology. Neohumanism, we are reminded, was a revival of the values and ideals of life as presented in ancient Greek literature and culture. The emphasis was strictly on the ideal in life, not on the practical or the real. The study of mathematics and the Greek and Latin languages and literatures formed the backbone of the neohumanist secondary-school curriculum. Between the early 19th and the early 20th centuries neohumanism functioned as the "ideological basis" of the elitist secondary schools—the Gymnasien—and the universities in Germany. Virtually all of Germany's 19th-century political and professional leaders were educated on this basis.

After 1870, however, academic specialization and Germany's rapid industrialization led to criticism of the neohumanist ideology. Reformist mathematicians and scientists, along with engineers and modern language teachers, challenged the content and distribution of subject matter taught in the classical Gymnasium. Between 1890 and 1914 the reformers, Pyenson shows, sought to emphasize applied—as opposed to pure—mathematics, to expand the scant amount of experimental science instruction offered in the secondary schools, and, in general, to increase the opportunities of graduates of other types of secondary schools to study at the German universities.

Pyenson's most original contribution is his discussion of the role of mathematicians and natural scientists—including, among others, the chemist Friedrich August Kekulé, the polymaths Hermann von Helmholtz and Ernst Mach, and the mathematician Felix Klein—in the debates about curriculum reform. He has skillfully used his knowledge of the history of physics and mathematics in Germany to highlight the central role of Klein and his acolytes within the reform movement. Mathematics, he argues, played a two-faced role in the secondary-school curriculum. On the one hand, its emphasis on abstraction and purity made it an integral part of the traditional neohumanist curriculum; on the other, its potential applications in the physical sciences and engineering made it important to the reformers. Pyenson stresses the pure mathematicians' claim that pure mathematics could also solve scientific problems in the real world; they thereby preserved, he says, pure mathematics. Klein and other mathematicians sought to reform secondary-school mathematics in order "to maintain the power of vested interests in the mathematical disciplines" (p. 57).

My only criticism of Pyenson's study emerges from his enigmatic title. For in one sense, a cognitive rather than social-institutional one, how could pure mathematics have *failed* to persist? In my opinion, by the middle of the 19th century mathematics' own internal logic guaranteed its continual development irrespective of the existence of neohumanism or the reformist activities concerning mathematics education in the secondary schools. Moreover, Pyenson says relatively little about the state and development of mathematics at the university level. This criticism notwithstanding, there is much to learn from Pyenson's fine account of neohumanism and the attempts to reform secondary-school mathematics instruction in Wilhelmian Germany.

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The Philosophy of Space-Time

Foundations of Space-Time Theories. Relativistic Physics and Philosophy of Science. MICHAEL FRIEDMAN. Princeton University Press, Princeton, N.J., 1983. xvi, 386 pp., illus. $35.

Over the last decade or so, a new standard of rigor has emerged in scholarly writing on the philosophy of space and time. This has come concurrently with the carrying over from mathematical physics of the "intrinsic" or coordinate-free method of formulating space-time theories. Friedman's new book will provide the philosophically oriented reader a palatable introduction to these new standards and methods, which are used exclusively throughout the book.

The essence of the new method is to treat the entities of space-time theories in a way that is independent of any coordinate system. For example, vectors are no longer thought of in terms of quadruples of numbers in a given coordinate system. Rather they are defined as a certain type of mapping of scalar fields on the space-time manifold, which turns out miraculously to have all the required properties. For this, coordinate systems just need not be mentioned. Friedman takes care to introduce these new ideas with "motivation" in the body of the text and to give a more rigorous development in a brief but in my case much-thumbed appendix.

The value of this new approach can be illustrated in brief by Friedman's discussion of the derivation of the Lorentz transformation (pp. 138–142). Traditionally, the linearity of the transformation is justified by an appeal to the homogeneity of space. Friedman's insistence that we clearly specify the structures that constitute this "space" shows just how ambiguous and incomplete this appeal is. It is satisfied, for example, by any space of constant non-vanishing curvature, in which the desired linearity condition does not obtain.