



**Woven warning:** detail from the Bayeux tapestry showing Harold I being told of comet Halley. The eleventh- or twelfth-century tapestry in Bayeux, France depicts the Norman conquest of England.

Charles Darwin and, perhaps influenced by his views, which favoured slow evolutionary processes for explaining the development of life, the catastrophism of Newton and Halley was all but ignored until fairly recently.

In the past few decades, comet and asteroid collisions have once again been recognized as important processes in rearranging the surfaces of the planets and their satellites and abruptly changing the evolution of life on Earth. There is a growing consensus in the astronomical community that comet collisions with Earth may have laid down much of the thin layer of carbon-based molecules and water that allowed the formation of life 3,500 million years ago.

Subsequent cometary collisions may have caused mass extinctions, allowing only the most adaptable species to evolve further. We mammals may owe our pre-eminent position on Earth to a series of cometary collisions that eliminated our stronger, but less adaptable, competition — including the dinosaurs.

This book is not a general history of comets. Rather than focusing on the development of ideas about their motions or physical characteristics, the author is concerned primarily with the perception of comets throughout history. It is a scholarly, well-illustrated and accurate work. Nearly half the volume is devoted to footnotes and references, however, which leaves the reader with the annoying task of continually having to leaf back and forth between the two halves.

European and English perceptions of comets during the seventeenth and eighteenth centuries are emphasized. Little mention is made of other cultures — that of China, for example — that actively observed and recorded comets. But within the confines of the subject area presented, the author does a fine job. The book should make an important contribution to the history of astronomy. □

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## Getting down to business

### The Scientist as Consultant: Building New Career Opportunities

by Carl J. Sindermann and Thomas K.

Sawyer

Plenum: 1997. Pp. 341. \$29.95, £18.15

William Bains

'Consulting' is famously identified with someone who steals your watch to tell you the time and, in this era of 'downsizing', has become almost synonymous with 'unemployed'. An exception to both calumnies is the technical consultant, especially the scientist. These are people who provide their expertise to many clients for a fee. But this book is not aimed at them, but rather at people who wonder whether consultancy is a career for them. Whether the career is right for you or not, the book is an excellent guide to help you decide.

What is a scientific consultant? The authors wrestle with this, and arrive at "a technically trained entrepreneur who makes available for a stated price his expertise, data, data analysis, evaluation and recommendations relevant to a client's needs", a catch-all they admit is unsatisfactory. They also emphasize the need for professional ethics as a consultant, citing a quaintly pre-1980s definition of a professional as one "who maintains a loyalty to a code of ethics that transcends his or her loyalty to the rest of the organisation" or to themselves, a tenet which, if adhered to by major consultancies, would send several of them bankrupt.

But above all the consultant is a business person, and consulting is a business. Consultants must be interested in the processes of both business and science. This means accepting the value of lawyers and accountants as advisers, sending off bills promptly and harassing clients who refuse to pay them, and 'selling'. Most scientists are unused to selling anything except ideas and, if you are not keen to try, then consultancy is not for you. Most consultancies fail, the authors believe, because of lack of aptitude for and interest in business. Squaring this with the Sisyphean task of keeping technically current requires real entrepreneurship. Scientific consulting is not just 'a job'.

The authors describe a rewarding career path from paid hobbyist to professional manager, which you can join or leave at will. They examine what sort of people might flourish in consultancy and why, how to escape from it, what the future is, and how people change, succeed or fail. They also give substantial detail on what consultants actually do. (The section on managing scientists is excellent — a 'must' for department heads as well as industrial managers.) The book is

stuffed with useful comments and guidance, including a very honest (if rather short) section on the downside of consulting. Consultants will enjoy putting names to the list of "clients from hell".

My only serious disagreement is with the authors' perception of big consultancy companies. Graduate entry to a large consultancy is not a viable route to a career in scientific consulting. Scientists are the drudges in such organizations, and do not rise to the top without radically altered goals; the leader of the 'science division' in one such consultancy publicly commented early in his post that research and development were a waste of money. Nor can they leave to set up on their own, as the competition clauses in their employment contracts will prevent them from competing as a consultant with their erstwhile employer. The route to scientific consultancy is clearly science first, consultancy later.

The book has a strong US bias, and 'rest of world' seems to mean not Europe but Africa. That said, non-American readers can easily sidestep the few parochial discussions.

This is a business book, because consultancy is a business. But, like science, the book is full of facts and hard detail, and does include the negative controls of business or scientific failure. It is an excellent guide to a fascinating career choice. □

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### Corrections

● Some incorrect star ratings were awarded to *The Colours of Life* by Lionel R. Milgrom in the review in *Nature* **389**, 687; 1997. They should have been "excellent" for range and style, "good" for depth, accuracy and accessibility, and "fair" for up-to-dateness. Our apologies for falsely raising expectations.

● In his review of *Molecular Systematics of Fishes* edited by T. D. Kocher and C. A. Stepien (*Nature* **389**, 30; 1997), John Long says that the book "only covers the largest living group of fishes, the teleostean fishes". The editors have asked us to point out that the book in fact contains a chapter on "Interrelationships of Lamniform sharks" — which are not, of course, teleosts.

● *Tropical Medicine and International Health*, reviewed in this year's New Journals supplement (*Nature* **389**, 145; 1997), resulted from the pooling of four previously existing journals, not three. The title not mentioned is the German *Tropical Medicine and International Health*, whose independent history extends back to 1897. *Antiviral Therapy*, reviewed on page 144 in the same supplement, has since its third issue been published by International Medical Press, not MediTech Media.

ence interpretation of quantum mechanics omits the central criticism that even if there are no correlations, the standard probability interpretation still has to be put in 'by hand'. He also fails to explain why it has led many people to take the Everett relative state theory more seriously, realizing that the central feature of this theory is not so much the splitting of the Universe as its potential for reunification in a future interference experiment.

No-one could accuse Jeffrey Bub of not taking the conceptual problems of quantum mechanics seriously. His authoritative book *Interpreting the Quantum World* makes no attempt to address a general audience, but consists of deep and detailed consideration of most, if not all, current thought in this area.

Many technical results are described and proved in detail. Bub clearly understands the Everett theory, but does not accept it. He explains David Albert's argument leading to apparent inconsistencies between different predictions of the answer an observer (Eve) would make to a questioner (Adam) about whether she has a definite belief about the result of the observation of the polarization state of a photon.

But I do not believe that Bub and Albert have properly taken on board the effects of decoherence, which explains why the classical states provide a preferred basis for this description. It seems to me that this inevitably makes it impossible in practice for Adam to address his question to the whole of Eve's mental state rather than to the branch of it in which he himself exists. I wonder whether similar considerations will not also form an insuperable barrier to the practical realization of a quantum computer.

It is probably no surprise to those who know about Bub's work that he ends up defending hidden-variable theories similar to those invented by David Bohm, with whom Bub started his research career. But I detect no trace of the "implicate order" beloved by the later Bohm, so I hope that Milburn would include this book in the subset of such texts that he describes as "quite excellent" in contrast to others that "invoke time-worn mysticism, both western and eastern". □

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**Related books**

*Mathematical Undecidability, Quantum Nonlocality and the Question of the Existence of God* edited by Alfred Driessen and Antoine Suarez. Kluwer, \$160, £95. Contains Paul Davies' acceptance lecture for the 1995 Templeton Prize.

*The Message of the Atoms: Essays of Wolfgang Pauli and the Unspeakable* by Kalervo V. Laurikainen. Springer, \$42, £26. Philosophical basis and implications of the Copenhagen interpretation of quantum mechanics.

**At a glance**

Excellent ★★★★★ Good ★★★★ Fair ★★★ Poor ★

**Radioactive and Stable Isotope Geology**

by H.-G. Attendorn and R. N. C. Bowen  
*Chapman and Hall: 1997. Pp. 522. £95, \$174.95*

Isotopic methods today crop up in every branch of modern Earth sciences and can elucidate countless processes that have shaped the Earth throughout its history, as well as making possible the dating of geological events. Here is a conscientious attempt to summarize the general principles of isotope geology as well as methods and techniques available for radioactive isotope dating, stable isotope abundance studies in the biosphere, and isotopic studies of terrestrial and planetary lithospheres.

The book is updated from an earlier version published in 1988. Because of the wide coverage, each section can provide only a basic introduction to principles and applications, and not all sections show the same critical insight. The reference list is not particularly exhaustive or up to date.

The descriptive density of the text and the overall paucity of illustrations may motivate prospective researchers to seek out more specialized textbooks and review articles.

The book is therefore recommended primarily for science libraries and laboratory reference shelves.

**Stephen Moorbath** *Department of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR, UK.*

Range	★★★★★
Depth	★★★
Accuracy	★★★★
Up-to-dateness	★★
Accessibility	★★★★
Style	★★★

**The Colours of Life: Introduction to the Chemistry of Porphyrins and Related Compounds**

by Lionel R. Milgrom  
*Oxford University Press: 1997. Pp. 249. £22.50, \$95*

"Porphyrins: molecules for all seasons" comes to mind as an alternative title for this book. The thesis that porphyrins permeate nature is sustained by seven chapters ranging from the origin of the Solar System and abiotic synthesis of porphyrins to their use in cancer therapy and possible application in molecular electronics. What other book would cover subjects as diverse as Kant-Laplace theory, anti-aromaticity and the Peierls transition?

The porphyrin-oxygen duet is the book's centrepiece. First we learn that the high oxidation potential available in PSII chlorophyll made possible the evolution of oxygen (a terrific pollutant which must have brought an end to much of early life).

Then we see how oxygen handling by haemoproteins made the full energy of reduced

**Paleontological Events: Stratigraphic, Ecological, and Evolutionary Implications**

edited by Carlton E. Brett and Gordon C. Baird  
*Columbia University Press: 1997. Pp. 604. \$65, £52*

Over the past 150 years, many groups of fossils have been used to establish a detailed biostratigraphy for Phanerozoic time. Biozonal schemes can achieve temporal subdivisions as short as 0.5–1.0 million years for strata as old as the Silurian period (417–443 million years ago) using the extinct graptolites. But is this the best that can be achieved, given the nature of the fossil record?

This multiauthored volume shows that renewed understanding of short-term 'catastrophic' episodes has recently opened the way to the possibility of such geologically 'instantaneous' events being recognized by fossil biomarkers.

Storms, earthquakes and volcanic eruptions all produce particular effects on land, different ones on the continental shelf and yet others in deeper marine basins.

The essays show how an understanding of the processes and effects of short-term events in different depositional environments are helping to pinpoint such events in Lower Palaeozoic rocks in North America.

**Douglas Palmer** *31 Mawson Road, Cambridge CB1 2DZ, UK.*

Range	★★
Depth	★★★
Accuracy	★★★★
Up-to-dateness	★★
Accessibility	★★★★
Style	★★★

carbon compounds available so that aerobes could evolve. And, finally, we discover that the photophysics of singlet oxygen sensitization by porphyrins which nature struggled to suppress in photosynthesis is used, ironically, to our advantage in photomedicine.

The chemistry along the way is elaborate, engaging and presented with unusual insight.

What is the price for exploring porphyrin chemistry on geological to photophysical timescales in 249 pages? Not too high: certain details about photosynthesis are confused and the latest information in the final chapter on "Porphyrins for the future" is about four years old.

**Thomas A. Moore** *Department of Chemistry and Biochemistry, Arizona State University, Tempe, Arizona 85287-1604, USA.*

Range	★★★★
Depth	★★★★
Accuracy	★★★★
Up-to-dateness	★★★★
Accessibility	★★★★
Style	★★★★

## Scales of progress

### **Air-Breathing Fishes: Evolution, Diversity and Adaptation**

by Jeffrey B. Graham  
*Academic*: 1997. Pp. 299. \$79.95, £55

### **Molecular Systematics of Fishes**

edited by Thomas D. Kocher and Carol A. Stepien  
*Academic*: 1997. Pp. 314. \$79.95, £57

**John Long**

Perhaps the greatest step in vertebrate evolution was the transition from fishes dwelling in an aqueous habitat to tetrapods crawling on land. Many scientists tend to think of the complex skeletal and physiological changes that happened during the geologically short time span involved, yet few are aware of the many inherent changes in the evolution of fishes that set the stage for their invasion of a new habitat.

Study of the anatomy and physiological mechanisms of air-breathing in living fishes gives an insight into the environmental factors that may have driven the first fishes into adapting an air-breathing behaviour. In *Air-Breathing Fishes*, Jeffrey B. Graham outlines the complete biology of how and why some fishes breathe air, investigates possible reasons for how such adaptations may have evolved, and revisits the fish-tetrapod transition from a fresh viewpoint.

Today some 49 families of fishes have representative air-breathers, falling broadly into two behavioural categories, the amphibious air-breathers and the aquatic air-breathers. Although lungfishes are commonly known as typical air-breathing fishes, there is also a great diversity of actinopterygian fishes

which can partially respire subaerially. The first two chapters of the book comprehensively cover the environmental factors affecting air-breathing, the terminology involved and the diversity of living air-breathing fishes. The remaining chapters deal with the anatomy and physiology of air-breathing fishes, specifically the anatomy of respiratory organs, circulatory adaptations, aerial and aquatic gas exchange and metabolic mechanisms, cardiorespiratory control, blood respiratory properties and metabolic adaptations. The book is well illustrated with clear diagrams, good photographs of dissected specimens, tissue sections and some scanning electron micrographs. It is written in a clear style, is well referenced and has a good index. It should have wide appeal for all interested in the anatomy of fishes and their physiology.

*Molecular Systematics of Fishes* is a collection of 17 papers covering the range of new and improved methods for taxonomic investigation using such molecular techniques as polymerase-chain-reaction amplification and DNA sequencing. Such methods are now widely used for comparing populations of living fishes with their neighbours, or for more distant phylogenetic relationships between species in widely distant taxonomic groups. Despite the all-encompassing title, the book only covers the largest living group of fishes, the teleostean fishes. It holds a wealth of valuable information visually well presented by many cladograms and tables. A must for teleost taxonomists and general fans of phylogenetic systematics. □

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From the cover of *Fishes of Chesapeake Bay* by E. O. Murdy, R. S. Birdsong and J. A. Musick. Smithsonian Institution Press, \$49.95, £38.95.

## New in paperback

### **Brainstorms: Philosophical Essays on Mind and Psychology**

by Daniel C. Dennett  
*Penguin*, £12.50

### **Where Does the Weirdness Go? Why Quantum Mechanics Is Strange, But Not As Strange As You Think**

by David Lindley  
*Verso*, £7.99

### **Infinity and the Mind: The Science and Philosophy of the Infinite**

by Rudy Rucker  
*Penguin*, £8.99

### **The Second Creation: Makers of the Revolution in Twentieth Century Physics**

by Robert P. Crease and Charles C. Mann  
*Quartet*, £12

### **Children Talk About the Mind**

by Karen Bartsch and Henry M. Wellman  
*OUP*, £14.95

### **Grassland: The History, Biology, Politics, and Promise of the American Prairie**

by Richard Manning  
*Penguin*, \$12.95

### **Humanity's Descent: The Consequences of Ecological Instability**

by Rick Potts  
*Avon*, \$14

### **The Molecular Vision of Life: Caltech, The Rockefeller Foundation, and the Rise of the New Biology**

by Lily E. Kay  
*OUP*, £16.95

### **The Evolving Coast**

by Richard A. Davis Jr  
*W. H. Freeman/Scientific American Library*, \$19.95

### **Size, Function, and History**

by William A. Calder III  
*Dover*, £14.95

### **Time's Arrows Today: Recent Physical and Philosophical Work on the Direction of Time**

edited by Steven F. Savitt  
*CUP*, £16.95, \$24.95

### **A Natural History of Amphibians**

by Robert A. Stebbins and Nathan W. Cohen  
*Princeton University Press*, \$19.95, £15

understanding of the diverse modes of viral replication may yield a variety of safe, efficacious, antiviral drugs and combination therapies. Later, there will surely be horror stories about epidemics of drug-resistant viruses for the journal to publish. □

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## Out of Africa

### Tropical Medicine and International Health: A European Journal

Coordinating editor D. J. Bradley  
Blackwell Science. 12/yr. North America \$690.50, Europe £378, elsewhere £416 (institutional); North America \$99.50, Europe £55, elsewhere £60 (personal)

**Robert Desowitz**

When Patrick Manson published his *Tropical Diseases* in 1898, there was no question what constituted a tropical disease: when an Englishman got malaria in the Fens of East Anglia it was an English disease; when an African got malaria it was a tropical disease. With the demise of colonialism, 'tropical medicine' became something of a pejorative.

However, to suggest that the diseases of tropical peoples were really nothing more geographically exclusive than the common cold would not be biologically or epidemiologically correct, and, bereft of the drama of the term, would not be attractive to international funders of health projects in the developing world. Modifiers such as 'international health', 'geographic medicine' and 'travel medicine' have come into fashion, although it is difficult to discern the difference they represent from Manson's *Tropical Diseases* and the discipline of tropical medicine.

And so to *Tropical Medicine and International Health: A European Journal*. Actually, this is not a brand new journal but a meld of



three old journals: the *Annales de la Société Belge de Médecine, Journal of Tropical Medicine and Hygiene* and *Tropical and Geographical Medicine* (which itself incorporated *Acta Leidensia* and *Tropical Medicine and Parasitology*). Those who wish the discipline of tropical medicine to prosper will have difficulty in deciding whether to rejoice at the founding of a new journal or mourn the loss of three well-established journals.

Each of the old journals had something of a distinct character; they were all good but not great journals. Clinicians, clinical researchers and laboratory scientists would send their good, but not their best, stuff to them. This is in no way to demean those journals, whose contents were very often more meaningful for the understanding, control and management of tropical diseases than the more rarefied papers in the journals considered more exalted in the publication hierarchy.

In reviewing the four issues from December 1996 to March 1997, one gets the impression that the amalgam that is *Tropical Medicine and International Health* has assumed, gestalt-like, the character of its components. Most of the papers are related to the diseases and health problems of sub-Saharan Africa. The papers are mostly on clinical topics, with or without a laboratory element, and public health studies on sanitation, policy and education.

There are very few (I counted only two) papers that report pure, laboratory-based, experimental research. Each issue begins with an editorial on an important aspect of tropical health, although none shows fire-in-the-belly fierce advocacy.

If I were a member of my institution's or department's library committee, I would certainly recommend subscription to the journal and would personally look forward to reading each new issue. Besides, three for the price of one is a bargain. □

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## Development ladder

### Science, Technology and Society: An International Journal Devoted to the Developing World

Edited by V. V. Krishna and Roland Waast  
Sage. 2/yr. Rs395, £58, \$88 (institutional); Rs225, £26, \$38 (personal)

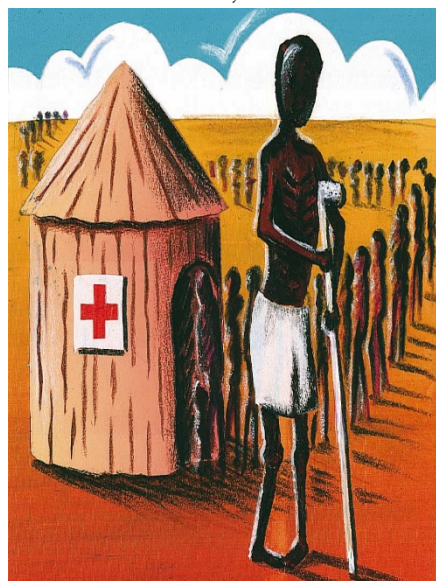
**Ziauddin Sardar**

What contribution do science and technology make to the economic development of a developing country? Conventional wisdom suggests that serious expenditure (around three to five per cent of gross national product) on research and development (R&D), particularly in pure sciences, automatically leads to economic development.

But more than five decades of experience now demonstrate that there is no direct connection between the R&D efforts of a country and its climb up the development ladder. The 'Asian tigers' — Malaysia, Thailand and Indonesia — acquired their 'newly industrialized' status by largely ignoring science and concentrating on manufacturing technology. And countries with highly developed research infrastructures, such as India, Egypt and Brazil, have achieved relatively little in terms of economic development. It turns out that the relationship between science, technology and a developing society is much more complex than the linear model dominant in science policy for so long.

Indeed, the proper study of this complex relationship calls for a new, interdisciplinary field of inquiry. Although the new discipline has to be broadly located in science, technology and society studies, it must have a more specific boundary defined by the cultures, traditions, histories and modern dynamics of developing countries. *Science, Technology and Society* is designed to map out this territory and to lay the foundations of the new discipline.

In many respects, the journal is similar to *Social Studies of Science*. It broadly covers the same area from the perspective of the devel-



oping world: history, philosophy and sociology of science and technology; social, gender and environmental issues in science and technology; and science and technology management. But, not surprisingly, the overall accent of the journal is firmly on science and economic development.

Even though it is edited from India, and has a bias towards things Indian, particularly in its review section, the journal casts a wide net. Latin America and Eastern Europe are well represented, and the main articles also carry abstracts in French and Spanish. And, despite its high standard of scholarship, the journal is designed to be accessible to a broad range of scientists working in R&D fields. It should be on the essential reading lists of all scientists with an interest in developing countries. □

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## What's it all worth?

### Environment and Development Economics

Editor Charles Perrings

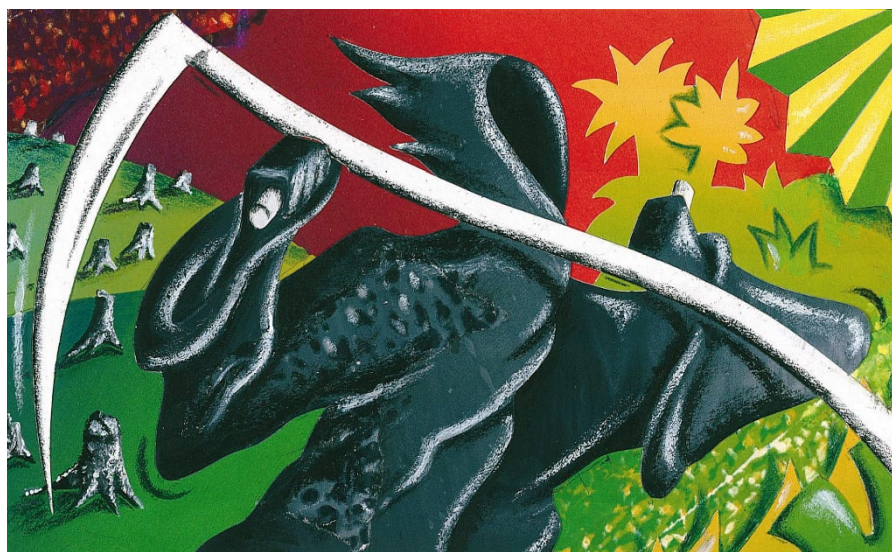
Cambridge University Press. 4/yr. £84, \$126 (institutional); £44, \$66 (personal); £22 (developing countries)

#### Neil Adger

It is the dominant world-view of applied social and natural scientists that the nature of economic preferences for natural resources and the environment is central to understanding why environmental change is occurring. Given the increasing scarcity of quality environments in all societies, and the apparent lack of success of regulators and individuals to stem the excesses caused by corporate, state and individual misuse of resources, insights from interdisciplinary research are required ever more urgently.

This journal provides evidence that analysis of these relationships is a burgeoning, policy-relevant field. In the first volume, applied papers examine such issues as the consequences of forest cover change; the intergovernmental economic institutions of the United Nations and their, at best, ambiguous role in sustaining the world's resources; epidemiology and environmental change; and economic incentives for conserving biological resources in contexts such as the ivory trade and wildlife hunting.

The target audience is primarily economists rather than other social scientists and natural scientists. Economists often argue that many decision-makers in government and other organizations are attuned to economists' ways of thinking and so they have a special place in the policy process, but not everyone believes what economists say.



MARK DOBSON

The journal plugs a hole in the literature, but it is one that has already been rapidly filling in the past few years with journals such as *Environmental and Resource Economics* and *Ecological Economics*, with which this journal shares many editorial board members.

The journal is attractively produced and contains both applied and theoretical papers and a policy forum section in each of the first year's issues. It is not in the prohibitively expensive category for some journals in this field. On the basis of the first volume, the journal deserves a place on the library shelves of universities and government ministries of planning and resources. □

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## Physics matters

### Studies in History and Philosophy of Modern Physics: Part B of Studies in History and Philosophy of Science

Editors Jeremy Butterfield, Peter Gallison and Michael Redhead

Pergamon. 4/yr. NFI523, \$300

#### David Goodstein and Judith Goodstein

The history and philosophy of science were once largely the domain of former physicists. These were almost exclusively men who, before or after a career as research physicists, decided they could put their very considerable knowledge to other ends. Over the years, however, the profession gradually changed. More conventional historiography began to be heard, women entered the field, sciences other than physics began to be considered, and viewpoints such as social constructivism began to raise their (now much-maligned) heads. But, as all physicists know, the pendulum swings both ways. *Studies in History and Philosophy of Modern Physics (SHPMP)* is a triumphant return to the good old days.

In these pages there is no squishy biology,

no feminist revisionism, no (well, almost no) social construction. This is hard-core internal history and philosophy of modern physics (essentially twentieth-century, although the prospectus allows modern to mean anything after the mid-nineteenth century). Relativity and quantum mechanics reign supreme.

Of course, the broad outlines of those histories are well known, but there are always new details and considerations to bring to light. Equations are a plus, or at least not a minus. It's heavy-going, and don't bother even to try reading it if you haven't taken your graduate courses in physics. But if you have a taste for this sort of thing, and if you've felt a little dispossessed since, say, the 1950s, you may just have found a new home.

In the Alice in Wonderland world of scholarly publishing, *SHPMP* does fill a void. Not for the readers, who are more or less irrelevant, but for authors, who need an outlet for this kind of material. The idea is that scholars get paid and promoted by their employers, the universities, provided that they can find someone to publish their material, so the universities can buy back for their libraries the scholarly output they paid for in the first place. Why all this works is a mystery, but it does, and *SHPMP* will fit right in.

The articles have a uniformity of style that indicates careful editing. The scholarly machinery is exquisite, with footnotes (in small type) often occupying more space than the text (in larger type). The content returns physics solidly to centre-stage, and deals with ideas and equations, not flesh and blood. Articles of up to 10,000 words — or even more in special circumstances — are accepted. If that's what you've been looking for, look no further. This is a journal that says: at the end of the twentieth century, physics still matters.

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