

Health risk: just a guessing game?

T. A. Connors

Ethylene Dichloride: A Potential Health Risk? 5th Banbury Report. Edited by B. Ames, P. Infante and R. Reitz. Pp.350. (Cold Spring Harbor Laboratory: 1980.) \$45, \$54 outside USA.

"WELL, is ethylene dichloride a health risk?" is the question that comes to mind after reading this book. The comment does not imply any specific criticism of the report but rather sums up our present knowledge of the toxicology of a wide variety of chemicals to which human beings are exposed. We suspect from animal and other laboratory tests that many chemicals may be a risk to human health as carcinogens, teratogens, mutagens and so on, but we do not have reliable methods to determine whether there is an actual risk in any situation or what the degree of that risk may be.

Ethylene dichloride is a very important chemical indeed, the US production in 1977 amounting to 11,000 million pounds in weight. It is used mainly as an intermediate, so most high-level exposure is in the chemical industry, but significant amounts are also used in the textile and food industries and in agriculture, for example. The possibility that ethylene dichloride might be carcinogenic was first suggested when it was shown to be mutagenic in bacteria. In a large international study, tests of this type have been shown — at least for certain classes of chemical — to correlate reasonably well with animal carcinogenicity tests which in turn have given positive results for most human carcinogens identified by epidemiological or case control studies. This Banbury Report summarizes what is known of the toxicology of ethylene dichloride and one learns that it can be metabolized *in vivo* to an alkylating agent which can react with DNA and initiate the events that many people think can lead to cancer. One also learns that other short-term tests, using *Drosophila* and yeast, for example, have given positive results and that the chemical, like many of its congeners, is carcinogenic in rats and mice. However not all of the data are unequivocal. In a well-controlled study, Maltoni and his colleagues could find no evidence for the carcinogenicity of ethylene dichloride in rats and they question the validity of earlier studies from a number of aspects including "the professionalism of the team carrying on treatment, control of animals and autopsies". Furthermore, no teratogenicity or major reproductive toxicity was found either in animals or in exposed workers, nor was there any evidence of an increased incidence of cancer in workers exposed to ethylene dichloride for 20 years or more.

All in all the book is a wonderful

miniature of the multidisciplinary field of toxicology and the problems that arise in interpreting data from different types of test, in choosing between conflicting results and in attempting to assess the risk to human beings. Although scientists, as in this report, are to be commended for attempting to measure carcinogenic potency and to quantify risk, the equation contains so many unknowns that the assessed level of risk must be seen to be based on a working hypothesis with many assumptions rather than as the result of an extrapolation based on scientifically reliable methods. It follows then that in making the decision to restrict a chemical, to replace it with "safer" alternatives or to ban it altogether, economic and social argument must be considered as well as the scientific aspects. There is concern that a number of chemicals which have been used for many years and considered to be safe because there was no acute toxicity

associated with exposure, may nevertheless be highly dangerous in the long term. The Banbury Report, with contributions from industrialists, government scientists and university researchers, shows how widespread this concern is, but until animal experiments can be related to human situations the debate on the dangers of chemicals will continue.

However, there has already been one welcome outcome. Workers are nowadays exposed to less dirty, dusty and smelly conditions than even a few years ago, while urban environments are certainly more wholesome than they once were. Whatever the effects may be on the cancer incidence only time will tell; but for those people who believe that quality of life is at least as important as quantity of life then there is already a vast improvement. □

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Catastrophes for starters

Colin Upstill

An Introduction to Catastrophe Theory. By P.T. Saunders. Pp.144. (Cambridge University Press: 1980.) Hbk £9.50, \$27.50; pbk £3.25, \$8.95.

ALL previous introductions to catastrophe theory have been either popularizations, devoid of any serious mathematics and often riddled with falsehoods, or works of considerable mathematical sophistication. This book succeeds in filling the gap between these extremes. It divides naturally into two parts. The first is an exposition of the theory, which deals with the singularities of smooth real valued functions, using only a limited mathematical vocabulary yet not glossing over anything of importance: structural stability, equivalence, the splitting lemma, determinism and universal unfoldings are all explained as clearly as one could wish. The second half of the book gives the flavour of applications of the theory by way of a selection of examples from the physical, social and biological sciences, all of which are to be found discussed in much greater detail elsewhere in the literature. The author is careful not to exaggerate the status of catastrophe theoretic models in the social and biological sciences, and concludes with a lucid discussion of the explanatory powers of the theory and some cautionary words on appropriate standards of judgement of applications in different disciplines.

My enthusiasm is not unqualified,

however. Central to catastrophe theory are the geometries of the catastrophes themselves, so it is inexcusable that their illustration in this book leaves something to be desired. Most of the relevant figures are slavishly and uncritically copied, with due acknowledgement, from the book by Bröcker and Lander (*Differentiable Germs and Catastrophes*; Cambridge University Press, 1975); some include labelling in a nomenclature incompatible with that used in Saunders's text, others include construction lines which are here irrelevant and unexplained, or fail to display the nature of the singularity at the origin of control space. Where the drawings are original, similar lack of care is evident. At the hyperbolic umbilic singularity, the rib (cusped edge) and the fold touch parabolically, yet here they are depicted as intersecting straight lines; the sketch of the lips event is quite dreadful.

The text does not suffer from any such sloppiness, but there are some omissions which are surprising in such a recent publication. Most notable is the absence of any reference to the work of the Russian mathematician V.I. Arnol'd, who is responsible for the enormous extension of Thom's classification to catastrophes of codimension > 4 , and for a rational system of symbols to label the catastrophes, which Saunders eschews — the Thomist "pet names" are fine if one is only considering a few low-dimensional catastrophes, but things get out of hand as the dimensionality and number of catastrophes in the list

increases. Explanations of the role of higher dimensional catastrophes as organizing centres and of the importance of compact catastrophes in applications would not come amiss; neither would some discussion of (or at least references to) recent vociferous criticisms of some applications of catastrophe theory in the social and biological sciences.

In a rapidly expanding subject it is inevitable that any book will be out of date as soon as it is published. However, much of this book could have been written four years ago. Whilst there is no claim to define

the "state of the art", it is an uneven treatment, to say the least, that for some applications covers material from one or two expository works of several years ago, but for others refers to a quantity of very specialized material of recent date. One is forced to conclude that the author has made no great effort to acquaint himself with recent work outside his own particular interests, which is a pity, because as a result he has written a good book when he could have written a superb one.

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Potpourri of nuclear structure theory

J. M. Irvine

Nuclear Spectroscopy. Lecture Notes in Physics, 119. Edited by G. F. Bertsch and D. Kurath. Pp.250. (Springer-Verlag: 1980.) DM33, \$19.50.

THE Gull Lake workshop on nuclear spectroscopy, held in the summer of 1979, reviewed most of the basic topics in theoretical nuclear structure physics. This book is a record of the deliberations of the participants.

The opening chapter by Gerry Brown takes us through the familiar analysis of the meson exchange nature of nuclear forces, linking it to the quark structure of the nucleon in the "little bag model" of Brown and Rho. The Brueckner-Bethe and Landau-Migdal theories of effective interactions are developed and the predictions for the bulk properties of nuclear matter presented. In other interesting papers, Dieter Kurath presents an introduction to the nuclear shell-model which is novel in that it includes a short discussion of the current shell-model computer codes, and George Bertsch discusses nuclear vibrations — both in the random phase approximation and Landau formalisms — and presents an up-to-date account of the new giant resonances.

Amand Faessler gives a unified account of deformed and transitional nuclei. Concentrating first on high spin states in deformed nuclei, he discusses the "back-bending" phenomena and the nature of Yrast traps, and goes on to give an account of the breakdown of pairing due to the Coriolis force in transitional nuclei. Franco Iachello describes the use of group theory in the analysis of nuclear spectroscopy with a natural emphasis on the successes of the interacting boson approximation.

The use of statistical analysis in describing complex spectroscopies has been advocated for a long time. At last there are signs that it is being put to use in nuclear physics and it is appropriate that the field should here be reviewed by J. B. French. Finally, there is an interesting appendix by Bertsch, Zamick and Mekjian which highlights some of the unsolved theoretical puzzles which abound in nuclear structure physics.

I found this an exceptionally readable account of current topics in nuclear theory. The level of presentation of the material is remarkably uniform for a multi-author volume. I am sure that students and research workers in the field will find this a useful addition to their bookshelves.

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where, although the relationships may be equally close and complex, they can be non-obligate and accidental, as with dipterous flies and many bacterial plant pathogens.

The book clearly points out the wide gaps in our knowledge and understanding of this subject. Many chapters end with questions for the reader or indicate need for further study. One contribution is even devoted to the search for the vector of a disease (lethal yellowing of coconut palm) where the very nature of the pathogen is still uncertain, although the reader may assume it to be a mycoplasma-like organism (MLO); a cixiid bug appears to be the most likely candidate as the vector.

The 13 chapters are written by different specialists, or groups of specialists who were clearly given a free hand and who have very different styles of writing. This variation in style adds to the interest but perhaps the editors might have tied the volume together a little more closely.

This thought-provoking book contains many references and will be of value and interest to researchers as well as to students and teachers. For example, how many of us have considered the possibility of a link between the use of mustard gas in the First World War and the recent spread of Dutch elm disease? The book suggests one. □

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Seabird synthesis

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Behavior of Marine Animals. Vol.4, Marine Birds. Edited by J. Burger, B.L. Olla and H.E. Winn. Pp.515. (Plenum: 1980.) £28.35, \$54.

STUDENTS of seabirds will warmly welcome this fine and wide-ranging compilation of data, ideas and references. Many important aspects of breeding biology such as choice of habitat, mate-selection, various factors and strategies relating to breeding success and the nature of communication behaviour are excellently reviewed. These articles form the core of the book but three others (seabirds at sea, the distribution of gulls in North America and, somewhat oddly placed, chemoreception in seabirds) stand outside this major theme.

Systematic use of headings and sub-headings produces welcome internal consistency within the volume but, in view of inevitable omissions in such a wide-ranging and essentially review work (references average 148 per article, excluding that by Southern), space could have been saved by editorial restrictions on the text authors devote to their own research. As it is, several contributors suddenly abandon the

Various vectors and plant diseases

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Vectors of Plant Pathogens. Edited by Kerry F. Harris and Karl Maramorosch. Pp.467. (Academic: 1980.) £27, \$48.

THIS book succeeds admirably in what it sets out to do, providing much detailed, up-to-date information on the inter-relationships of many plant pathogens, their plant hosts and various vectors. It is

third in a series of four volumes being published on this general topic. The earlier volumes were concerned with aphids and leaf-hoppers, and, although the first chapter of this volume is devoted to pathogen-vector relationships within these groups of insects, most of the current book is concerned with other, generally less well-known vectors. These range from mealybugs, to fungi and to nematodes