each accompanied by detailed descriptions. Together with the works of Porter and Houston, this book should be essential reading for anyone interested in the making of psychiatry. ■

Akihito Suzuki is in the History Programme, School of Economics, Keio University, 4-1-1 Hiyoshi, Yokohama 223-8521, Japan.

The man who talks a lot

My Life in Science
by Sydney Brenner
BioMed Central: 2001. 191 pp. £14.99

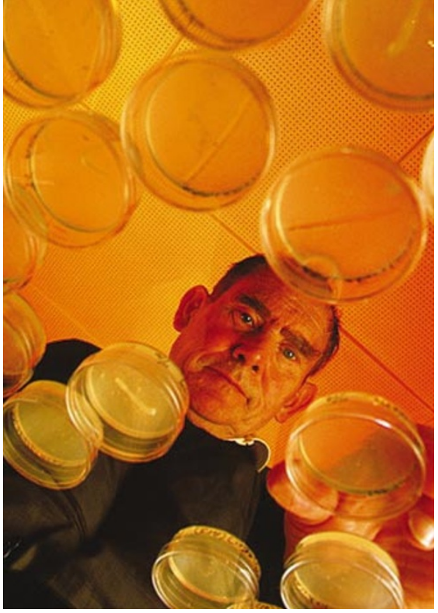
Jan A. Witkowski

In April and May of 1994, Sydney Brenner sat down in front of a video camera and talked to Lewis Wolpert, recording enough to fill 15 videotapes. Errol Friedberg and Eleanor Lawrence have taken sections from the transcript of the interviews and woven them, with linking and explanatory passages added by Friedberg, into *My Life in Science*, an 'autobiography' of Brenner's more than 50 years of research.

I opened this book with considerable misgivings. Of all the ways to set words on paper, transcription is the least satisfactory, as anyone who has had to edit a transcript knows. The most polished phrases can be reduced to mere platitudes or worse, while every hesitation, deviation and *non sequitur* is recorded for the continuing embarrassment of the speaker. I am glad to say that in the present case my fears were misplaced; Brenner, Wolpert, Friedberg and Lawrence have produced an informative and entertaining book, redolent with Brenner's voice.

There are many pleasures in the book. It is interesting to learn the inside stories behind some of the classic experiments in molecular genetics. The experiment to confirm the existence of messenger RNA was conceived in a moment of inspiration in Cambridge, but carried out in more prosaic circumstances in a basement at CalTech — François Jacob dropped phosphorus-32 into the water bath and Brenner carried the ultracentrifuge rotor from the cold room to the laboratory as though it were a relic of a saint, in solemn ecclesiastical procession. The paper was written in a form unfamiliar to today's researchers. Brenner and Jacob, in their enthusiasm for Karl Popper's insistence on the falsifiability of scientific hypotheses, began by proposing three models, two of which they set out to disprove.

The book gives many of Brenner's *bon mots*, which hide some serious insights into how biological research should be done. Take, for example, the 'Don't Worry Hypothesis' — if you have a strong idea that



Brenner: famous for his championship of the nematode that can be grown in a Petri dish.

JAMES KING-HOLMES/SPL

explains something interesting, don't worry too much about what it doesn't explain. Life is complicated, and even the best idea is not going to explain everything. Without the 'Don't Worry Hypothesis', the double helix would have been rejected because no one understood how the two strands of DNA could be unwound during replication. James Watson and Francis Crick put this seemingly insuperable problem to one side, arguing that, as DNA did get replicated, the cell must have ways of unwinding the helix and these would be discovered sooner or later. It is here that Brenner's 'Occam's broom' comes in handy, to sweep the currently difficult facts under the carpet (at least until it becomes impossible to walk on it). 'HAL' is a related concept. Because organisms are complicated, often we do not have the knowledge to make clear-cut predictions. So the thing to do is, 'Have A Look' — just try something and see what happens. Unfortunately, this eminently pragmatic strategy is unlikely to find favour with funding agencies.

Brenner is best known, perhaps, for his championship of the nematode worm *Caenorhabditis elegans* as an experimental animal. He recounts how he searched through a veritable bestiary of weird and wonderful animals — the protozoa *Paramecium, Naegleria* and *Hartmanella;* rotifers; and the fly *Sciara.* But although these organisms had interesting biology, they were not amenable to genetic studies. Then he found nematodes, which have an ideal sex life — from a geneticist's perspective — a nervous system small enough to be described completely, and — especially appealing — they can be grown, like bacteria, in Petri dishes. The rest, as they say, is history; more than 3,000 papers have been published on *C. elegans* since Brenner's classic paper on its genetics was published in 1972. One of these, of course, was the complete sequence of the *C. elegans* genome, the first genome to be determined for a multicellular organism.

This is not a scholarly book and it does not need to be. However, BioMed Central has done the subject and the editors a grave disservice in two regards. First, there are no photographs, even though there must be innumerable pictures of Brenner from every stage of his career; a few of these would have added greatly to the pleasure of reading the book. Second, there is no index, not even one of names.

Brenner tells us that Fred Sanger described him as "the man who talks a lot", and, indeed, Brenner considers talking — producing a "stream of unconsciousness" — to be one of his great skills. We are fortunate that these skills are recorded and it is good to have more of Brenner's words down on paper. Brenner remarked once that young Turks quickly change into old Greeks. This fate has not yet befallen him, and together with his own *Loose Ends* (1997), *My Life in Science* provides us with a view of the life and works of one of modern biology's most innovative, influential and irrepressible characters. ■

Jan A. Witkowski is at the Banbury Center, Cold Spring Harbor Laboratory, Cold Spring Harbor, New York 11724-0534, USA.

An integrated view of *Bacillus*

***Bacillus subtilis* and its Closest Relatives: From Genes to Cells**
edited by Abraham L. Sonenshein, James A. Hoch & Richard Losick
ASM Press: 2001. 646 pp. $149.95

Nicola Illing

Bacillus subtilis has been touted as the model organism for Gram-positive bacteria as well as for microbial cell differentiation for many years. This vision — inspired by work in the late 1950s by John Spizizen and Pierre Schaeffer — has come to fruition and is embodied in this comprehensive review of all aspects of *B. subtilis* physiology and genomic information. This text is more comprehensive than an update of the previous Bacillus subtilis *and Other Gram-Positive Bacteria* (ASM Press, 1993), by the same group of editors, in which physiological and genetic information of different Gram-positive bacteria was catalogued in detail, but with little integration between the two. It is inevitable that this new volume will also be compared with the other major prokaryotic reference, Escherichia coli *and* Salmonella*: Cellular and Molecular Biology*, edited by Frederick Niedhardt (ASM Press, 1996), and covering the biochemistry of Gram-negative bacteria. This new work not only provides a biochemical view from the Gram-positive perspective of the bacterial fence, but is in a different league with respect to the scope of its coverage.

What is particularly inspiring about this volume is that it is one of the first of a new generation of reference books that successfully integrates information generated by the sequencing of the *B. subtilis* genome with the many facets of microbial physiology — including cell architecture, chromosome replication and division, metabolism and its regulation, macromolecular synthesis, and adaptation and differentiation. The challenges of annotation — and interpreting the volume of information generated by genome sequencing — are addressed in a separate chapter, and will serve as a useful reference for any group embarking on a genome project.

In addition to focusing on the genes that have been assigned function on the basis of comparative sequence information, all chapters include an analysis of homologues identified in different bacterial species, providing valuable insight into the evolution of specific genes. For example, the genes involved in endospore formation in the genera *Bacillus* and *Clostridium* are compared by a genome-wide analysis searching for homologues among their constituent species. Whereas some of the key sporulation genes — including transcription factors and their regulators — are conserved across *Bacillus* and *Clostridium*, which are both endospore-forming genera, other genes are not. The phospho-relay system that activates *spoOA* — the master regulator of sporulation in *B. subtilis* — in response to the metabolic condition of the cell, the state of chromosomal replication and cell density, is absent in *Clostridium*. This analysis has also shown that homologues of many of the sporulation genes, such as *spoIIIE*, are also found in bacteria that do not form spores, including *Escherichia coli*. These genes are postulated to have evolved a new function in endospore-forming bacteria.

There is much in this reference for researchers working on genes that originated in prokaryotes. I focused on chapters dealing with stress tolerance, and cell signalling through the histidine kinase phospho-relay cascade, and found a wealth of information that can be applied to many biological systems, such as stress tolerance in plants.

Although each chapter has been written by a different group of authors, a common thread and uniformity of style runs through the book. In spite of its size and breadth of scope, this is a very readable book. Explanations are solidly grounded on experimental data and references. The referencing cannot be faulted and includes a combination of classical and current references. Bacillus subtilis *and its Closest Relatives* sets a new high standard for physiology and biochemistry texts, and is an essential reference for researchers, university libraries and both undergraduate and graduate students. ■

Nicola Illing is in the Department of Molecular and Cell Biology, University of Cape Town, Rondebosch 7700, South Africa.

Science in culture

The Kings' comet

Giotto, Halley and the art of observation.

Martin Kemp

According to legend, it was 11 days after Christmas, on Epiphany, that the Kings brought their gifts to Christ. They arrived at precisely the right spot courtesy of a guiding star, whose behaviour differentiated it clearly from those normally visible in the night sky. If it was a star outside the normal run, what did it look like?

For most medieval artists, the conventional pointed star did the job well enough, hovering above the stable in which Christ had been born. But not so for Giotto di Bondone, the great early-fourteenth-century pioneer of naturalism. In his lucid and eloquent image of the *Adoration of the Magi* in the Arena Chapel in Padua, Giotto characterizes the Kings' guiding light as a flaming ball streaking across the heavens. The eight-pointed star at the centre of the array dissolves at its rear into a trailing tail of streaky fire. Less prominent than when first painted, through losing some of its painted gold, it still has a striking effect, unparalleled in earlier representations. It is easy to believe that Giotto had witnessed the advent of a comet. But which one?

By far the best candidate is Halley's comet, which was visible from mid-September to November in 1301. The date works well enough, for Giotto painted his image in the years immediately preceding 1305. The comet's visit was noted in various written records, and one Italian chronicler described it as having "great rays of smoke behind it".

Giotto's ability to depict the comet so convincingly was due to his innovative naturalism. More than a century before the invention of linear perspective, he had experimentally determined how to create the effect of solid forms, overlapping in space, with simple architectural features slanted back into the picture. One important tool was his use of a consistently directional light, described as coming from a large window on the west wall of the chapel. Not only does Giotto use this light to sculpt the figures, but he also plots its passage on the stable, as the diagonal beams of the roof fall systematically into shade on its far side.

It is in this context that the comet declares itself in the spectator's mind as an observed phenomenon rather than a conventional pictorial symbol. Embedded precociously in Giotto's image is the as-yet unrecognized potential for the use of empirical science in the naturalistic techniques forged by the artists of the fourteenth and fifteenth centuries.

Giotto's portrayal of the appearance of a 'real star' could not be more fitting for Epiphany, given that the Greek *epi* means 'around' or 'over' and *phainein* 'appearance' or 'manifestation'. It was also a happy choice to name the spacecraft launched in 1986 to investigate Halley's comet after the great Italian artist. ■

Martin Kemp is in the Department of the History of Art, University of Oxford, Oxford OX1 2BE, UK.

BRIDGEMAN ART LIBRARY