Preface

Antarctic ecology: from molecules to ecosystems. Part 1

Antarctica, by virtue of its isolation and the extreme nature of its environment, is a unique 'laboratory' for understanding evolution in natural populations and the effects of climate change. The revolution in molecular technologies has had a far-reaching affect on many aspects of biology. In the case of the Antarctic, it has revealed how organisms have evolved and adapted to extreme physical conditions and, importantly, how they may respond to the effects of climate change. The fact that Antarctica (or parts thereof) is one of the areas subject to the most dramatic changes in physical climatic conditions (and therefore in biological systems) in the world means that it acts as an early warning system of the degree of climate change and how biological systems are reacting to it.

Molecular biological methods have also revolutionized our understanding of the microbial world, previously limited by our inability to culture many of the important species in terms of ecosystem function. A complete understanding of ecosystem-level processes can only be obtained through science that integrates across scales of all aspects of biological organization (hence 'from molecules to ecosystems'). This is especially true in the case of climate change, where the effects are pervasive on all levels of biological organization.

The papers gathered together in these two volumes present an important synthesis of genomic and genetic studies on the Antarctic organisms, including the first synthesis of molecular studies related to the evolutionary history of the Antarctic biota. Its coverage is comprehensive, ranging from micro-organisms to vertebrates, from genes to ecosystems, from geographical scale of sub-millimetre to thousands of kilometres, and from time-scale of seconds to more than 100 Myr. It is timely, since over the last decade, there have been significant leaps in our understanding of the Antarctic ecology from the genomic to entire ecosystem level, making this a good moment to review the state of knowledge and understanding prior to embarking on the biological projects of the International Polar Year 2007–2008. Indeed, the material covered lays the ground for the IPY 2007–2008.

A key message which emerges is the need for the integration of scientific studies across different scales of organization and complexity, and how, for example, understanding of processes at the genomic scale can be critical to the understanding of processes at the ecosystem level. Similarly, the connectivity between different parts of biological systems is found to be critical in terms of response to climate change.

I commend the organizers, editors and contributors for a most valuable reference volume.

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One contribution of 8 to a Theme Issue ‘Antarctic ecology: from genes to ecosystems. I’.