Harnessing the power of genetics

P.A. Lawrence

Genetic Neurobiology. By Jeffrey C. Hall, Ralph J. Greenspan and William A. Harris. Pp.284. ISBN 0-262-08111-3. (MIT Press: 1982.) \$30, £20.95.

WHEN I was an undergraduate studying biology, genetics was not estimated as much use for anything — at least not by those who organized our timetable. Paramount were the sciences of chemistry, botany and zoology; these lectures were given in the morning when we were thought to be most receptive. Spent by the afternoon's sport a minority of us went at 5 p.m. to J.M. Thoday's excellent lectures on genetics, and tried to learn things that were deemed insufficiently important to feature in the exams.

This attitude to genetics has been all too common, and can still be easily detected. But genetics provides powerful tools to help us understand biology as, although the approach is almost bound to be indirect, it can lead us to the heart of intricate and difficult problems.

You don't need to read much of *Genetic Neurobiology* to discover that the authors are also fans of the genetic approach, and their book justifies their enthusiasm. It is not a multi-author work in the usual sense as the three authors have written all of it together; typical sections consist of a detailed description of a topic plus occasional bits of critical and thoughtful commentary. It is an instructive and useful mix because the reader can clearly see at what stage the field is, what needs to be understood and, sometimes, how the next step might be achieved.

The book is generally clear, entertainingly peppered with typos, and only occasionally becomes heavy going. My only minor complaint is that there are too many references to unpublished work; many unpublished discoveries remain unpublished for good reason.

A great deal of ground is covered: examples are movement in bacteria, sensory receptors in *Paramecium*, *Drosophila* and nematodes, vision, learning and courtship in fruit flies, cell lineage in *Caenorhabditis elegans*, neurogenesis in vertebrates, brain circuitry in Siamese cats and even psychosis in human beings. This might sound indigestible but adherence to the genetic approach focuses the material nicely.

The book contains many good examples of the power of genetic methods. Here is one: the biological clock has been around for a long time, we know that the behaviour of animals is subject to an internal timer but we do not know what makes the clock tick, or even if it does. In *Drosophila* a particular gene, *per*, is close to the heart of a "clock" which tells the flies that it is time to hatch out of their pupae (Konopka and Benzer, *Proc. Natn. Acad. Sci.* 68, 2112;

1971). Mutations in the *per* locus change the periodicity of this behaviour and have allowed the methods of mosaic fate mapping to locate the clock in the head. Lack of the *per*⁺ function appears to stop the clock and hatching becomes arrhythmic, one *per* mutation speeds up the clock, and another slows it down. These hatching times are circadian, but significantly the same mutations also affect a behaviour which cycles every minute or so — the courtship song of the male — and they affect the cycle length in the same way.

Mars viewed through Viking eyes

J. Veverka

The Surface of Mars. By Michael H. Carr. Pp.232. ISBN 0-300-02750-8. (Yale University Press: 1982.) \$45, £35.

THE 1976 Viking mission to Mars not only answered the age-old question, "Is there life on the Red Planet?", but provided a wealth of new information, much of it contained in the more than 50,000 images returned by the Viking Orbiters between 1976 and 1980. *The Surface of Mars*, written by Michael Carr, leader of the Viking Orbiter Imaging Team, is an excellent summary of what Viking saw. While the emphasis is on the surface and on its study through the Orbiter cameras, related topics and techniques are dealt with as needed to provide a comprehensive picture of the planet today and to outline its complex history.

Carr's book is a worthy successor to the *Geology of Mars* by Thomas A. Mutch and colleagues (Princeton University Press, 1976) which was based on Mariner 9's initial reconnaissance in 1971–1972. The discussion follows a logical progression: major surface features and processes are considered systematically, building up a detailed view of Mars. Throughout, there is an admirable tendency to concentrate on the big picture and shun side-issues. The treatment emphasizes questions rather than answers and conveys accurately the idea that Mars remains a puzzle in spite of Viking's thorough investigation.

Of all the surface features, perhaps the most enigmatic are the various dry valleys or "channels" originally discovered by Mariner 9. Usually attributed to erosion by liquid water, they have been used to argue that the martian climate was very different at some time in the past than it is today. (Currently the atmosphere is too thin and too cold to permit the presence of open bodies of liquid water.) Carr carefully discusses the types and probable ages of the channels and critically reviews various

With *Drosophila*, geneticists and molecular biologists have worked out how to take laborious but straightforward steps which allow one to go from mutants in a gene, to the cytological locus on the chromosome, to the gene itself and finally to the product. So the *per*⁺ product may be identified soon, and that could get us into the workings of the clock at last.

This book is a success and is well worth detailed study; and it is even entertaining — where else could you read about the mosaic wasp that spent its days stinging would-be mates and copulating with caterpillars? □

Peter Lawrence is at the MRC Laboratory of Molecular Biology, Cambridge, UK.

suggestions for their origins. A serious problem, and one that hinders any discussion of events on Mars, is the lack of an absolute chronology. Although relative dating can be attempted from comparisons of crater counts and from stratigraphic relationships, we do not know the absolute age of any surface unit on the planet. Given the recent hiatus in planetary exploration (at least in the United States), it is unlikely that the situation will improve soon; absolute dating of events on Mars will probably require the return of samples for analysis on Earth.

In the absence of an absolute chronology, it is not surprising to find a lack of unanimity in discussions of when major events left their imprints on the surface. One extreme view is that Mars today is pretty much a dead planet, and that most of the geologically important events took place in the first billion years of its history. Carr's own view is less extreme. He suggests that although major geologic events, including the formation of most channels, were concentrated in the first half of the planet's history, important geologic activity has continued into the present. For example, volcanism appears to have extended throughout the life of the planet, and although Viking did not observe a single eruption it is highly unlikely that, volcanically, Mars is a dead planet.

Carr emphasizes that the study of surface features provides important clues to the evolution of the planet's interior and to the history of its atmosphere. There are geological indications that at some time the atmosphere of Mars was thicker than it is today, and there is ample evidence that large amounts of volatile material (presumably mostly H₂O) are frozen in the subsurface and in the polar regions. It is these reservoirs of volatiles that have been implicated in various models of climatic change. Although there remains a lively debate about the timing, extent and causes