affairs is at best very indirect in plants and would appear to be non-existent in the evolutionary process.

Despite its inadequacy, Dr Bateson's discussion of the nature of mind is the clearest section of his book. The remainder discusses some of the prerequisites for learning and insight and the problem of evolution, but I found it impossible to understand the general drift of the argument let alone to summarize it. He illustrates his themes with examples drawn from many different fields: few are novel and it is unclear what conclusions he draws from them. He notes, for instance, that the equation $(a+b)^2 = a^2 + 2ab + b^2$ can be represented geometrically as a square with sides of length $a+b$ and with the interior divided into four rectangles of areas a^2 , ab , ab , and b^2 . But he stops short at explaining

why such a representation is easier for most people to grasp than the algebraic equation, and the relationship between this and other examples to his main thesis remains obscure.

In short, *Mind and Nature* is a book to be read for the incidental examples strewn through it, but anyone who wants to discover its general message will have a hard time. As Heraclitus wearily steps for very much more than the second time into yet another river, one gathers that process is important and that everything is connected to everything else — the book is indeed a grand but empty synthesis of everything. □

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Microelectronic technology

T.H. O'Dell

Magnetic Bubble Technology. By A.H. Eschenfelder. Pp.317. (Springer: Heidelberg and New York, 1980.) DM97, \$54.40.

AT A time when microelectronic devices based upon single crystal silicon have become part of our popular culture, it is good to see a book concerned with a microelectronics based upon the far more interesting magnetic crystals, the garnets. The information-processing potential of these devices exceeds that of their silicon predecessors by at least two orders of magnitude.

While there have been two previous books on the theoretical aspects of magnetic bubbles, Eschenfelder's is the first to go into the real technical detail of devices and, like most books of this kind, a feel for the work can be obtained from a study of the index; this is good, and calls attention to Chapter 6 which is an excellent review of the available magnetic materials of bubble technology, the garnets, hexaferrites, amorphous metal films and orthoferrites. All these materials are treated very effectively using a powerful graphical technique, pioneered by Eschenfelder, in which the coordinates are chosen such that different values of exchange constant may be represented by

sets of parallel straight lines. The unification which this technique brings about is really striking.

Chapter 6 also contains a valuable treatment of magnetic anisotropy. In magnetic bubble garnets this is induced during the growth process for the film, one of the topics in Chapter 7 which is on device fabrication and includes a good discussion of lithography giving considerable numerical detail.

Chapter 8 deals briefly with device packaging, while Chapter 9 is on applications and is not just concerned with simple memories but also describes the fascinating information-processing possibilities of the technology. This enables data to be sorted as it is in the process of being stored or retrieved by means of the flow-steering switches pioneered by Eschenfelder's IBM colleagues Chen, Chang and Tung. The book concludes with Chapter 10 which takes a brief look at what the future may hold for this exciting and highly developed microelectronic technology.

The first five chapters of this book are not so good, however. No Appendix A, promised on p.1 to relate the Gaussian units, in which the book is unfortunately written, to SI units, exists. A conversion table is printed inside the front cover to rectify this omission. Figures 1.8 and 1.10 are repeated later as Figs 4.31 and 8.3. Page 8 sees the start of half a page of text with the most peculiar absence of capitals and punctuation.

Chapters 1-5 deal with bubble statics, dynamics and propagation structures, but give no help at points where earlier publications may have been obscure. An exception is to be found upon pp.156-158, where the elegant cross-hatch current sheet device due to Voegeli, and unpublished until now, is described. □

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Fungal ecology

John Webster

The Ecology of Fungi. By W. Bridge Cooke. Pp.274. (CRC Press: Boca Raton, Florida/Blackwell Scientific: Oxford, 1980.) \$77.95, £50.75.

ABOUT 100,000 species of fungi are known. They are ubiquitous in soil, in water, on organic matter of all kinds, and occur as parasites of plants and animals, and as symbionts in association with algae in lichens, and with roots forming mycorrhizas. Their prolific reproduction and effective dispersal ensure that suitable substrata are quickly colonized, and it is uncanny how, at the right place and time, on the appropriate substratum, a particular fungus can be found, indicating precise adaptation to its niche. Fungi play important roles in ecosystems, especially as parasites and as decomposers. Some — for example, lichens, or *Rhytisma acerinum*, the cause of tar-spot of sycamore — are valuable indicators of SO₂ pollution.

To review the ecology of such a group of organisms is a daunting task and, for a single author, well-nigh impossible unless he attempts severe selection of the wealth of available material. A glance at the contents page of *The Ecology of Fungi* shows that this sets out an impressive synopsis of subject matter. Unfortunately the actual text is a great disappointment. "Basically, this book is an elaboration of an earlier review of the subject . . ." (by W. B. Cooke in 1958). It is emphatically not a book for a beginner. Nowhere is there an attempt to set out the principles of the subject and many terms are introduced without definition. Most of the sections are annotated literature abstracts, such as might be made by compiling and arranging a collection of *Biological Abstracts*. Rarely is there any critical appraisal or synthesis. Too often, no conclusions are drawn, but merely a statement is made that a certain study has carried out. It is, of course, dangerous to make selected quotations out of context, but the following are offered, without the reference numbers, to give an impression of flavour.

It has been shown that collections of *Schizophyllum commune* can produce turgid spores after more than a year of complete desiccation. Assuming that a turgid spore is a viable one, spores of this species can withstand considerable desiccation.

There is an obvious confusion here. The reference is to Buller (1909), and it should have been added that the *fruit-bodies* which Buller freeze-dried have been revived some 52 years later (Ainsworth in *Nature* 195, 1120; 1965).

Transpiration was found to be a vital function in the fruit-bodies of agarics. It occurred under conditions of complete

● *Statistical Mechanics* by R. H. Fowler has been reissued in paperback by Cambridge University Press, price £18.

● *Sociobiology: The Abridged Edition* by Edward O. Wilson with drawings by Sarah Landry (pp. 366; price: hardback \$18.50, £11.10; paperback \$9.95, £5.95) has just been published by Harvard University Press.