Feeling for nature

Robert M. May

Gilbert White: A Biography of the Author of The Natural History of Selborne. By Richard Mabey. *Century Hutchinson, London:1986. Pp.239. £14.95.*

ONLY three books in the English language have gone through more editions than Gilbert White's *The Natural History of Selborne*. This claim leaps out from the blurb on the back of the 1977 Penguin edition, and has left me wondering what ranks third behind the Bible and Shakespeare; probably *Pilgrim's Progress*. The separate editions of *Selborne*, over 200 of them, have appeared at a steady rate since the book was first published in 1789 (note the impending bicentenary), forming an interesting record of changing tastes in book design and changing visions of the countryside as revealed in the illustrations.

On first acquaintance, *Selborne* is a surprising book to have evoked such unwavering affection. As Mabey observes, it is

> the kind of book presented on prize-giving days, ... a work, in all senses, of the old school. Even when I eventually came to read it, I cannot say my opinion changed dramatically. I could not cope at first with its rambling disorder, its sudden plunges into thickets of taxonomic Latin, and, for a while, I failed to notice the feeling behind the often dispassionate prose.

Selborne is organized as a collection of letters, similar to many other works about local natural history by enthusiastic parsons. It endures while these other books ornament the libraries in stately homes because beneath its unassuming surface is a fully contemporary appreciation — quite new in its own time — of plants and animals as more than curiosities, but as parts of a community, interacting among themselves, with their environment and with humans. White raises general questions (such as how populations are regulated), but always against a background of keenly observed detail (the breeding success of swifts, the singing of crickets, or the way fly-catchers keep their fledglings cool in summer by fanning their wings above the nest).

Richard Mabey has produced the first biography of Gilbert White for over 80 years. The difficulty is that not a lot is known about White, except that he lived an uneventful bachelor life in the parish and rarely left it (as Richard Boston observed, reviewing the book in *The Guardian*, how else could White have described the South Downs as "that chain of majestic mountains"). Mabey's book is more in the nature of an introduction to, and appreciation of, *Selborne*, than a biography in the strict sense. At such, it does a fine job of relating Gilbert White and his book to the village of Selborne as it was then and is now. Despite his observations, White never fully gave up the contemporary notion that swifts and swallows disappeared in winter because they hibernated; Mabey empathizes, suggesting that White simply could not imagine why anyone could want to leave Selborne.

Mabey explains that "it was seeing Selborne itself, the source of White's inspiration, that changed my view [quoted above] decisively, and helped me to understand what the book was truly about". The patterns of field and woodland around the village have changed little since White's time, and the village itself conducts its Gilbert White trade in a low-key way (the stained glass memorial window in the church, with White as Saint Francis among his birds, is alone worth a visit: see the cover illustration of *Nature*, 22 December 1983). Visit Selborne and read Mabey. Then read *The Natural History of Selborne*. □

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In the groove

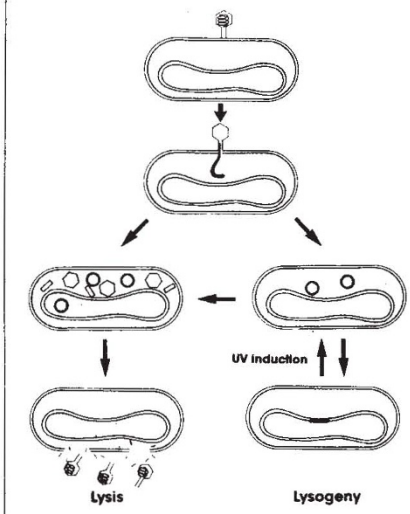
Sydney Brenner

A Genetic Switch: Gene Control and Phage λ. By Mark Ptashne. *Cell Press, Cambridge, Massachusetts/Blackwell Scientific: 1986. Pp.128. Pbk $16.95, £14.50.*

MAX Delbrück did not believe in lysogeny. He thought that the persistence of bacteriophages in some bacterial cultures was due to cryptic infection and he dismissed it as a fringe phenomenon. Everybody he influenced therefore worked on virulent bacteriophages, especially T4, and their work led to one branch of molecular genetics and to the discovery of the fine structure of the gene, the general nature of the genetic code and messenger RNA. Fortunately, Delbrück's influence was not totally pervasive and in Paris, where there was a long tradition of research on lysogenic bacteria, the work of Lwoff and of Jacob and Wollman on bacteriophage λ revealed that lysogeny is in fact due to a gene regulatory mechanism that allows the phage DNA to remain silent in the bacterial chromosome until activated by, for example, ultraviolet light. Their major step was the realization that the properties of the phage mutants on which they worked were isomorphous with those affecting the expression of β-galactosidase, and that in both cases gene regulation was achieved by the negative effect of repression.

Mark Ptashne isolated the λ repressor in 1967 and has spent nearly 20 years in pursuing its molecular structure and mode of action. This little book is an account of his research, focused especially on how the λ repressor and *Cro*, another regulatory protein, form a switch by their interaction with an operator, O_R. In one state, corresponding to stable prophage, the binding of λ repressor inhibits the rightward transcription from the promotor site P_R and stimulates its own production by transcription in the direction from another promotor, P_{RM}. When the repressor is removed by proteolysis induced by ultraviolet light, rightward transcription is turned on and *Cro* is produced. The binding of *Cro* to O_R prevents any further synthesis at P_{RM}, thus turning off repressor, irreversibly throwing the switch and sending the phage down the lytic pathway. Ptashne shows how these events are precisely conditioned by the mode of binding of repressor and *Cro* to the three-component sequence of the operator. The structure of these proteins is known and both recognize the major groove of DNA through a characteristic α-helix–bend–α-helix, a motif now known to be present in a large number of DNA-binding proteins.

This work is a paradigm for the mechanisms of regulation but Ptashne would like to go further and sees the λ switch as the model for switching between develop-



Lysis or lysogeny — the alternative modes of growth of phage λ which are controlled by a switch mechanism operated by λ repressor and Cro regulatory protein. Once it has entered the host bacterium (top), the phage DNA can either replicate autonomously and then lyse the host; or it can insert itself into the host chromosome and be propagated along with it until the lysogeny decision is reversed by, for example, irradiation of the bacterium with ultraviolet light. (Reproduced, reduced in size, from A Genetic Switch; *the original is in two-colour.)*

mental pathways in higher organisms. In a general sense this is true because, logically, the λ system appropriately combines positive and negative feedback in a simple way to implement a switch; but this is not necessarily the only way it can be done. Years ago Novick performed a most illuminating experiment. Normally the galactosidase of *Escherichia coli* is repressed, but it can be released from repression (induced) in the presence of lactose or an analogue thereof. Novick briefly exposed *E.coli* cultures to a high concentration of an inducer which was then diluted a thousandfold to provide a maintenance level. In a fraction of the cells, enough of the inducer got in to derepress the genes; the rest remained uninduced. The resulting mixed population maintained itself indefinitely as long as the low level of inducer was present, because induction entails the production of a permease that increases the uptake of the inducer so that even at low levels enough can enter the cells to maintain the induced state. Thus it could be said that *E.coli* had "differentiated" into two cell types with heritable states. This result depends on the properties of the permease: only cells with permease can take up inducer at the low maintenance level and only such cells can have permease induced; transient induction at high levels simply initiates the process in part of the population. Here the logical elements of positive and negative feedback are implemented in another way and it is arguably a better paradigm for some developmental processes than the λ switch.

The analogy between the λ switch and developmental processes should not be carried too far. In discussing the difference between "commitment" and "differentiation" of cells, Ptashne writes

> By analogy, a λ-lysogen is indistinguishable from an uninfected bacterium by casual inspection, but the former and not the latter is 'committed' to lyse and release phage when it encounters an inducing signal in the environment.

However, he quickly realizes that this is not a good analogy because the difference between the bacteria is a *genetic* one and he continues

> The lysogen, of course, has genes that are lacking in the non-lysogen, but it is not difficult to imagine analogous forms of commitment involving only differential gene expression. To take a simple example, the regulatory proteins of a cell might turn on a gene encoding a hormone receptor.

Do we hear a faint echo of the permease paradigm?

But this is quite a minor criticism of a clear exposition of a series of triumphant experiments and insights that have brought us close to the molecular heart of the matter of genetic regulation. □

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Eastern originality

Christopher Cullen

China: Land of Discovery and Invention. By Robert K. G. Temple. *Patrick Stephens, Wellingborough, UK: 1986. Pp.248. £12.95.**

READERS of this journal will need no more than a brief reminder of the importance of the work of Joseph Needham. With the help of a large group of collaborators, over the past 40 years he has been engaged in a great project of research and publication on the history of science, technology and medicine in pre-modern China. The results are appearing in the pages of *Science and Civilisation in China*, the seven volumes of which are being published by Cambridge University Press as some 30 separate tomes (about half of them have appeared to date). This work is widely regarded as the most influential British contribution to historical scholarship in the present century, and it has certainly completely changed the perspective of many well-informed Westerners on the origin of important aspects of modern science.

As the weight of his research has accumulated, Needham has had to move far from his original aim of writing a short book for the general reader. Robert Temple's book, which is compiled almost entirely on the basis of material already published or awaiting publication in Needham's volumes, is intended to meet this need. Temple has divided his account into 11 broad subject areas, such as "Agriculture, Medicine and Health", "Magnetism" and "Warfare". Under these he has grouped a hundred short, illustrated essays on particular topics. Temple is clearly no mere hack compiler of coffee-table books: his writing is clear and vigorous, and he succeeds in communicating his obvious enthusiasm for the subject. It is hard to imagine anyone with a general interest in the history of science failing to find a great deal in this book to intrigue and delight.

There are some flaws. Temple makes no systematic attempt at writing history; the book is a series of vignettes on "the wonders of Chinese science", and as such does not convey any sense of the social and philosophical background from which Chinese science, technology and medicine arose and against which they functioned. The choice of topics and the balance between them sometimes seems odd: the section on engineering devotes more space to the novelties known as "spouting bowls" than to cast iron. Some of the statements are out of date or just plain wrong, and the one-page list of "further reading" is so incomplete that it does not even mention Colin Ronan's readable and reasonably priced abridgement of Needham's work, also published by Cambridge University Press. On the whole, however, Temple deserves the gratitude of his readers for having provided a ready means of access to a fascinating subject. □

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*To be published in the United States in January by Simon & Schuster, under the title *The Genius of China: 3000 Years of Science, Discovery, and Invention.* Price will be $19.95.

From *China: Land of Discovery and Invention*

Sowing sophistication — spring wheat being sown by seed drill in northern China. Seed drills, which are much less wasteful than broadcasting seed by hand, were available in China from the second century BC. It was almost 2,000 years later that they came into use in Europe.