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Book Review

Lichen Biology. Edited by **Thomas H. Nash** III. 2008. 2nd edn. London: Cambridge University Press. Pp. ix + 486, monochrome plates, 18 × 25·5 cm. ISBN 978-0-521-87162-4 hardcover, price £ 70, approx. $101/€72; ISBN 978-0-521-69216-8 softcover, price £35, approx. $50/€40.
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This excellent book nicely illustrates how far lichen studies have come since the late Mason E. Hale's pioneering guide *The Biology of Lichens* (1967). Unlike Hale however, this cannot be considered a beginner's book.

Nash (2008) is a second edition of that first published in 1996. As before, it provides a series of commissioned reviews, by experts in their fields, on various aspects of lichenology, and implicitly attempts to be comprehensive. Most areas of lichenology seem to be covered to some extent, with the notable exception of taxonomy, while over half of the chapters deal with physiology or ecological physiology. The 17 chapters are provided by 21 contributors. Chapter titles include Photobionts, Mycobionts, Thallus morphology and anatomy, Morphogenesis, Sexual reproduction, Biochemistry, Stress physiology, Physiological ecology of carbon dioxide exchange, Carbon economy, Nitrogen, Nutrients and mineral accumulation, Individuals and populations, Environmental role, Sensitivity to air pollution, Biogeography and finally Systematics, plus an appendix on culture methods for lichens and lichen symbionts.

The preface highlights the main changes that have taken place in lichen research since the last edition. Molecular biology in particular, has substantially altered the way in which we view lichen systematics. Further subject areas which were not covered or have been greatly expanded since the first edition include Sexual reproduction, Stress physiology and Growth and Ecology. Some chapter revisions have been so great that those dealing with Individuals and Populations, and Air Pollution appear to be completely new. The appendix on lichen culture is included to serve the growing needs of biotechnology.

It is inappropriate to single out individual chapters as they are mostly excellent and comprehensive. Many chapters focus on modern research and some give creditable attempts at a history but relatively few end with a conclusion. For example, it seems remarkable to me that still there are few reliable accounts of the sexual fertilization process, germination stages and the early lichenization process leading to lichen thalli. There is though, a fascinating and well-illustrated account of the early stages of growth in *Xanthoria parietina*. Further intriguing articles on photobionts show how far we have come since the days when we thought *Trebouxia* was never free-living. Some articles are more prescriptive in character; one gives the latest classification of Ascomycetes, another describes, what appear to be all known morphological structures, including those very confusing new names. In places then, the book becomes like a text book.

The book is especially stimulating where it points out the many remaining gaps in our knowledge. For example, some authors note that direct evidence of biosynthetic pathways leading to secondary products is 'meagre', and only hypothetical pathways exist. This is despite some 700 compounds being known, with only 50–60 occurring in other fungi or plants. Many chapters reflect on the concept of 'lichens as an ecosystem' as it is now well-known that the lichen thallus may contain several unrelated taxa of both myco- and photobiont. In addition, different strains of each can exist, so that parts of the thallus may be quite distinct genetically. This poses challenges for the taxonomist in trying to name a lichen, and to the physiologist who needs to know precisely what organism is being studied.

My criticisms are very few. The volume is excellently produced and I detected no typing errors. The photographic plates, though occasionally small, are generally adequate although many seem less than sharp and are rather lacking in contrast. Unusually, the chapters have no bibliographies as these are combined into a single, enormous list, of 97 pages, at the end of the book. This list is admirably extensive and valuable but I found it impossible to relate entries to the articles in which they were cited without scanning through the most promising chapters. A taxon index occupies 15 pages and there is a 10-page subject index.

This book is learned in style and is avowedly aimed at the specialist, whether amateur or professional. I would add that it should be an essential reference for serious students, project researchers, and teachers of lichenology. It is a very timely and up-to-date summary of the state of lichenological studies.

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