The Effects of Low Temperatures on Biological Systems

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Preface

The effects of low temperature, in the natural environment or laboratory, are likely to attract the attentions of most biologists at some point in their studies. These effects are diverse, complex and can be studied at many levels. For example, the distribution, behaviour and reproductive strategies of whole organisms are commonly moderated by low temperature, influencing the ecology of both animal and plant populations. Reduced temperature and its effects on the productivity and survival of plants is also an area of major concern, particularly where food crops are involved. In these instances low temperatures are typically restrictive, although they may have important developmental functions, particularly in plants. The diversity of effects is increased following freezing when temperature *per se* is separated, as it must be for a full understanding of the system, from the presence of ice.

In the laboratory the influences of low temperature can be studied through to the cellular and molecular levels to give insight into basic biological mechanisms, and a more complete understanding of natural systems at all levels. The practical benefits of preservation of biological systems at low and ultra-low temperatures can also be manipulated, ranging from maintenance of activity in isolated biological macromolecules to keeping a wide range of microorganisms, higher organism cells and tissues viable whilst frozen. Beneficial aspects of the application of low temperatures are also exploited, both in fixation and observation, in light and electron microscopy.

Each of these areas of study has already accumulated a large body of literature to occupy much of the time of the investigator, increasingly restricting the opportunities to stray into other areas of cryobiology. This restraint

is effectively strengthened as most workers are involved in a specific area of biology firstly, and with the effects of low temperature subsequently. Rarely does one find a genuine investigator of low temperature effects who is bold enough to range widely across the biological spectrum.

This book was begun as an attempt to encourage excursions by interested biologists, at all levels from undergraduate finalists, into areas of biology possibly unfamiliar to them to look further at low temperature effects. It is hoped that they will see signposts in these areas indicating similarities, parallels and divergences from their own experience that will help in the approach to their specific interests. It is not intended as a comprehensive text but as a guidebook to foreign parts.

We would like to acknowledge the willingness of the publishers to take on this task, and the skill and care with which each of the contributors has used their specific knowledge to develop the general theme of effects of low temperature on biological systems.

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