of *Climate and Life*, by S.H. Schneider and R. Londer (Sierra Club Books, San Francisco; 1984) — suggests that the rich should control their resource consumption and help put resources on the line to allow the poor to develop, but only if such development is in the context of reducing population growth rates and investing in specific technologies and organizations that have some promise of a sustainable future. To place CO₂ on the global agenda for action outside the context of world development is probably to doom the world to adapt to the changes that inevitably will occur. It would be unfortunate if a potential problem of this magnitude were once again to be handled by random adaptation in the absence of intelligent advanced thinking that could minimize potential damages and even take advantage of potential opportunities.

Despite my dwelling on these omissions, to be fair I should note that the title of the book has "ecosystems" in it, not health or water supply systems. But since the report from Villach was otherwise so comprehensive it is unfortunate that a few more chapters were not added to this already excellent volume.

Finally, the individual authors, especially Dickinson, stress that the problem will alter with time, even though most analyses assume future equilibrium changes. There needs to be a sense of the urgency of the greenhouse problem: both climatic and ecological systems could well be forced to change at virtually unprecedented rates. Therefore, not only will this require study of climatic or biological systems' transient behaviour, but also their coupled transient interactions. It can take centuries, if history is our guide, for forests to march hundreds of kilometres in response to a temperature change of a few degrees. But that magnitude of change could occur in one century or less. How ecosystems can cope with such rates of change, complicated further by other human changes to the physical and chemical environment, is a major uncertainty and is of serious concern. It reminds me of my favourite cliché in dealing with the greenhouse effect issue: "We insult the environment faster than we can understand it or predict the consequences". That point is well documented by Bolin *et al.* But it is a value judgement, of course, whether that is enough to alter global development planning substantially. I myself agree with the Villach participants' report that it is not premature "to explore the effectiveness of alternative policies". Uncertainty is ever present, as SCOPE 29 reiterates; nonetheless, our great biogeophysical experiment continues inexorably into the next millennium. □

Stephen H. Schneider is Head of the Interdisciplinary Climate Systems Section, National Center for Atmospheric Research, PO Box 3,000 Boulder, Colorado 80307, USA.

Open resistance

Julian Davies

Antibiotic Resistance Genes: Ecology, Transfer, and Expression. Edited by Stuart B. Levy and Richard P. Novick. Cold Spring Harbor Laboratory: 1987. Pp.436. \$68.

THE ecological consequences of antibiotic use have provided a prime example of the way in which the environment responds to a global assault with man-made poisons. Human and animal applications of antibiotics have been practised with enormous therapeutic and economic gain since the introduction of the synthetic sulphonamides in the late 1930s; the assault was intensified with the introduction, some ten years later, of penicillin and other secondary metabolic products of microbes. In 1978 alone, 12 million kilograms of antibiotics were produced in the United States — the Earth is literally bathed in a dilute solution of antibiotics.

The response of the endogenous microbial population to this minor catastrophe was unexpected but spectacular: transmissible antibiotic resistance, first identified in Japan in 1959, is now virtually ubiquitous, and is often the principal determinant of how and when antibiotics are used. Watanabe proposed in 1971 that R-plasmids arose through the 'pick-up' of antibiotic resistance determinants by plasmids. Because both plasmids and antibiotic resistance genes were present (independently) in nature well before the antibiotic era, this was a highly plausible notion. With the discovery of transposable elements, and the advent of modern genetic engineering methodology, we have begun to fill in some of the gaps in this molecular history.

In 1985, the Banbury Center of Cold Spring Harbor Laboratory held a symposium, "Antibiotic Resistance Genes: Ecology, Transfer, and Expression", with the specific goal of examining the possible origins of antibiotic resistance genes and assessing the risks associated with their spread in the environment. This is a controversial subject; in spite of good evidence of inter-species dissemination as a result of the wide human and animal use of antibiotics, there are counter-claims that no dramatic changes in antibiotic susceptibility of the Enterobacteriaceae took place in the United States between 1971 and 1984.

The conference embraced three general themes: microbial ecology, gene transfer and maintenance, and evolution of genes and gene transfer systems. The papers, now published in the book under review, are relatively short, and rather uneven in content and in style. Many of the authors

have tended to limit themselves to their own speciality, and although there is a discussion after each paper this too often concentrates on minor points of experimental detail and not on the main issues. The summary discussion session does not always address the questions raised in the introductory chapters, and substantive conclusions are lacking.

In addition to being an object lesson in man's influence on environmental microbiology, antibiotic resistance provides fundamental information for epidemiology, biochemistry and evolutionary science which could aid in guiding the future release of man-made agents (chemicals, microbes) into the environment. The implications for the release of genetically engineered microorganisms (with or without resistance genes) are not discussed in the book. In an area where soundly based biological conclusions might lead to more rationality and less nonsense, it seems that a chance has been missed to present some scientifically valid considerations. For example, plasmid and gene stability are covered, but without reference to broader questions. What determines the movement of genes in what were once considered sterile relationships, such as between Gram-negative and Gram-positive organisms? What is the role of positive selection (of linked characters) versus metabolic load? Such speculations would have added to the value of the book.

Many informative chapters are included, but it is worth noting that several of the authors have also contributed to "Evolution, Ecology and Epidemiology of Antibiotic Resistance", published by Academic Press in 1986. In comparison, the latter has certain advantages and is better focused, but the two together provide an up-to-date and comprehensive overview of what we know about the determinants of antibiotic resistance. Clearly, the last word has not been written on this subject. □

Julian Davies is in the Department of Biotechnology, Institut Pasteur, 25 rue du Dr Roux, 75724 Paris Cédex 15, France.

New in paperback

- *New Guinea Tapeworms and Jewish Grandmothers: Tales of Parasites and People* by Robert S. Desowitz. Publisher is Norton, price is £4.95, \$6.95. For review see *Nature* **296**, 514 (1982).
- *Uneasy Genius: The Life and Work of Pierre Duhem* by Stanley L. Jaki. Publisher is Martinus Nijhoff, price is Dfl. 45, £15. For review see *Nature* **317**, 482 (1985).
- *The History of the Countryside: The Full Fascinating Story of Britain's Landscape* by Oliver Rackham. Publisher is Dent, price is £8.95. For review see *Nature* **321**, 823 (1986).
- *Evolution: Essays in Honour of John Maynard Smith* edited by P. J. Greenwood, P. H. Harvey and M. Slatkin. Publisher is Cambridge University Press, price is £15, \$24.95. For review see *Nature* **319**, 19 (1986).