

## BOOK REVIEWS

**Genetics and Physiology of *Aspergillus*:** edited by JOHN E. SMITH and JOHN A. PATEMAN. The British Mycological Society Symposium Series no. 1, Academic Press, 1977. x + 552 pp. £12.00; \$23.50.

The title of this book may be misleading in that it understates the contents. All 24 papers are either directly or indirectly relevant to genetics or physiology, but, as stated in the editor's preface, one of the main features of the book is the wide range of pure and applied research in which species of *Aspergillus* are being used. The reviews of *Aspergillus* in industry, nutrition and medicine, will interest a wider readership which may not be attracted by genetics and physiology. As well as presenting a diversity of special interests, which is useful for a general reader and convenient for reference, this collation should provide a stimulating cross-fertilisation between different interests; with one reservation, I think that most of these aims will be achieved.

After an introductory review of the taxonomy of the 132 or more species of *Aspergillus* by Fennell, in which the potential usefulness of chemotaxonomy is demonstrated, there are accounts of asexual and sexual development by Smith *et al.* and Zonneveld respectively. Cove summarises the considerable research on the genetics of *Aspergillus nidulans*, and later in the volume there are papers on the genetics of conidiation (Clutterbuck), of mitochondria (Turner and Rowlands) and of populations (Croft and Jinks) of this species. It is surprising that more than twenty-five years after the establishment of *Aspergillus* in genetical research almost all of the research is still with *A. nidulans* only. The papers on mitochondria and populations are particularly useful. There has been much progress in mitochondrial genetics, but there is still much to learn about the organization of mitochondria and their interdependence with nuclei. Analyses of natural populations of *A. nidulans* have revealed considerable diversity within the species, and there is some limited evidence that similar variation and polymorphism occurs elsewhere in the genus, in both asexual and sexual species. Recent progress in chromosome cytology which demonstrates that *A. nidulans* is a eukaryote by Morris *et al.*, and an account of chromosome aberrations by Birkett and Roper provide a sound basis for normal and exceptional genetic analysis. Of the shorter papers, Cohen's review of the importance and as yet limited knowledge of the proteases of *Aspergillus* species is a concise but stimulating warning of their relevance in many fields of research.

The predominant contributions in the first half of the book are full reviews of carbon metabolism (McCullough *et al.*) and its regulation (Arst and Bailey), of nitrogen metabolism (Kingham and Pateman) and its regulation (Pateman and Kingham), and of the regulation of arginine catabolism (Bartnik *et al.*) and of purine breakdown (Scazzocchio and Gorton). These are detailed reviews of research areas in which experiment and analysis are difficult, and in which recent progress is revealing diversity and complexity. Advances in the understanding of genetic regulation in simple eukaryotes are important, but a more selective review or reviews would have been more useful. These papers, and some others in the first half of the book, are marred by a surprising frequency of errors in spelling and punctuation, and occasionally by the omission of a word. Most of these do not confuse the reading, but suggest an inexcusable carelessness in preparation and proof reading which should not occur in a publication.

The later papers have been prepared and edited more carefully. Cocker and Greenshields review the cultivation of *Aspergillus* for mass fermentation, and Bårbesgaard describes the production of amyloglucosidase and other industrial enzymes by several species of *Aspergillus*. Berry *et al.* and Jakubowska describe in detail the biosynthesis of citric acid and of itaconic and itatartaric acids respectively. Thomas's account of the role of *Aspergillus* species in biodeterioration contains expected and unexpected examples. The fungal contamination of many stored food products and of wool and textiles is not surprising, but the causing of corrosion in Concorde aircraft fuel tanks by an albino strain of *A. fumigatus* is a salient reminder of the potential of gene mutations. The description by Wood of the use of *Aspergillus* species in oriental foods, extends the common knowledge of Koji to a wider range of major and minor fermentations. This is followed by an equally readable review of *Aspergillus* mycotoxins, by Moss, including the aflatoxins produced by *A. flavus* which are both toxins and carcinogens. The final paper by Edwards and Al-Zubaid, reviews medical aspects of *Aspergillus*, and provides further examples of the adaptability of the genus to an exceptional range of habitats. Most of the book is readable and it can and should be a useful source of information and a stimulus for many biologists and biochemists as well as for those working already with *Aspergillus*.

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**Recent Developments in Nitrogen Fixation:** edited by W. NEWTON, J. R. POSTGATE and C. RODRIGUEZ-BARRUECO. Academic Press, London, New York, San Francisco, 1977. 622 pp. £16.

World consumption of industrially fixed nitrogen is now probably almost 80 million tonnes per year, requiring for its formation the energy equivalent to twice this weight of oil. With the impending decline in our energy resources

and the increase in the world population (an extra two mouths to feed every second), there is no doubt that we would be well advised to pay serious attention to the improvement of biological nitrogen fixation since, apart from water, fixed nitrogen is the most common limiting nutrient for plant growth. Certainly biological nitrogen fixation is now an active field of research, as demonstrated in the present volume which comprises the proceedings of a symposium held in Salamanca, Spain, in September 1976. This was the second international symposium to be held on this topic, the first being in 1974.

It is not possible to mention here more than a few of the 37 papers which were presented. In his introduction Professor Bond indicates the scope for improvements in biological nitrogen fixation and he emphasizes the ecological necessity to reduce our reliance on industrial fixation. The first five papers deal with the fundamental molecular interactions and thermodynamics of metal catalyzed nitrogen reduction. This is the region in which the pure chemist can aid the biochemist in suggesting feasible models for nitrogen reduction. One might hope that the industrial chemist could also eventually profit from the study of these processes. As the model for nitrogenase, G. J. Leigh favours end-on co-ordination of dinitrogen at a single metal site, with single electron reduction steps. J. E. Bercaw considers the reduction of molecular nitrogen to hydrazine on titanium and zirconium. E. I. Stiefel and G. N. Schrauzer speculate on the role of molybdenum in the function of nitrogenase, and the mechanism of hydrogen formation is reviewed by W. E. Newton and co-workers. Properties of the component proteins of nitrogenase are presented by W. H. Orme Johnson and his associates and the more physiological

aspects of nitrogenase are considered by M. G. Yates. Several papers present results obtained with Mössbauer and EPR spectra, which have been especially useful in establishing the function of the active centres in this complex enzyme system. The relation of hydrogenase to nitrogen fixation has been studied by K. R. Schubert and H. J. Evans, mainly in *Rhizobium*. Other topics concerning nitrogen fixation in *Rhizobium* include acetylene reduction (D. L. Keister and V. R. Rao), the correlation of nitrate reductase and nitrogenase (T. Sök and I. Barabas), extrachromosomal DNA (J. Olivares *et al.*) and the stability of leghaemoglobin (M. J. Dilworth and D. R. Coventry). The problems involved in aerobic nitrogen fixation and the electron donors for the nitrogenase in *Azotobacter*, and nitrogen fixation in the blue-green algae are reviewed respectively by H. Haaker and W. D. P. Stewart and co-workers. Several very interesting papers are concerned with the regulation and cloning of the genes for nitrogen fixation. The transfer of the Nif genes to higher plant cells is still considered to be in the realm of science fiction. Amongst the more biological papers, A. H. Gibson *et al.* and R. H. Burris speculate on the possibility that *Spirillum* rhizosphere associations might be used to improve cereal crops. This symposium volume concludes with several contributions on nitrogen fixation in *Alnus* and some detailed electron micrographs by M. Lalonde. The papers are of uniformly high quality and reflect well on the endeavours of the editors. The 18 page index will make this a useful reference source and for a total of 622 pages the book appears to be good value at the price of £16.

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