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How far the stars?

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Graphic descriptions of these events track the evolutionary development of medical practice, highlighting areas where modern clinical practice is indebted to 'ancient' medicine, 'foreign' (non-Western) health-care techniques or traditional practices handed down within families over the generations.

At the same time, the stories demonstrate how "Western ways of knowing" made it difficult for many physicians to accept these treatments easily.

Take one of the most famous examples: Edward Jenner's 'discovery' of vaccination. Smallpox killed many and left survivors with ghastly scars and even blind. 'Variolization' (scratching the skin of a healthy person with pus taken from a patient with a mild case of smallpox) was introduced into Western medicine from the East in the early eighteenth century. It usually resulted in only a mild case of the disease and protected the patient from more virulent strains.

Although less dangerous than contracting smallpox naturally, variolization could kill or scar. English dairy farmers recognized a different and less threatening preventative against smallpox: cowpox, which affects humans only slightly. Rural people insisted that people who had had cowpox could safely nurse smallpox patients.

Physicians rejected this idea as foolishness — most physicians, that is. Jenner infected cowpox survivors with weakened strains of smallpox. During the 1796 outbreak of cowpox, Jenner used pus from the arm of a cowpox patient to inoculate a young boy, James Phipps. A few weeks later he inoculated James with smallpox pus. The boy remained immune. Analytically considered, the practices of farmers and milkmaids changed the face of medical practice.

In examining the curative and preventative treatments that have entered clinical practice from non-traditional sources, the authors, perhaps predictably, call for a sense of humility. As the Root-Bernsteins report, people survived before the advent of antibiotics; maggots were and are used successfully to clean wounds and honey solutions were and are used to pack burns. Many cultures around the globe have engaged in mud- and clay-eating; today, we enjoy the benefits of calcium carbonate and kaopectate.

The practice of blood-letting predates written language; contemporary health care continues to recognize the benefits of phlebotomy in conditions such as haemochromatosis, and leeches have once again joined the medical arsenal. Saliva and urine have been used as therapeutic agents over the ages; patients today are rediscovering the antibacterial benefits of these bodily secretions. The historical development of serendipitous and innovative technological interventions, such as cellophane bandages and 'pneumatic leeches', also receive their due in this enter-



Suck it and see: leech therapy from Aldebrando da Firenze's *Medical Treatise*, 1356.

taining and informative book. Written from the perspective of Western medical thought, these stories of unusual therapies are often followed by a contemporary medical explanation of the mechanisms underlying the treatment.

The authors illustrate the evolutionary aspects of medical practice by drawing on connections between therapies observed among other mammals and those practised by humans, such as the licking of wounds and the ingestion of urine. They also investigate the role of culture and economics in the acceptance or rejection of medical therapeutics, recognizing that "the best treatment is not simply the most efficacious one, but the one that is actually put to use".

Their conclusion delineates the very real economic barriers to further incorporation of folk medicine into our current health-care system. In most countries today, medical therapies must be approved by a regulatory body before they can be marketed or distributed. For example, in the United States it costs millions of dollars to fund the clinical trials demanded by the approval process of the Food and Drug Administration, not to mention millions for product development, manufacture, advertising and the like.

Such an enterprise would be commercially unfeasible for an inexpensive, readily available product such as honey that cannot be patented. Moreover, despite their generally positive portrayal of non-traditional therapies, towards the end of the book, the Root-Bernsteins issue a warning against cavalierly embracing all such modalities, and provide numerous examples of health-care fraud based on anecdotal evidence from folk medicine. But this short chapter offers little concrete advice on how non-medical people can make meaningful choices.

Still, this entertaining book is replete with fascinating tales examining the untraditional, at times irrational, practices that have been adopted by contemporary medical practice. □

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How far the stars?

Measuring the Universe: The Historical Quest to Quantify Space

by Kitty Ferguson

Headline: 1999. 306 pp. £14.99

Virginia Trimble

From Earth and Moon to Sun and stars and on to galaxies and the Universe, our view of the world has grown more or less monotonically throughout recorded history (at least Western history). It is this expanding horizon that Kitty Ferguson has set out to map. Her chosen method is to focus on specific measurements that yielded numbers we now regard as accurate, from Eratosthenes and the diameter of the Earth to current attempts to pin down the cosmic expansion rate (Hubble parameter), the density of the Universe and the infamous cosmological constant. Ferguson tries to give the reader a feeling for what it must have been like to attempt these measurements for the first time.

I came to the book thinking the task worth doing and worth doing well, and so was prepared either to admire elegant explanations of difficult concepts or to carp unmercifully at errors, omissions and misconceptions. Sadly, the negative points greatly outweigh the positive ones. My list of 'bravos' has half-a-dozen items, including an appealing preface on triangulating windmills, a good epilogue, a thought-provoking quote from Fred Hoyle on the impossibility of knowing in advance which problems are solvable by current methods, and an excellent approach to acronyms: she uses very few.

On the other side of the balance sheet: my list of 'truly wrong' has 40 items; 'misleading' = 48; 'something vital left out' = 45; 'poorly explained, perhaps because not understood' = 52; and other miscellaneous oddities, including sudden switches of topic in the middle of a story = 29.

How much do these things matter? Some hardly at all, unless you are personally concerned or need to tell others about the topic. Consider the following (and only) description of the discovery of quasars: "Sandage was involved in some of the first investigations of these objects in the early 1960s, along with Thomas Matthews and Maarten Schmidt." This is, I believe, unique in the literature in the extent to which it understates the contribution of Schmidt, the actual discoverer, although, as a corrective to common overstatements, it also fails in not crediting the radio astronomers, without whose accurate coordinates nothing would have happened.

Somewhat more serious are omissions that leave a very incomplete picture. For instance, neutrinos of non-zero rest mass are the only potential form of dark matter pre-

sented in a chapter called "The quest for omega", and they are credited to very recent laboratory results. Where are the cold dark matter candidates like Weakly Interacting Massive Particles and axions; where the baryonic candidates (MACHOs and brown dwarfs), strings, and all the rest? Where, for that matter, is the 20-year history of neutrinos as dark matter? Nowhere. And, indeed, omega is nowhere defined.

The intended audience consists of the customary intelligent laymen and women (the book is generally careful about such matters), with zero knowledge but infinite capacity. These probably mythical persons will not notice and may not care about numerical and historical errors and omissions. But incomprehensible explanations are surely fatal. Said readers will be left feeling either unintelligent or mistreated. Thus, I suspect they will cast the book aside about the time (*circa* 300 BC or the middle of Chapter 1) when Aristarchus of Samos is trying to learn the distances to the Moon and Sun.

Aristarchus' attempt to get the solar distance from the unequal lengths of the four main phases of the Moon (from new to first quarter, first quarter to full, and so on) is extraordinarily clever. Why did he fail? The Moon's orbit is an ellipse, not a circle, but Ferguson never tells you this. The figures do not seem to help difficult geometric concepts; author and illustrator conspire together

to keep the reader from discovering that, if you can measure two angles of a triangle and the included side, you have the rest.

Modern territory brings us to ways of measuring distances to galaxies, clusters and quasars very far from our own Milky Way. Those involving sources of known absolute brightness come across fairly well, but the more complex ones could not be understood from what is given even by infinite intelligence. You always need to measure two things (and often do some modelling as well). For distances to gravitationally lensed quasars, the two things are the time delay between flares seen in separate images and their angular separation on the sky. Only the time delay is mentioned. For the hot gas in rich clusters of galaxies, the two are the degree to which gas scatters photons of the cosmic microwave background (for which the author gets the sign wrong) and its X-ray emission. Only the scattering is mentioned.

Many popular books of popular science, both in and out of my field of astronomy, have passed the test: "Would you be reading this if you hadn't been asked to review it?", including ones by Fred Hoyle, Carl Sagan, Isaac Asimov, Peter Medawar, Malcolm Longair, Martin Rees, Walter Sullivan and Stephen Jay Gould. *Measuring the Universe* is not one of these books. □

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4575, and in the Astronomy Department, University of Maryland, College Park, Maryland 20742, USA.

Further astronomy

Astronomy in Prehistoric Britain and Ireland

by Clive Ruggles

Yale University Press, \$65, £45

Sustaining hopes for change

The Brundtland Commission's Report – 10 Years

edited by Guri Bang Sjøfting, George Benneh, Kjetil Hindar, Lars Walløe and Anders Wijkman

Scandinavian University Press/Research Council of Norway: 1998. 234 pp. Nkr298

Peter Doran

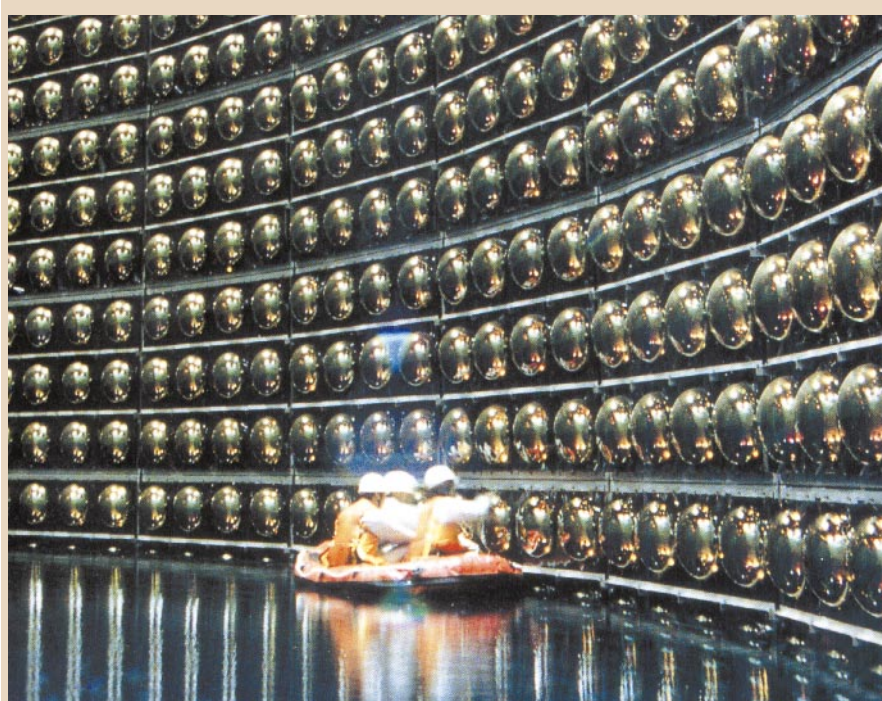
More than ten years after the landmark publication of *Our Common Future* by the World Commission on Environment and Development (WCED), the questions that face the growing community of policy-makers and researchers in sustainable development have changed radically.

Research agendas are no longer driven simply by a need to understand the various categories and causes of unsustainability in our social, economic and environmental decision-making. They are increasingly concerned with knowledge itself and reflect the important challenge of making better use of existing information and framing that knowledge in a way that makes it useful and accessible at all levels of decision-making.

At the local level, for example, research that leads to understanding and action must often be pursued with the participation of local people. Such approaches to knowledge-gathering most frequently occur where empowerment, motivation, understanding and democracy have become interlinked. The Nordic countries' enthusiastic response to the sustainable-development movement seems to support the view that a democratic culture and an informed citizenry provide the most fertile soil for new values and behaviour patterns to take hold.

These changes to the research agenda for sustainable development are reflected in the broad recommendations in *The Brundtland Commission's Report*. This is a collection of papers produced for an international research conference in Oslo to mark the tenth anniversary of the publication of the WCED report. The conference was designed to take stock of the "evolution of sustainable development up to the present", and the Norwegian Research Council is already planning a research programme around some of the points that came out of it.

Blessed with an optimism that can



Underground enlightenment

Technicians travel by raft under the giant dome of the Kamiokande neutrino detector, a kilometre under a mountain near Tokyo, to clean the faces of photomultipliers. These detect the presence of neutrinos by the light created

when they collide with atoms. This is just one of 220 mind-expanding illustrations — with clear, informative text about the advances physics has made this century — in *Physics in the Twentieth Century* by Curt Supplee (Abrams, \$49.50, £32).