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.

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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.

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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 adenylyl cyclase—thus providing a versatile tool for studying cellular effects of cAMP as well as opening avenues to understanding the structure and function of the GTP-bound active forms of G proteins. As described in a chapter by Ui, ADP-ribosylation by the exotoxin of *Bordetella pertussis* led to the discovery of the G_i proteins and, later, of the G_o proteins, which are ubiquitous in the brain. By blocking activation of substrate G proteins, pertussis toxin furnished a simple and specific way of determining whether a G protein participates in a transmembrane signaling pathway—thereby implicating G_o or G_i proteins as mediators of hormonal inhibition of adenylyl cyclase, opening and closing of ion channels, and (in some cells) stimulation of phospholipases C or A_2. Similarly, the botulinum-derived ADP-ribosyltransferases will help to elucidate cellular functions of actin (a substrate of botulinum C2 toxin) and of several small GTPases modified by another botulinum protein, called C3 transferase.

The exotoxins are fascinating in their own right. Each is divided into two functionally distinct portions, one of which binds to the exterior of a target cell and somehow transfers the second portion, the ADP-ribosyltransferase proper, across the lipid bilayer into the cell. Unraveling the mechanisms used by these transmembrane injection devices may provide fundamental insights into protein-lipid interactions involved in membrane fusion, protein translocation across membranes, and assembly and function of protein channels, pores, and transporters.

Diphtheria toxin and exotoxin A of *Pseudomonas aeruginosa* arrest protein synthesis by ADP-ribosylating EF 2. Their amino acid target, diphthamide, poses a real conundrum. Diphthamide, a chemical derivative of histidine, is found in EF 2 of all eukaryotes studied, from yeast to man—but nowhere else. Nobody knows why evolution has gone to the trouble of putting diphthamide on EF 2 and keeping it there. Mutant cells in culture appear to get along just fine without the several host enzymes that participate in diphthamide biosynthesis (Bodley and Veldman). There are hints (Iglewski and Fendrick) that an enzymatic activity of the host, perhaps occurring in EF 2 itself, may also ADP-ribosylate diphthamide. The evolutionary puzzle, however, remains unsolved.

What are the selective advantages for bacteria for expressing these ADP-ribosyltransferases? What roles do their host substrates play in pathogenesis of actual disease? The 30 percent of this book devoted to these enzymes does not ask such questions.

Most of the rest of the book is devoted to G proteins as transmitters of chemical signals across the plasma membrane. Several useful and interesting chapters cover receptors that act via G proteins (Caron, Lefkowitz, and colleagues), genes encoding G protein α subunits (Kaziro), regulation of ion channels and other effectors (Birnbaumer, Brown, and colleagues), phospholipid turnover (De Vivo and Gershengorn), and relations between structure and function of GTPases (Price, Barber, and J. Moss).

Overall, however, the treatment of G proteins is uneven and idiosyncratic. Although its signaling role is not well defined, the α subunit of G_o is allotted a chapter all to itself (Moss and colleagues), whereas the much more thoroughly studied α subunit of retinal transducin is not. A summary of the confusing literature on G proteins and neutrophil function (Snyderman and colleagues) is useful, but one seeks in vain a scholarly account of hormone-sensitive adenylyl cyclase—the signaling system, after all, in which the first G protein was discovered.

Three books on G proteins (not including symposium volumes) have appeared in the last year—surely enough to satisfy all but the most ravenous appetites. They overlap not only in subject matter but also in contributors; several authors have contributed papers on the same subject to all three. Compared to the present volume, *G Proteins*, edited by Birnbaumer and Iyengar (Academic Press, 1989) is more comprehensive but lacks detailed coverage of bacterial exotoxins. Both books cover G proteins in more detail than does the slender (232 pages) *G-Proteins as Mediators of Cellular Signaling Processes*, edited by Houslay and Milligan (Wiley, 1990).

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Books Received

Account Episodes. The Management or Escalation of Conflict. Peter Schonbach. Cambridge University Press, New York, and Editions de la Maison des Sciences de l'Homme, Paris, 1990. x, 222 pp., illus. $49.50. European Monographs in Social Psychology.

Accountancy Comes of Age. The Development of an American Profession, 1886–1940. Paul J. Miranti, Jr. University of North Carolina Press, Chapel Hill, NC, 1990. xii, 275 pp. $29.95.

Behavior, Society, and Nuclear War. Vol. 1. Philip E. Tetlock *et al.*, Eds. Oxford University Press, New York, 1990. xii, 401 pp. $49.95. From the Committee on Contributions of Behavioral and Social Science to the Prevention of Nuclear War, National Research Council.

Blood Cell Biochemistry. Vol. 1, Erythroid Cells. J. R. Harris, Ed. Plenum, New York, 1990. xviii, 537 pp., illus. $89.50.

Botany for Gardeners. An Introduction and Guide. Brian Capon. Timber, Portland, OR, 1990. 220 pp., illus. $29.95.

Categorical Perception. The Groundwork of Cognition. Steven Harnad, Ed. Cambridge University Press, New York, 1990. x, 599 pp., illus. Paper, $27.95. Reprint, 1987 ed.

The Cerebral Cortex of the Rat. Bryan Kolb and Richard C. Tees, Eds. MIT Press, Cambridge, MA, 1990. xii, 645 pp., illus. Paper, $35. A Bradford Book.

Change in Societal Institutions. Maureen T. Hallinan, David M. Klein, and Jennifer Glass, Eds. Plenum, New York, 1990. xvi, 277 pp., illus. $39.50.

Drinking and Driving. Advances in Research and Prevention. R. Jean Wilson and Robert E. Mann, Eds. Guilford, New York, 1990. x, 294 pp., illus. $37.50. Guilford Substance Abuse Series.

The Elements of Nonlinear Optics. Paul N. Butcher and David Cotter. Cambridge University Press, New York, 1990. xiv, 344 pp., illus. $49.50. Cambridge Studies in Modern Optics, 9.

Experimental Inquiries. Historical, Philosophical and Social Studies of Experimentation in Science. H. E. Le Grand, Ed. Kluwer, Boston, 1990. xviii, 275 pp., illus. $79. Australasian Studies in History and Philosophy of Science, vol. 8.

The Fate of the Forest. Susanna Hecht and Alexander Cockburn. HarperPerennial (HarperCollins), New York, 1990. x, 357 pp., illus. Paper, $9.95.

Fidia Research Foundation Neuroscience Award Lectures. Vol. 4, 1988–1989. Raven, New York, 1990. x, 227 pp., illus. $50. Lectures by Jean-Pierre Changeux, Rodolfo R. Llinás, Dale Purves, and Floyd E. Bloom.

Finsler Geometry and Applications. Aurel Bejancu. David E. Blair, Translation Editor. Horwood, New York, 1990. 198 pp., illus. $59.50. Ellis Horwood Series in Mathematics and Its Applications.

Fox at the Wood's Edge. A Biography of Loren Eiseley. Gale E. Christianson. Holt, New York, 1990. x, 517 pp., illus. $29.95.

Graphics Gems. Andrew S. Glassner, Ed. Academic Press, San Diego, CA, 1990. xxx, 833 pp., illus. $49.95.

Guidance and Control 1990. Robert D. Culp and Arlo D. Gravseth, Eds. Published for the American Astronautical Society by Univelt, San Diego, CA, 1990. xvi, 660 pp., illus. $95; paper, $80. Advances in the Astronautical Sciences, vol. 72. From a conference, Keystone, CO, Feb. 1990.

Handbook of Mineralogy. Vol. 1, Elements, Sulfides, Sulfosalts. John W. Anthony *et al.* Mineral Data, Tucson, AZ, 1990. x, 588 pp. $82.50.

Human Sex Determination. An Historical Review and Synthesis. Ronald Wells. Riverlea, Tharwa, Australia, 1990. vi, 244 pp. Paper, $30.

Inquiry and Change. The Troubled Attempt to Understand and Shape Society. Charles E. Lindblom. Yale University Press, New Haven, CT, and Russell Sage Foundation, New York, 1990. xiv, 314 pp. $29.95.

An Introduction to Dynamical Systems. D. K. Arrowsmith and C. M. Place. Cambridge University Press, New York, 1990. viii, 423 pp., illus. $79.50; paper, $29.95.

The Invisible Hand. Economic Equilibrium in the History of Science. Bruna Ingrao and Giorgio Israel. Ian McGilvray, Trans. MIT Press, Cambridge, MA, 1990. xvi, 491 pp., illus. $47.50. Translated from the Italian (Roma-Bari, Italy, 1987).

Isozymes. Structure, Function, and Use in Biology and Medicine. Zen-Ichi Ogita and Clement L. Markert, Eds. Wiley-Liss, New York, 1990. xxvi, 973 pp., illus. $250. Progress in Clinical and Biological Research, vol. 344. From a congress, Toyama, Japan, May 1989.

Kangaroos, Wallabies, Rat-Kangaroos. Gordon Grigg, Peter Jarman, and Ian Hume, Eds. Beatty, Chipping Norton, Australia, 1989. 2 vols. xxiv, 835 pp., illus., + plates. $148. From a symposium, Sidney, Australia, May 1988.

Knowledge, Culture, and Science in the Metropolis. The New York Academy of Sciences 1817–1970. Simon Batz. 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.

Lectures on the Theory of Few-Body Systems. V. B. Belyaev. Springer-Verlag, New York, 1990. x, 134 pp., illus. $45. Springer Series in Nuclear and Particle Physics. Translated from the Russian edition (Moscow, 1986) by G. B. Pontecorvo.

Logic and Computation. Interactive Proof with Cambridge LCF. Lawrence C. Paulson. Cambridge University Press, New York, 1990. xiv, 302 pp., illus. Paper, $24.95. Cambridge Tracts in Theoretical Computer Science, 2. Reprint, 1987 ed.

Madness in the Streets. How Psychiatry and the Law Abandoned the Mentally Ill. Rael Jean Isaac and Virginia C. Armat. Free Press (MacMillan), New York, 1990. x, 436 pp. $24.95.