the best they could. It was not just the doctors who would have seen poetic justice when Molière dropped dead on stage during the third performance of *Le Malade Imaginaire*. (Even hypochondriacs sicken and die sooner or later.)

As always, it seems, medical theories changed more regularly than medical practice. The authors dissect the nuances of Galenism, Paracelsianism, iatromechanism, vitalism and the other 'isms' that permeated medical thinking. They also describe minutely the bleeding and purging that were the mainstays of treatment for many diseases. In 1658 Louis XIV was repeatedly bled and purged during a fever (probably typhus) which almost killed him. Even his physician, Antoine Vallot, was happy, Ambroise Paré-like (*Je le pensay, Dieu le guarit*), to attribute the outcome to providence. (The 20-year-old monarch lived for another 57 years.) Both doctors and patients approached their mutual encounters with a healthy dose of fatalism.

In 1720, five years after Louis' death, plague struck France for the last time. Brockliss and Jones analyse the epidemic in Marseilles and argue that it was a turning-point for the country's doctors. Although the reasons why the plague was confined to Marseilles were more administrative than medical, the doctors received much of the credit. And they earned it: almost 22 per cent of the doctors sent to care for the plague victims in 1720 died. Traditional advice — medical and lay — about how to cope with plague was contained in the aphorism *cito, longe, tarde* (leave early, go far, come back late). By remaining at their posts, doctors had demonstrated their integrity, even courage.

There are many other facets to this wonderful book: vivid reconstructions of the contours of several medical practices; analysis of medical incomes; reflections on the development during the Enlightenment of preventive medicine, hospitals and surgery; shrewd insights on the changing shape of medical ethics and doctor–patient relationships. These are but a few examples. The volume is quite simply a stunning achievement, a monument to cooperation and humane scholarship. □

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The higher idiocy

Yes, We Have No Neutrons: An Eye-opening Tour Through the Twists and Turns of Bad Science
by A. K. Dewdney
Wiley: 1997. Pp. 180. £17.99, $22.95

Walter Gratzer

"Anybody who goes to a psychiatrist ought to have his head examined," Sam Goldwyn sagely observed. Here at least was one central European (born Shmuel Gelbfisch) who was not in the grip of the prevailing fashion. The tide has since turned against Freud (not before time), and for Professor Dewdney in his pursuit of intellectual deviance he presents a soft target.

The subtitle of Dewdney's book rather begs the question of what anyway constitutes science. A definition is always elusive, and the term has in any case been stolen from us, for what greater oxymoron can one conceive of than 'political science'? No doubt we shall one day hear talk of literary science and perhaps even theological science; after all, we already have creation science. So today's jest becomes tomorrow's degree course. But Dewdney, who seems to base his own valuations entirely on the teachings of Karl Popper, might have recalled that the sage regarded psychoanalysis, which he loathed, as the antithesis of science. It is not bad science: it is not science at all.

Dewdney keeps clear, rather surprisingly, of the 'dismal science' of economics, which John Maynard Keynes, unlike a horde of his successors, regarded as unamenable to quantitative analysis. Nor, in the social and medical line, has Dewdney considered one of the most truly pernicious examples of spurious science — the frontal lobotomy operation, which for decades was inflicted indiscriminately on the vulnerable, most often without consent and with almost uniformly disastrous consequences. For this Egas Moniz, who invented the procedure, was rewarded with the 1949 Nobel Prize for Medicine.

Dewdney does deal effectively with the measurement and heritability of intelligence, and the racial undertones of that sinister subject. But his adherence to Popper, with frequent incantations about what is and what is not falsifiable, leads him to an extreme view of, for example, the search for extraterrestrial intelligence (SETI). In truth this is no more "bad science", as Dewdney defines it, than the study of cosmology or of evolution, where one has to make do without controls, and the principle of falsifiability scarcely helps. Dewdney, in common with many others, is entitled to regard SETI as a waste of public funds and certainly one of the more chancy ventures. But, Popper notwithstanding, an intelligent signal from the void would be sufficient to prove him wrong.

Dewdney lumps SETI with various failed initiatives, driven by manic ambition, greed or injured pride, such as the cold-fusion fiasco and the ill-starred Biosphere 2 project. But can one really compare neural networks with these sad failures? Dewdney does not assert that the many successes of this computational technique are all illusory, only, when one reads carefully, that it has been hyped far beyond its real value. That may be so, but by such a measure how much of recent cancer research could escape damnation (let alone gene therapy, say)? I would have chosen catastrophe theory as a better example in applied mathematics; this enjoyed a short-lived vogue a decade or so ago, with supposed solutions to half of all human predicaments. Among many other revelations that stick in the mind, it presented an astonished world with a rigorous proof that an aggressive dog would attack suddenly, rather than gradually.

Dewdney, who is a mathematician and who inherited the "Mathematical Recreations" column in *Scientific American* from Martin Gardner, is best on his home ground. He is especially clear on issues of probability (SETI) and statistical analysis (IQ tests). He writes in a wearingly populist style and is profligate with clichés; nor is he too fastidi-

New in paperback

Radiogenic Isotope Geology
by Alan P. Dickin
Cambridge University Press, £29.95, $44.95
"Fills an important niche by providing an encyclopaedic, research-level review of the principles, methods and applications of radiogenic isotopes in geology... a notable contribution to the scientific literature on radiogenic isotope geology". Joel D. Blum, *Nature* **381**, 126 (1996).

An Interpretive Introduction to Quantum Field Theory
by Paul Teller
Princeton University Press, $16.95, £14.95
"This is a valuable book. Indeed, the specific interpretive proposals [Teller] makes could have an influence on hidden-variable theories....

[The] book reflects a welcome trend toward a reassessment of the notions of meaning and visualization in contemporary science". Peter Holland, *Nature* **378**, 454 (1995).

Resistance to New Technology: Nuclear Power, Information Technology and Biotechnology
edited by Martin Bauer
Cambridge University Press, £24.95, $39.95
"Consists of papers presented at a conference at the Science Museum in London. Under the rubric of 'resistance', many different stories are told from many different perspectives. Some are stories of comparative diffusion; others of policies for regulating particular technologies; some of public attitudes to certain new technologies". David Edgerton, *Nature* **376**, 653 (1995).

ous when it comes to syntax. "Spearman, who treaded where angels evidently feared to..." is how one of his less inviting sentences begins.

Dewdney might also have taken more trouble to check facts. He misspells consistently the name of one of the two principal protagonists in the cold-fusion story (and quite a number of other names besides), bestows a knighthood on Charles Darwin and credits Lynn Margulis, not James Lovelock, with inventing the Gaia hypothesis. He would have us believe that tritium is "a triatomic molecule" and that the emission spectrum of hydrogen consists of "dark and light bands". He has Paul Broca joining in the pursuit of the chimerical N-rays 20 years after his death.... I could go on.

But perhaps none of this matters much if the message — that unreason stultifies, costs money and sometimes even kills — gets through to the general reader, for whom presumably the book is intended. The trouble is that, as the writer Franz Werfel put it, for those who believe, no explanation is necessary, while for those who do not believe no explanation is possible.

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The lure of the red planet

The "grand canyon" on Mars (above) stretches 3,100 miles and extends to a width of 62 miles, dwarfing Earth's Grand Canyon which is a mere 217 miles long and 11 miles wide. From *Destination Mars: In Art, Myth, and Science* by Martin Caidin and Jay Barbree with Susan Wright (Penguin, $29.95), an illustrated survey of the enduring fascination of the red planet.

Riddles in the sky

Unsolved Problems in Astrophysics
edited by John N. Bahcall and Jeremiah P. Ostriker
Princeton University Press: 1997. Pp. 377. $69.50, £55 (hbk); $24.95, £19.95 (pbk)

Wendy Freedman

The Vela satellites made a serendipitous discovery while watching for illegal nuclear explosions in space in the 1960s. Gamma-ray bursts were detected whose origin has remained one of the unanswered questions in modern astrophysics. These bursts involve the release of about 10^{50} ergs of radiation into small volumes of the order of 1,000 km across with short durations of hundreds of seconds down to a few microseconds.

Hundreds of gamma-ray sources continue to be discovered each year, but even the basic issue of whether they are of Galactic or extragalactic origin has remained unresolved for more than a quarter of a century.

These sources are among the enigmas discussed in this compendium of unsolved problems edited by John Bahcall and Jeremiah Ostriker. And now, within months of the publication of this volume, evidence appears to have been found confirming that these gamma-ray bursts are of extragalactic origin (see *Nature* **387**, 859; 1997).

Nevertheless, as this lively volume attests, there are still many exciting problems left to interest the graduate student entering the field of astrophysics. The articles are based on invited talks given at a conference held at the Institute for Advanced Study in Princeton in April 1995 in honour of Bahcall's sixtieth birthday.

But the editors have made a great effort — successfully in my opinion — to address a very different audience. The written version is aimed at graduate students at the beginning of their courses, and should also be of interest to senior undergraduates. Each essay was apparently written with this question in mind: "I am thinking of doing a thesis in your area. Are there any good problems for me to work on?"

The present time is perhaps unparalleled in astrophysics. A healthy confrontation between theory and observation exists in many diverse areas and, as new instruments, telescopes and surveys reach fruition, the prospects over the next 10 to 15 years of gaining a deeper physical understanding of the Universe are enormous.

For example, mapping of the anisotropies in the cosmic microwave background down to arcminute scales will give a glimpse of the earliest structures in the Universe and lead to a measure of the geometry and other key parameters of cosmology. Diverse methods are being applied to measure the expansion rate and the mean mass density of the Universe, and to establish limits on the amount of energy density in the vacuum of space. Large surveys of galaxies, active galactic nuclei and quasars, both local and distant, will provide data to confront increasingly detailed theories about the formation and evolution of galaxies and clusters of galaxies.

Our current view is that the dark matter that makes up most of the mass in the Universe is not composed of ordinary baryons. Continuing efforts to elucidate the nature of this matter range from laboratory cryogenic detector experiments searching for weakly interacting particles to observations on the largest scales aimed at measuring the mean mass density and its distribution.

Finally, coming decades are likely to shed light on the "dark ages", the redshift interval between 5 and 1,000, corresponding to the time interval 10^6–10^9 years after the Big Bang, where no observations have so far been available.

Each article contains excellent bibliographies and notes suggesting entry points to the literature. I would have loved to have read such a volume when I was a student starting off in the field. It also provides an excellent summary of exciting areas in astrophysics of interest to a wider readership than just the students for whom it is intended. I would recommend it to interested physicists at all levels, and also as a good conference summary proceedings with review talks on a