Putting us to ignorance again

Peter T. Landsberg

Thermodynamics: Foundations and Applications. By Elias P. Gyftopoulos and Gian Paolo Beretta. *Macmillan, Inc., New York: 1991. Pp. 658. $66.*

LET us take the view that the *basic* ideas to be taught in thermodynamics should be the same for all students, be they engineers, chemists or physicists, while the applications should differ so as to be most appropriate to the students' needs. What, then, should constitute the basic framework? My own answer would be: (1) a phase space in which points represent equilibrium states and curves represent quasistatic (that is, reversible) changes; (2) the ideal gas and some other simple sytems; and (3) a clear understanding of inexact and exact differentials.

The students at the Massachusetts Institute of Technology, who have attended at least part of the course presented in this book, are by no means all engineers. In fact, the authors do not seem to address themselves to any particular students. I would expect, however, that engineering students are the most suitable readers. But there is one caveat: they should not know the subject beforehand, because the ideal readers are, according to the authors, those "without much background in thermodynamics".

So reviewers are not really very suitable readers because they "know too much". The authors go on to explain that "experienced readers . . . may be appalled when they read that thermodynamics applies equally well to macroscopic and microscopic phenomena, that entropy is equally well defined for equilibrium and non-equilibrium states, and that temperature is . . . useful also for . . . a single particle . . . .The new perspective requires . . . a subtle and demanding reconsideration of basic premises . . .". Thus there is little in the book on the first two points of my desiderata, and almost nothing on the third. But there are some challenging new points of view. The emphasis is away from mathematical concepts. This is not because the authors do not like to touch mathematical physics — I need only refer to their research papers on "quantum thermodynamics" published in *Nuovo Cimento* and elsewhere in the mid-1980s. (Their proposed union of mechanics and thermodynamics even attracted a leading article in *Nature* back in 1985 (**316**, 11).)

The unusual nature of the authors' exposition is illustrated by the fact that the first and second laws of thermodynamics appear in chapters 1–4, whereas adiabatics and entropy are introduced only later (in chapters 5 and 7 respectively). It may be that beginners will take strongly to the book; and so they should, considering that the course on which it is based has been taught for 20 years. The authors have worked outstandingly hard: there are many tables and numerical data and plenty of problems. It seems churlish to hesitate to give the book a full-blooded recommendation.

But I do hesitate, in part because of details such as the definition of reversibility (page 59), the alleged achievement of perpetual motion in the laboratory (page 39) and the absence of a reason why the ideal gas cannot exist near $T = 0$ (page 325). More excusable for non-British authors is the description of Lord Kelvin as an English physicist, even though I fancied I saw him turn in his grave on being thus described. (He was born in Belfast of Scottish parents and held university chairs in Scotland.)

The length of the book (it seems occasionally verbose) seems to be due to the authors' desire to cover both graduate and undergraduate courses, both introductory and advanced. However admirable the book's concept, its lack of references to research papers of even the 1960s or 1970s means that a graduate course would require yet more material to be added to an already long exposition.

In fact, the atmosphere of the book gives the impression of thermodynamics being a closed rather than a continuing subject. Perhaps the authors could present their philosophy of the subject forward more clearly by putting it into a shorter book next? □

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Killing fields

Gwyn T. Williams

Apoptosis: The Molecular Basis of Cell Death. Edited by L. David Tomei. *Cold Spring Harbor Laboratory Press: 1991. Pp. 336. $44 (pbk).*

ALTRUISM is easy to justify for cells — the death of some for the benefit of the whole organism makes perfect genetic sense. Nevertheless, in accepting the idea that biological systems can be controlled by the modulation of cell death, scientists have had psychological as well as technical barriers to overcome. The current interest in active cell death would suggest that the importance of the process is now widely appreciated. The fundamental implications of the phenomenon account for the broad range of subjects represented in this book, which originated from a meeting held in 1990.

Several chapters deal with apoptosis as a whole, and the reviews by J. F. R. Kerr and B. V. Harmon and by S. R. Umansky serve as an especially useful introduction to the field. The rest of the book is concerned mainly with cell death in cancer development and treatment; there is an increasing awareness that cell populations can grow without increasing their proliferation rate provided that the rate of cell death is reduced. It has now been clearly shown that failure or suppression of physiological apoptosis can have an important role in cancer development. On the other hand, several contributors describe attempts to eliminate malignant cells through inducing apoptosis by irradiation, cytotoxic drugs, manipulating the hormonal signals received by the cell or engaging specific cell-surface receptors with antibody. The true effectiveness of these procedures is not yet known.

Other authors cover areas of immunology. The reviews of T-cell-mediated killing by R. C. Duke and thymocyte death by D. J. McConkey and S. Orrenius address research areas that have been greatly influenced by the concept of cell death as a closely controlled, active process.

Neurobiologists have long appreciated that programmed death of developing neurons is suppressed by specific growth factors. A. C. Server and W. C. Mobley's discussion of neuronal death is very helpful for those outside the field. The authors emphasize that an understanding of active cell death in other lineages should prove to be valuable in establishing the significance of the process in neuronal development and degeneration, despite the idiosyncrasies of neuronal death.

The book provides a valuable overview of apoptosis, even though there are important areas that it does not fully cover. The molecular genetics of the precisely programmed cell death that occurs during the development of the nematode *Caenorhabditis elegans*, and the role of the proto-oncogene *bcl-2* in suppressing cell death in both physiological and pathological situations, for example, certainly deserve more extensive discussion. Such deficiencies are inevitable in such a rapidly developing field and may well be rectified in a second volume on the subject, now in preparation. □

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