BOOK REVIEW

Biochemistry and Molecular Biology of Anaerobic Protozoa

Edited by: David Lloyd, Graham H. Coombes, and Timothy A.P. Paget
Harwood Academic Publishers. ISBN 3-7186-4943--8: List price $US 69.00

This publication is a compendium of presentations made at a two-day symposium on anaerobic protozoa held in Cardiff in 1988, and as such is a collection of papers of interest to specialists in Molecular Biology, Protozoa and related topics. It also has as a final presentation a general paper by Lloyd and Coombes which considers some unsolved problems. The book is a timely bringing together of a number of papers on anaerobic protozoa as there is a strong movement towards the molecular biology and biochemistry of eukaryotes, and the protozoa provide a suitable subject for some of these studies.

The presentations in the book fall roughly into categories of techniques, general physiology, rumen protozoa, the trichomonads, *Giardia*, and the entamoeba.

The first paper, by David Lloyd *et al.*, makes an important point about aerotolerant protozoa. Many so-called anaerobes live in conditions where there is oxygen at low levels, and they therefore need to be able to tolerate this oxygen. The authors have used a number of non-invasive techniques to study the metabolism of aerotolerant protozoa under controlled conditions. Only by using these methods is it possible to obtain realistic information on intracellular states that occur during chemotheraputic attack. This information helps us to understand why some drugs fail where others are effective. The range of techniques described forms a useful resource for potential research workers in this area. Methods reviewed are membrane inlet mass-spectrometry, fluoremetory, and NMR mass-spectrometry.

The second paper, by Brewers *et al.*, describes a case of essential endosymbionts in protozoa. Amoebae subjected to aeration lost their mitochondrial cristae and symbionts, and were then incapable of anaerobic growth. This is a nice study of the association between endosymbionts and their host allowing adaptation to a particular environment.

A detailed paper by Lloyd and Williams looks again at the utilisation of oxygen by so-called anaerobes, this time in the rumen. Their paper sets out well presented data to propose that the protozoa population plays a significant role in oxygen scavenging, and may act to control oxygen levels (which are detrimental to more susceptible organisms). The rumen holotrich population alone can utilise 7% of the rumenal oxygen: apparently a significant amount. The rumen ciliate protozoa constitute 50% of the total biomass occupying 10% of the rumen volume.

Dauvrin and Thines-Sempaux study the distribution of invertase in the rumen holotrich, *Isotrichia prostoma*, and find that it is associated with particular bodies known as invertosomes. This is a very neat study, and is the first point in the book at which we are presented with the inevitable SDS gel. The unusual invertase distribution in subcellular fractions of *Isotrichia* shows that portions of the native enzyme are not associated with any previously described organelle in this ciliate.

Barbara Lockwood *et al.* report a thorough study of proteinases in anaerobic protozoa, and have studied a wide range of rumen and trichomonad protozoa, including more than 10 species. SDS-PAGE gels demonstrate the activity of the proteinases in very neat, presentable diagrams and tables. The results show that there are some similarities between the proteinase contents of all the anaerobic protozoa studied.

Next come three papers on enzymes and metabolism of trichomonads, particularly *Trichomonas vaginalis* (which of course has medical significance). Following this is an interesting paper on the effects of reducing agents on *Trichomonas*. Reducing agents and oxygen tensions are favourite topics in studies of anaerobes. Paget and Lloyd have produced an interesting paper here on the oxygen inhibition thresholds and observed maximum respiration rates in these organisms. This paper is particularly useful because it has a small section on the growth and maintenance of the organism, which is of

great use to people getting into the area. The results indicate that the levels of cystine and ascorbate in the Diamond's medium used for anaerobes are vastly in excess of those necessary for the growth of *Trichomonas*. It is possible that the biochemistry of *Trichomonas* grown without the excess reducing agents is more similar to that found *in vivo*. Metronidozole is a drug used against a number of anaerobes. Kulda *et al.* present an interesting paper on the mechanism of resistance to metronidozole. This is a well presented paper, with comparisons between *Trichomonas foetus* and *T. vaginalis*. There are then a number of papers on hydrogenosomes, hydrogenosomal enzymes, and hydrogenosomal enzyme purification from the *Trichomonas* and *Tritrichomonas* protozoa. These are useful papers in elaborating the function of hydrogenosomes, and hang together well as a group.

We then come to a number of papers on *Giardia* - which is becoming a significant area of research in New Zealand. The problems of using both cysts and trophozoites for *Giardia* respiratory studies are outlined by Paget and Lloyd. This is a very useful paper because it is important to know about the respiratory activity of *Giardia* - an aerotolerant anaerobe. Their paper on growth, maintenance, and measurements of oxygen uptake is useful, as is the comparison between *Giardia muris* and *G. lamblia*. This latter paper is well set out, and is one of the best in the book. One of the significant parts of this paper is that this is the first report of respiratory activity from the cysts of *Giardia*. There is a useful commentary paper on proteinases and cyst metabolism by Ed Jarroll. It is a biochemical paper with some sub-cellular localisation and SDS-PAGE work. Not surprisingly, the proteinases of *Giardia* are of the cysteine type. We then have a report of differentiation of *Giardia muris* and *G. lamblia* using Southern Blotting by Van Kevler *et al.* This is a very useful paper because it has not previously been possible to make this distinction other than by using morphological criteria. However this paper does not give the source of the *Giardia muris* (i.e., *in vitro*, or *in vivo*). The problem of differentiation between these species has been a major problem in *Giardia* work. This Southern Blotting technique should become a useful tool in many labs. A later paper on the anti-amoebic activities of some plants used in traditional medicine covers a fascinating area which, I think, would bear more research. The identification of anti-amoebic compounds isolated from a number of plants (with which I am not familiar), and the possibility of these extracts being important either in medicine or just naturally is an important area. I complement Colin Wright for this paper.

This book, like so many of its type, is a collage of distinct papers with just the thread of anaerobic protozoa providing a common theme. As such, it would make useful, but not particularly interesting reading. However, the final paper, by David Lloyd and Graham Coombes on unsolved problems of aerotolerant anaerobic protozoa puts the icing on the cake, and hangs the book together. It goes back to look at the organisms that we are really dealing with, i.e., *Entamoeba*, *Giardia*, and *Trichomonas*, and to define the different levels of anaerobiosis. It looks at certain protozoa and the heterogeneities of their environments.

Finally, the presentation of the book with the typewritten typeface may not be attractive to some. I find that it is easy to read. The tables and diagrams are well presented. It is a very specialised bench research book, and will not have a wide market. In my own laboratory it certainly will be used.

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