BOOK REVIEWS

Science in Brazil

A Space for Science. The Development of the Scientific Community in Brazil. SIMON SCHWARTZMAN. Pennsylvania State University Press, University Park, 1992. x, 286 pp. $32.50. Revised translation of the Portuguese edition (1979).

A decade ago I attended, as the science counselor of the American embassy in Brasília, the opening in Campinas of a meeting of the Brazilian Association for the Advancement of Science. It seemed all too First World: a local symphony orchestra played classical music and the distinguished President offered opening remarks. Even the protesters, who interrupted but did not disrupt, seemed familiar. But then, right at the end, the orchestra struck up a well-known *samba* and everyone leapt into the aisles and danced, chins held high, singing "Brasil, Brasil" in a position the whole world has come to know from television coverage of Rio's Carnival extravaganza.

Samba (along with many other aspects of Brazilian life) contrasts strongly with the ideal so starkly inscribed on the national flag: "order and progress." There has nevertheless grown in this Third World country with First World ambitions a scientific community second only to India's among developing countries, with areas of excellence that compete in the major leagues. *A Space for Science* is the most comprehensive and intelligent account of Brazilian science, past and present, I have seen. Its availability in English in this extensively revised version is to be welcomed.

For Schwartzman, the glass is half empty, however. He opens with the myth of Sisyphus and chronicles the repeated, and only partly successful, efforts to promote scientific culture in Brazil. Eventually, efforts would crystallize around local health problems, minerals, animals and plants, the weather, solar eclipses: all provided reasons for scientific activity and left behind people and institutions to carry it on, but none was strong enough as a social and intellectual force to support the scientific enterprise as a whole.

Only in the 1930s did Brazil acquire the kind of university, in São Paolo, that could sustain modern research and teaching of the sort known in the industrialized world. The ingredients of this development are well worth noting: the University of São Paolo was founded by the local elite, in reaction to the defeat of their political rebellion, with extensive help from French academics. The Paulistas might not be able to have their own country, but they would have their own education, one inspired by European culture.

Politics and foreigners have remained ingredients of Brazilian scientific development ever since. The French and Italians were especially important before World War II, but it was the Americans who would establish stronger links thereafter. Beginning with the Rockefeller Foundation's efforts in the 1930s, the United States became a source of funding, training, professors, and inspiration.

This foreign contribution to Brazilian science is not something all Brazilians want to hear about, and it gives some Americans pause as well. The political context of Brazilian science is highly nationalistic, at times even xenophobic. Science in Brazil has become associated not with European culture but with efforts to find substitutes for imports, to exploit the country's natural resources, and to develop the national economy.

After the military took over in 1964, scientists expected to suffer, and many left the country. Seeing one of them approaching me at a conference years later, I expected him to berate me for American support of the dictatorship, only to find him thanking me for the efforts of a predecessor of mine at the embassy who had helped him to leave the country on short notice to avoid arrest.

Scientists and soldiers in fact soon found more common ground than expected by applying science and technology to development. They reserved the domestic market for telecommunications equipment and computers, maintained a "parallel" (and in part secret) nuclear program distinct from that associated with safeguarded German sales of reactors and fuel cycle technology, and undertook a national missile program that aimed eventually at a space-launch vehicle.

I once knew well the major figures in these national programs, and it is hard for me to agree with Schwartzman that the glass is half empty. I take it from him that with the return to democracy and the economic crisis of the late 1980s science in Brazil has been less well supported than it was in the fading years of the military dictatorship, when I lived and worked there. But the excitement and vision of those who tried to forge Brazil's future through science and technology were inspiring, even when their efforts were economically counterproductive, damaging to the environment, and risky in terms of nuclear proliferation and sales of missiles to Iraq and Libya.

The political context has now changed. Today, a well-known opponent of proliferation is a government minister, Brazil's economy is opening up, and the country is hosting a world environment conference that will unquestionably express concerns about the Amazon that the military regime would once have rejected out of hand. Schwartzman is disappointed that science for the sake of knowledge has not caught on in Brazil, but that it has caught on for any purpose should be a source of satisfaction to those who wish that immense and populous country the best. Nothing against *samba*, of course. But order and progress should have their place as well.

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Some Other Books of Interest

Modern Radio Science, 1990. J. BACH ANDERSEN, Ed. Published for the International Union of Radio Science by Oxford University Press, New York, 1991. x, 210 pp., illus. $42.

Among the activities of the International Union of Radio Science since the mid 1980s has been the sponsorship of some half dozen books, ranging in character from a *Review of Radio Science* to a *Directory of Radio Scientists in Developing Countries*. With the present volume, a sequel to a 1988 work of similar title, the Union sets out to provide "at least a glimpse of what Modern Radio Science is"—in the editor's words, "a truly amazing collection of phenomena all bound together by electromagnetic fields"—as of the time it was prepared. The volume contains 11 papers, most of them apparently originating as "tutorials" arranged by the various commissions the Union comprises. In one paper B. Kibble gives a report on electrical metrology, noting increases in the precision with which the volt and the ohm can be defined and concluding that "by no means have the SI units ceased to evolve." S. Ström, representing the commission on fields and waves, discusses work on techniques for solving electromagnetic field problems, and Carl E. Baum, James W. Eastwood, L. O. Chua, and V. Radhakrishnan offer expositions of the theory of electromagnetic interference control, simulation methods for plasma wave research, nonlinear net-

works and chaos, and polarization, respectively. Space exploration provides the impetus for several of the contributions—Owen K. Garriott on research from manned space platforms, Gerald R. North on satellite measurements of moisture variables as related to global change, and P. Bauer on the ionosphere as viewed from space. Finally, there are two papers that have a biological cast: W. Ross Adey on "electromagnetic fields and the essence of living systems" and Humio Inaba on "bio-information" from ultraweak photon emissions.

Katherine Livingston

Advances in Bioclimatology, 1. G. STANHILL, G. L. HAHN, J. D. KALMA, R. S. LOOMIS, and F. I. WOODWARD, Eds. Springer-Verlag, New York, 1992. x, 157 pp., illus. $89.

In his preface to this new series Stanhill notes that advances in bioclimatology—defined as "the study of the relations between the physical environment and the form and function of living organisms"—have been "unevenly spread through the vast field of interest encompassed" by the term. The purpose of the series is to overcome this separation by providing a "common forum." The inaugural volume consists of four papers. In the first, R. L. Desjardins briefly reviews techniques for measuring CO_2 flux densities both locally, with ground-based instrumentation, and regionally, from aircraft, noting also the potential of such large-scale projects as the First International Satellite Land Surface Climatology Field Experiment. R. M. Gifford then discusses the relation of CO_2 to vegetation productivity, considering photosynthetic irradiance, water regime, temperature, and nutrients. Modeling of radiative transfer in nonhomogeneous plant canopies is the subject of a contribution by T. Nilson, who concludes that, given the difficulty of determining the input data required, more models of canopy and individual plant structure are needed. The last and longest paper in the volume is a consideration by E. A. N. Greenwood of deforestation, revegetation, and water balance that is subtitled "An optimistic path through the plausible, impracticable and the controversial." Each paper has an extensive reference list, and there is a subject index for the volume as a whole. Volume 2 of the series, also scheduled to appear this year, will be devoted to the bioclimatology of frost, announced contributors being J. D. Kalma, G. P. Laughlin, J. M. Caprio, and P. J. C. Hamer.

Katherine Livingston

Paleoanthropology Annuals. Vol. 1, 1990. ERIC DELSON, IAN TATTERSALL, and JOHN VAN COUVERING, Eds. Garland, New York, 1992. xvi, 287 pp., illus. $55.

This volume inaugurates a series of reprint collections, based on the resources available at the American Museum of Natural History, that is "designed to make available to a wide audience a selection of those works . . . which the Editors consider to have been the most significant" in the field of paleoanthropology. Chronologically, the criterion for inclusion is, the editors state, actual appearance in the calendar year the volume represents, rather than date of record. The editors open the volume with an essay on "the year in paleoanthropology." Highlights they discuss include various proposals regarding the contested status of plesiadapiforms as early primates, several significant finds of Miocene hominoid fossils, new approaches to deciphering primate paleoenvironments and the timing of developmental sequences, and discoveries of various Middle Pleistocene artifact assemblages in Europe. Ongoing interpretation of and controversies over already known material are also summarized. The year 1990 saw, in addition to the many additions to the journal literature, the appearance of eight books the editors deem noteworthy, and these, along with over 40 papers not included in the volume, are listed in a bibliography that follows the introductory essay. For reprinting, a total of 32 articles have been chosen from some dozen journals ranging from *Science News* (a write-up of a controversy over a specimen of *Ouranopithecus*) to *Palaeontographica, Abteilung A* (an announcement of a possible new species of omomyid primate from Morocco), with representation from such general journals as *Nature* (five papers) and *Science* (three) as well as from anthropological and paleontological journals. The articles have been put into a uniform format, and those originally published in languages other than English have been translated by the editors.

Katherine Livingston

Vignettes: Popular Images

Most people I have met, even in the outback of Australia, seem to have heard of the giant radio telescope at Jodrell Bank—it is, so to speak, the Eiffel Tower of England.

—*R. Hanbury Brown*, in *Boffin: A Personal Story of the Early Days of Radar, Radio Astronomy and Quantum Optics* (Hilger/Institute of Physics)

Steinmetz has certainly not kept pace with Edison, Ford, Babe Ruth, and the other folk heroes of the "lowbrow" newspaper story . . . . [One] reason for Steinmetz's decline in popularity has to do with the shift in hero worship in the twentieth century from idols of production (in industry, politics, and the military) to idols of consumption (movie stars and sports figures, for example) . . . . Edison, Ford, Steinmetz, and Harding were idols of production; Ruth and Dempsey were idols of consumption. One reason Edison and Ford were so popular is that they easily became idols of consumption as well. Edison's picture and name appeared on such everyday items as phonograph cylinder cases and light bulb advertisements. Ford's name was stamped on every Model T . . . . But what was there to consume in the case of Steimetz? The square root of minus one? Lightning in the laboratory?

—*Ronald R. Kline*, in *Steinmetz: Engineer and Socialist* (Johns Hopkins University Press)

I had a science fiction magazine called *Strange Adventures*. It was a monthly magazine and was selling slightly above average. One issue had a fantastic rise in sales—a leap of ten points. What happened? We looked at the cover which showed a gorilla in a cage in a zoo. The people outside the cage were looking at this gorilla, and the gorilla had a slate in his hand and he had written in chalk, "Please help me, I am the victim of a horrible scientific experiment."

—*Julius Schwartz*, as quoted by Mike Benton in *The Illustrated History of Science Fiction Comics* (Taylor)