

## Life under chilly conditions

F. Franks

**The Effects of Low Temperatures on Biological Systems.** Edited by B. W. W. Grout and G. J. Morris. *Edward Arnold: 1987. Pp. 500. £45, \$89.50.*

MULTI-author volumes tend to exhibit common strengths and weaknesses. Most chapters are written by experts in their field and are therefore authoritative. On the other hand, the strength of the chain is that of its weakest link. There is invariably at least one unreliable author who ignores deadlines, with the result that publication is delayed and the volume, when it finally appears, is not as topical as it could and should have been. This book bears the marks of such laggard contributors.

It is composed of 15 chapters, grouped into four sections: fundamental principles, techniques, environmental low-temperature biology, and applications. The chapters vary in length, detail, comprehensiveness and emphasis. Some authors have chosen to provide state-of-the-science overviews, whereas others critically discuss experimental evidence in order to draw conclusions. Yet others have limited themselves to summaries of practical freezing and thawing protocols. There is also a certain ambivalence in emphasis: is the book aimed at the student of the effects of cold on living organisms (that is, cold tolerance/resistance, acclimation) or at the cryopreserver (dimethyl sulphoxide, controlled cooling, liquid nitrogen)? If the former, then why is there no mention of microorganisms or insects? What determined the choice of the topics? The volume could have benefited from some ruthless editing.

For me, the three outstanding chapters are "Cells at Low Temperatures" (Morris and Clarke), "The Adaptation of Aquatic Animals to Low Temperatures" (Clarke) and "Low Temperature and Biological Electron Microscopy" (Skaer). Each is a masterpiece of description, critical analysis, conclusions and pointers for future developments; they are stylishly written, with useful bibliographies. Contributions dealing with higher plants (Wilson, Grout), mammalian hibernation (Wang), medical and clinical aspects (Fuller, Green) are also interesting, although not as incisive.

The point of a chapter on 'direct' chill injury (Morris) is not clear. The symptoms are brought about by fast cooling. In the ecosphere such cooling rates do not occur and in the laboratory one can presumably avoid them in order to achieve optimum results. Accounts of recent developments in optical cryomicroscopy (McGrath) and



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*Tree time — the picture, of resting chimpanzees, is reproduced from the new paperback edition of Jane Goodall's In the Shadow of Man, which was first published in 1971. The paperback has a brief introduction by Stephen Jay Gould, together with a very brief postscript by the author, and is published by Houghton Mifflin. Price is \$11.95.*

the cryopreservation of parasites (James) will appeal to specialists. The chapter on plant germplasm preservation (Withers) reflects the underdeveloped state of that subject; at best it is recipe science. Withers makes a reasoned plea for *in vitro* plant germplasm preservation, but her bibliography, limited essentially to names of half-a-dozen senior authors, is only too revealing of the lack of importance attached to this subject by industry and governments, and hence by the scientific community. The final chapter on food freezing (Reid), eight pages in length, is no more than an appendix; one must wonder why it was written at all.

Despite a valiant attempt by the author to tackle a difficult and wide-ranging subject, the introductory chapter on physico-chemical principles (Taylor) poses problems. Some of the concepts (such as water structure, antemelting and incipient melting, bound water) are quite out of date. Some terminology is incorrect (for example, on p. 19 heat of crystallization is referred to as heat of fusion) and the material is not presented in the most effective sequence. In places Taylor side-

steps important, if complex issues, such as the freezing behaviour of ternary systems in which one component (glycerol?) does not crystallize. Instead, he deals at length with the familiar binary water-NaCl phase diagram. The reader is then referred to specialist articles which are not the easiest of reading.

The book is attractively produced and is essentially free from typographical errors, although some names are consistently misspelled. It is recommended reading for postgraduate students and others who wish to acquaint themselves with the elements of laboratory cryobiology and with the various responses of live cells and some organisms to low temperatures. □

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## Field surveys

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**Geomagnetism, Vols 1 and 2.** Edited by J. A. Jacobs. *Academic: 1987. Vol. 1, pp. 627, £62, \$112; Vol. 2, pp. 579, £62, \$112.*

GEOMAGNETISM, which may be broadly but incompletely defined as the study of the Earth's magnetic field, is a subject of curious contrasts. In academic circles it is often regarded as a highly esoteric topic seldom to be taught outside advanced geophysics courses; yet in the severely practical role of navigational aid it underpinned world exploration and trade for centuries. It has thus traditionally attracted an uneasy alliance of mathematical theoreticians and navy hydrographers. In its pure form as a study of the structure and origins of the Earth's magnetic field, it is often regarded by Earth scientists as an isolated topic unconnected with almost anything else; yet in a blaze of glory during the 1960s it gave rise to an offshoot, palaeomagnetism, that revolutionized the whole of geology. Though studied by few, it has thus influenced the thinking of every Earth scientist in the world.

There are internal contrasts, too, for the subject comprises two fairly distinct fields, generally studied by two quite different groups of people. When Chapman and Bartels published their huge two-volume work *Geomagnetism* in 1940, 'geomagnetism' was revealed as largely the study of short-term variations in the small part of the Earth's magnetic field generated externally — a branch of solar and atmospheric physics, in fact. The main (internal) geomagnetic field could be described very quickly, and there was nothing at all to be said about its causes. Little had apparently changed in a relative sense when the two volumes of Matsushita and Campbell's multi-authored *Physics*