other nations, he could have convincingly demonstrated how cultural and political forces shape the business corporation's development. Mainstream U.S. economists are usually ethnocentric and overly wedded to the idea that our economic institutions are socially optimal. Sociology has much to contribute to the remedying of those faults. But this book is a poor demonstration of that claim.

SANFORD M. JACOBY
University of California, Los Angeles, CA 90024

A Biomedical Success

Patenting the Sun. Polio and the Salk Vaccine. JANE S. SMITH. Morrow, New York, 1990. 413 pp. + plates. $22.95.

Jane Smith's account of the development and clinical trial of the Salk polio vaccine is dramatic, suspenseful, exciting, sad, touching, and detailed. Her book belongs to a genre of scientific tell-it-as-it-was in which the science is shown as deeply embedded in society, which does not simply provide a distant ideological background for it but brings it into existence, or blocks it, in a very direct way. An earlier example having to do with medical research is David Zimmerman's *Rh: The Intimate History of a Disease* (1973), which starts out by saying that it is about scientific creativity but is really about the struggle for funding.

This book, too, is about funding and politicking. Although the costs involved were enormous, the money for the development and testing of the Salk anti-polio vaccine was raised not from state or government, which were scarcely involved at all at any stage, but directly from the people in what may be uniquely American, "democratic" style. The author suggests, and this is a most interesting suggestion, that it was the public participation in the fundraising for polio research and the successful outcome of the effort that have formed the public paradigm of an all-powerful medical science. For a post-polio generation, children are expected to be healthy, and science is expected to be able to find a cure for anything, given enough funds.

In all applied science, research falls somewhere along a line stretching from basic science to the demands of the economic client. Where it falls in any given case is probably determined by the institution in which the work is done. In this case, however, no institution provided Jonas Salk with a context in basic science, and there was no network of colleagues to enfold him, or to recommend him for a Nobel Prize. The National Foundation for Infantile Paralysis owned the means of production: the client in this case owned the scientist outright. The picture of the relationship between Salk and the National Foundation is full of slightly snide insights, based quite firmly on the data, but tinged with pity. Of Salk's first contact with the Foundation Smith writes (p. 111): "Salk was proud of having maneuvered around a restrictive budget to find another source of money, but he was now working with people far wilier than he. Their scheming was to get someone to find an end to polio. Dr. Salk fell gladly into their toils."

The account of the National Foundation for Infantile Paralysis, its March of Dimes fund-raising campaigns, its internal politics, and its relations with Jonas Salk is solidly based on the Salk papers at the University of California, the Thomas Francis papers at the University of Michigan, and a large number of personal interviews, as well as the usual published scientific material. Smith's style is colorful, even perhaps, quite appropriately in the circumstances, *popular*, but her research outdoes the most meticulous Ph.D. thesis. This is a book that is both readable and insightful. Your reviewer enjoyed it and also learned a lot from it.

PAULINE M. H. MAZUMDAR
Institute for the History and Philosophy of Science and Technology, University of Toronto, Toronto, Ontario M5S 1K7, Canada

Science in New York

Knowledge, Culture, and Science in the Metropolis. The New York Academy of Sciences, 1817–1970. SIMON BAATZ. New York Academy of Sciences, New York, 1990. x, 269 pp., illus. Cloth or paper, $55. Annals of the New York Academy of Sciences, vol. 584.

At the outset of his study of the New York Academy of Sciences, Simon Baatz notes that he has little interest in the organization's internal features, its officers, finances, and administration. Rather, the political and cultural factors that shaped the institutional development of science in New York City and the impact those developments had on the Academy's history are the focus of this work. The result is a lively, insightful book that offers the first extended analysis of science in New York City.

Baatz examines the history of the Academy in relation to institutional developments on a local and national scale. The Academy, first known as the Lyceum of Natural History, was created in an auspicious political environment that favored the interests of a coterie of naturalists and physicians. Subsequent efforts to obtain a permanent location for its meetings and collections led to temporary alliances or negotiations with New York University, City College of New York, and Cooper Union. In addition to describing the development of those institutions, Baatz analyzes a more significant problem: how the Lyceum, a local natural history society, responded to the challenges posed by the emergence of national scientific organizations and increasing scientific specialization. In New York the establishment of the American Museum of Natural History and the transformation of Columbia College into a major university presented problems for an institution that had emphasized research and public education. Deftly weaving together local and national developments, Baatz describes the emergence of the Academy as an umbrella organization for specialist scientific societies. Rather than declining as a result of specialization, the Academy emerged as an important metropolitan forum for scientists becoming increasingly isolated by disciplinary developments.

Baatz studies the changing character of the Academy by focusing on prominent figures who dominated its activities. Samuel Latham Mitchell, John Torrey, John William Draper, and Charles Frederick Chandler are among those he examines in some detail. Particularly noteworthy is his study of two figures who transformed the Academy: Nathaniel Lord Britton and Eunice Thomas Miner. Britton, a botanist best known for establishing the New York Botanical Garden, played a pivotal role in changing the Academy into an umbrella organization. Miner, a zoologist who became the Academy's executive secretary in the 1930s, transformed a local body of 300 members into an internationally renowned society of over 26,000 members. Through his ability to describe their scientific contributions and define their political and administrative talents, Baatz provides new insights into the work of those prominent New York scientists.

The focus on notable individuals and external relationships also highlights weaknesses in the book. At times the discussion of scientific organizations, for example the Torrey Botanical Society or the Scientific Alliance, takes on a life of its own; only after several pages does the reader realize the connection to the Academy. Despite the author's discussions of the work of Torrey, Draper, and Chandler it is unclear whether the Academy took up their interests in its meetings or publications. Baatz offers little analysis of the scientific preoccupations of

the Academy, particularly in the 19th century. The discussion of the Academy's Porto Rico Survey offers some compensation; however, the emphasis is still on political and economic developments. By the mid-20th century the Academy was sponsoring biomedical conferences, but the author fails to provide a background that adequately explains how and why those concerns had become so important. The Academy's function as an umbrella organization makes analysis of its intellectual interests difficult, but some discussion of the principal scientific questions that characterized its meetings or its publications would have enhanced the book.

RONALD RAINGER
Department of History, Texas Tech University, Lubbock, TX 79409–1013

Solar Correlates

The Earth's Climate and Variability of the Sun Over Recent Millennia. Geophysical, Astronomical and Archaeological Aspects. J.-C. PECKER and S. K. RUNCORN, Eds. Royal Society, London, 1990. x, 294 pp., illus., + plates. £42.60. From a meeting, London, Feb. 1989. First published in *Philosophical Transactions of the Royal Society of London*, series A, vol. 330 (no. 1615).

Although the existence of periodicities or quasi-periodicities in solar activity has been known since the mid-19th century, it was not until the latter part of that century that Spöerer and Maunder called attention to an episode of about 60 years' duration before 1700 when there were practically no sunspots and the 11-year cycle appeared to vanish or nearly vanish. This interesting phenomenon was more or less buried in the literature until it was again brought to the attention of the scientific community by Eddy in a forceful series of articles dating from 1976. Because there is an inverse relationship between solar activity, as measured by the Wolf sunspot number, and radiocarbon production, solar minima correspond to radiocarbon maxima. Fortunately, by 1976 sufficient radiocarbon data were available to enable Eddy to identify other solar minima. These radiocarbon maxima (corresponding to solar minima) appear to repeat with a periodicity of about 210 years, as was first quantitatively demonstrated in 1971 by Jan Houtermans, a student of Suess's at LaJolla. (Suess has repeatedly brought this periodicity to our attention and has persistently related the solar minima and maxima to climate change.) There are other periodicities that occur in both radiocarbon production and solar activity, specifically 11, 52, and 88 years. Thus the utility of the radiocarbon record as a proxy record of solar activity has been firmly established.

The relationship between solar activity and climate has been much more controversial. The numerous and questionable corrections required to determine the solar "constant" and its possible variation based on data from mountain observatories and radiosonde balloons have been unconvincing. Second, as is pointed out by Runcorn, one of the editors of this volume, "Meteorologists, very conscious of the complexity of modeling the atmosphere, even assuming a constant energy input, have often been very critical of claims to have detected the solar cycle, and even hostile to the search for one" (p. 287).

Recent developments have made it imperative to reopen the question of a solar activity-climate relationship. First, the nearly continuous record of total solar irradiance monitored by the Active Cavity Radiometer Irradiance Monitor (ACRIM I) aboard the Solar Maximum Mission (SMM) have detected variations on time scales ranging from minutes to the duration of the measurements from 1980 to 1988. The variation from solar maximum to solar minimum corresponds to a peak-to-trough variation of about 0.08 percent, which, in direction if not in magnitude, is consistent with previous hypotheses concerning the relationship between solar activity and climate during the Little Ice Age (A.D. 1400 to 1750) and the Medieval Warm Epoch (A.D. 1100 to 1250); thus a direct relationship exists between solar activity and total solar irradiance. This relationship has been explained by one of the participants (Foukal) as the result of the growth and decay of excess radiation produced by bright faculae in the magnetic network outside of active regions. Second, Röthlisberger has demonstrated that climate events like the Little Ice Age are global and not merely regional in extent. This, along with the radiocarbon-climate correlation, is discussed by Wigley and Kelly. Third, Labitzke and van Loon make a convincing case for an association of the quasi-biennial oscillation with the 11-year solar cycle.

It is these new developments along with the importance of the ^{14}C record as a proxy record of solar activity that make this symposium volume both timely and interesting. ^{10}Be has also shown promise as a sensitive record of solar activity, but the ^{10}Be solar record has been deformed by the erratic fluctuations of paleo-rainfall. Fortunately, Raisbeck *et al.* in their figures 2 and 3 show a remarkably undistorted ^{10}Be record from the South Pole station that compares very favorably with the ^{14}C record during the last millennium.

Unfortunately, historical records of solar activity, as reviewed by Stephenson and by Zhentao, are of uncertain reliability. After reading the contributions on this theme, it seems to me that paleoclimatology will be a great asset to those concerned with such records. For theoretical astrophysicists who seem to have great difficulty in reconciling solar periods such as the 210-year period with theory, the new developments, as reviewed in this volume, will present an important challenge. For anyone who wants to know about the history of atmospheric CO_2 during the last 50,000 years, recent results on astronomical determinations of solar variability, modeling the climatic response to solar variability, spectral analysis of sunspot data during the past 300 years, or any of the other topics mentioned above, this symposium volume will be worth reading. The editors' summaries also make interesting reading. My only complaints are that the recorded discussions are not sufficiently critical or illuminating and that several contributions consist of little but an abstract.

PAUL E. DAMON
Department of Geosciences, University of Arizona, Tucson, AZ 85721

Toxins and Cellular Signals

ADP-Ribosylating Toxins and G Proteins. Insights into Signal Transduction. JOEL MOSS and MARTHA VAUGHAN, Eds. American Society for Microbiology, Washington, DC, 1990. xviii, 567 pp., illus. $79; to ASM members, $69.

Diphtheria, whooping cough, and cholera are caused by bacterial toxins that share a common biochemical mechanism: Each toxin is an enzyme that cleaves NAD^+ and transfers its ADP-ribose moiety to a specific substrate protein in cells of the unfortunate host. Remarkably, almost every host protein targeted by these toxins—and by other bacterial ADP-ribosyltransferases—turns out to be a GTPase. Several of these host proteins are G proteins involved in transmembrane signaling, such as the GTP-dependent stimulator (G_s) and inhibitor (G_i) of adenylyl cyclase. Other host proteins include elongation factor (EF) 2, one or more 20- to 25-kilodalton *ras*-like GTPases, and a single ATPase, actin.

The usefulness of these exotoxins in illuminating significant problems in eukaryotic biology helps to unify this multiauthored volume. By ADP-ribosylating G_s, for instance, cholera toxin inhibits its intrinsic GTPase and enhances its ability to stimulate