BOOK REVIEWS

'Mitochondria and Microsomes' Edited by C.P. Lee, G. Schatz and G. Dallner. (Addison Wesley Publishing Company, Advanced Book Programme, Reading Massachusetts 01867). pp. XVI+811. Price $ 34.50.

Lars Ernster, currently Chairman of the Department of Biochemistry at the University of Stockholm, was sixty years old on 4 May 1980, and the occasion was availed of for an almost global review of research on mitochondria and microsomes in eukaryotic cells. Ernster is probably the most committed mitochondriologist alive, and certainly the one who has contributed most significantly and most profoundly to our understanding of the biochemistry and physiology of mitochondria and microsomes. His publications on these two cell organelles, nearly 400 in number, constitute a formidable and hand-to-match encyclopedia of mitochondrial and microsomal physiology and biochemistry. This great erudition and industry are associated in Ernster with personal qualities of the highest order and contribute to the almost universal desire on the part of his students, colleagues and friends, to come together to write a volume to honour a great biologist, biochemist and scientist. The result is a 800 page volume to which 67 scientists have contributed, an extraordinary and unparallelled display of devotion, affection and admiration.

There are thirty papers in the book, twenty on mitochondria and half the number on microsomes.

Mitochondria occupy the major attention of the contributors; they are larger, more easily isolable and, clearly have a dominant role in the physiology of the cell. They have a delicately organised and complex enzyme system and are sites of intracellular respiration. While the cytoplasm provides the oxidizable substrates and the material required for growth and regeneration of the mitochondria, these cell organelles transfer energy they generate to the rest of the cell.

Mitochondria And Cell Respiration

The principal biological interest in mitochondria is their identification as sites of intracellular respiration. It is now nearly 70 years since succinic oxidase and indophenol oxidase were found in heart muscle 'particles' by F. Battelli and L. Stern. This led to a continual search for the involvement of mitochondria in the synthesis and production of several respiratory enzymes. By 1950 it was clear that all the reactions involved in the oxidation of pyruvate, fatty acids and oxidative phosphorylation took place in isolated liver mitochondria. Electron miscroscopy followed soon after and it was established that mitochondria from a variety of tissues and different organisms were similar and also that variation in respiratory activity of different tissues was correlated with the number of internal membranes in the mitochondria.

Understandably, several papers in the volume deal with the different aspects of cell respiration. The flavoproteins of the respiratory chain are dealt with by Thomas Singer and others in mammals along with succinic dehydrogenase, NADH dehydrogenase and ETF dehydrogenase. No more complete and exhaustive account of these three mammalian enzymes exists. Cytochrome oxidase gets exclusive and extensive treatment in a special chapter by Marten Wickstrom. This is the most important respiratory enzyme in biology. Ubiquitous and crucial, it is found in every aerobic organism from bacteria to man and is responsible for 90% of oxygen consumption by living organisms. It is a multi-subunit membrane protein and three of its polypeptides are coded by mitochondrial DNA and synthesised on mitochondrial ribosomes. Its dominant role is energy conservation, and while Wickstrom deals with this aspect primarily, others like structure, electron transfer, O_2 reduction and energy transduction, all of which are intimately connected with each other as well as with energy conservation, are exhaustively reviewed. We are close to a detailed picture of the mechanism of cellular respiration though much work still remains to be done. Accounts of several other aspects of mitochondrial involvement in cell respiration follow. Two of these are particularly important: protein stoichiometry coupled to mitochondrial electron flow, by A.L. Lehninger and others, and the role of the electrical field in ATP synthesis by T.E. Conover and G.F. Azzone.

Mitochondrial Genome and Biognesis of Mitochondria

Boris Ephrussi's discovery, over 30 years ago, that in yeast an inheritable cytoplasmic factor was coupled with mitochondria was a major one and is not a little responsible for our current concepts of extrachromosomal inheritance. With the observation of mitochondrial DNA by the Nasses in 1962, the role of mitochondria as a discrete but integrated system, complete with machinery for replication, transcription and translation, was firmly established. Gottfried Schatz as well as Ronald Butow have in their reviews brought our knowledge of these phenomena up-to-date. Mitochondrial DNA is relatively small. usually $1-5 \times 10^6$ daltons, and their genetic code differs

from that of the other biological systems. They appear self-contained, accounting for almost all the 8–20 polypeptides. However, these mitochondrial polypeptides account for only a tenth of the total protein mass of the cell, the rest being produced by nuclear genes.

Interesting as the mitochondrial genome is, an offshoot of the discovery of a discrete genetic system in the mitochondria is the speculation on their biogenesis. No other cell organelle (except the chloroplast) has such a system, and the concept put forward in the early years of this century of the bacterial origin of mitochondria has recently been revived with a greater possibility of acceptance. That mitochondria are ancient bacterial symbionts introduced into eukaryotic cells has currently acquired a measure of respectability and has led to expectations of rapid progress towards a clearer perception of the possible events in the incorporation of bacteria into eukaryotic cells, their transformation into cell organelles of great consequence and their integration into the cell system. Herrick and Margareta Baltsch effsky in their review of mitochondrial ancestry argue that endosymbiosis might have occurred several times during biological evolution involving more than one organism, including *Rhizobium* and *Rhodospirillum*.

Thermogenic Mitochondria

Singular among mitochondrial classes is the one which is regarded as thermogenic. Found and reported so far only in brown adipose tissue in a number of organisms, including mammals, thermogenic mitochondria dissipate energy instead of conserving it. Olov Lindberg's review brings us up-to-date on this interesting and special type of mitochondria and indicates the possible models of thermogenesis. The existence of one specific polypeptide in their inner membrane, which Lindberg calls Thermogenin, is unique to brown fat mitochondria but nothing is known of its synthesis in molecular terms. Nor do we know anything of the factors governing the concentration of thermogenin, nor indeed of its origin. Here is a field which is open for immediate investigation.

Role of Glutathione

A review of the role of glutathione in the cell is presented by Bengt Mannervik. Found in all kinds of organisms and cells, glutathione is the most abundant low molecular weight thiol. It differs in concentration from organ to organ in the same organism and even in different parts of the same organ. Glutathione is believed to protect cells from the action of necrotic or carcinogenic chemicals, and the varied responses of organs to them could be ascribed to their differential distribution and concentration. Lung has a concentration of about 20% of that found in the liver or glandular stomach in rats, and this is believed partly to account for the greater susceptibility of the lung to carcinogenesis by polycyclic aromatic hydrocarbons. Mannervik has suggested that glutathione counteracts three classes of reactions deleterious to cells: (a) free radicals, (b) oxidative chemicals, and (c) alkylating and arylating compounds. It is interesting that both mitochodria and microsomes are implicated in radical generating reactions as well as in peroxidation. Both mitochondria and microsomes produce substantial amounts of H_2O_2 which is a toxic oxidant and which is inactivated by glutathione.

Microsomes

Ever since A. Claude's isolation in 1938 of a high speed centrifugation pellet and his finding that it contained most of the RNA of the cytoplasm, we have evidently traversed a great deal of ground. Lars Ernster himself was involved in studies on the biophysics and biochemistry of the microsomes, particularly on aspects of electron transport chains. That they were predominant sites of phospholipid synthesis in animal cells came soon after. But the more important discovery of their association with ribonucleoprotein particles attached to the membrane of the endoplasmic reticulum was made in 1956 by George Palade and Philip Siekewitz of the Rockefeller University.

However, 'microsomes' are a highly heterogeneous mixture of different membranes of the cell, especially mitochondrial outer, plasma and Golgi membranes. It has been estimated that only about 60–70% of the total microsomal protein belongs to the endoplasmic reticulum housing the microsomes and regarded as truly 'belonging to it'. The difficulty in the estimation of the components of, and association with, true microsomes can be judged by just one example. Cholesterol has been reported to be associated with the plasma membrane by some, while others have found it in association with elements connected with the endoplasmic reticulum. All of which show that microsomes are amongst the most difficult cell organelles to isolate in pure state and that more refined techniques are called for.

Recently, renewed attention has been paid to the origin of the Golgi apparatus and the concept that it is an extension of the endoplasmic reticulum has been developed. Henry Beaufay and others have in their paper on the topology of enzymes presented an excellent summary which, while specifically related to the liver, could well delineate the microsomes of almost any secreting cell. The endoplasmic reticulum is visualised as a closed, continuous, membranous

domain from the rough surfaced cisternae through tubular smooth-faced connections to the conventional Golgi apparatus. Both mitochondrial and microsomal physiology is, in the ultimate analysis, membrane physiology. The existence of cellular mechanisms which direct synthesized polypeptides to specific membranes and, at appropriate times assist their transport across these membranes is a message of outstanding interest in cell biology. Indeed, the microsomes and mitochondria are the important cell organelles involved in post-translational events in the cell where the polypeptides have close relationships with the specific membrane components in it.

That Lars Ernster, perhaps more than any other, has been responsible for developing the current concepts of mitochondrial and microsomal physiology is far from an accident. It is the result of sustained study over nearly 30 years by cell biologists nearly every one of whom has been inspired by the energy, drive and scientific creativity of Lars Ernster.

"Mitochondria and Microsomes" is not merely a fitting tribute to a great cell physiologist, it is a reference work of outstanding importance to all those interested in these two cell organelles. Written by acknoweldged experts in the field, each paper not only summarises the current position but provides insights into future possibilities. Extensive references follow each paper, highly valuable both to the teacher and the research scientist. A great book.

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To Fulfil a Vision: Edited by Y. Neeman, Addison Wesley Publication Co. Inc., U. S. A. (1981), 279, Price $ 39·50.

This book is a compendium of the proceedings of the Jerusalem Einstein Centennial Symposium, held in Israel during March 1979. The subject matter covered by the symposium is 'Gauge Theories and Unification of Physical Forces'. Participants and speakers included some of the leading theoretical physicists in the world.

This is a delightful book—not so much for the lay reader interested in anecdotes about Professor Einstein, but for the serious working theoretical physicist. Too often symposia commemorating scientists tend to be syrupy sweet affairs, devoted largely to historical reconstructions of the work and times of the great man in question. While such dedicated eulogy has its place, it can be overdone—and in the case of Einstein it has been. The resulting 'Proceedings' tend to have a lifeless quality of them, as compared to the excitement of present-day science.

By contrast, the symposium covered by this volume was decidedly 'alive'. The proceedings contain some of the best available wisdom on the perplexing problems at the frontiers of today's physics. While speakers do make laudatory references to Einstein, these are brief and their emphasis is on relating current issues to aspects of Einstein's vision.

The principal theme is the understanding, at the fundamental level, of the forces between particles—a problem to which Einstein had devoted much of his time. Yet, despite the achievements of Einstein, of Maxwell before him, and of three generations of nuclear and particle physicists since then, a unified understanding of fundamental forces still evades us. This is in part because the scope of the problem has grown. In addition to the well-known gravitational and electromagnetic forces which Einstein sought to unify, experimental and theoretical work with elementary particles in the last 40 years has revealed the existence of other, more exotic forces, particularly those allegedly holding quarks inside protons, neutrons, pions, etc.

The lectures contained in this volume summarise the current state of knowledge in the understanding of these forces and of the methods for doing calculations using them. There are about 15 sets of lectures in the book, and it will be difficult to summarise or even mention all of them in this review. The lectures of Yang on 'Geometry and Physics' of Nambu on 'Quark confinement' and of Glashow on 'Old and New Directions in Particle Physics', I found particularly enjoyable. There are many other informative and lucid articles in the book and the reader is urged to sample them himself.

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Annual Review of Public Health Volume 2. 1981 Editors Breslow Fielding and Lave; Published by Annual Review Inc. 4139 Camino Way Palo Alto, California 94306, Pages 505, Price U.S.A. $ 20 and outside $ 21.00.

Public health is an amalgam of hard science and social activism. Neither can accomplish much without the other, although each occasionally becomes impatient with the other. Important developments in epidemiology and biostatistics must be translated into methods practitioners can use; new problems in public health must be conveyed to researchers to keep the basic sciences relevant.

The volume highlights, among other current topics, advances in knowledge and care for the perinatal period and infancy as well as growing understanding

of how to control infections and certain parasitic diseases. Recent trends in cardiovascular disease, especially the spectacular decline in ischemic heart disease, and how such improvement may be accelerated, have received attention. Summaries of the health effects of air pollution and low level exposure to lead are presented. The volume, likewise, included a substantial attention to technology and economic issues, health hazard appraisal, health indicators and information systems for the future, new and continuing problems in ambulatory and other aspects of health care, and behavioral factors in health improvement and health services.

Exploration of problem areas, advances in underlying sciences, and humane, ethical and economic concerns are other special features presented in this volume.

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M. SIRSI

ANNOUNCEMENTS

INTERNATIONAL JOURNAL OF ENTOMOLOGY

The Division of Entomology of the Department of Zoology, University of Calicut proposes to bring out the first issue of its maiden publication "International Journal of Entomology" by July 1982.

The journal, to be published twice a year, will be devoted to the publication of original research papers and brief communications in the following fields of entomology: physiology, biochemistry, systematics, morphology, histochemistry and ultrastructure behaviour, applied entomology, cytology and genetics.

The members of the Editorial Board are Dr. U. V. K. Mohamed (Chief Editor), Dr. U.C. Abdurahiman (Executive Editor) and Dr. T. C. Narendran (Associate Editor) and those of the Editorial Advisory Committee are Prof. S. M. Alam, (Aligarh, India), Dr. Z. Boucek (London, U. K.) Prof. L. I. Gilbert (North Carolina, U. S. A), Prof. K. J. Joseph (Calicut, India), Dr. D. Livingston (Coimbatore, India), Prof. Y. Matsumoto (Tokyo, Japan) Dr. N. C. Pant, (London, U. K.), Dr. N. R. Prabhoo (Trivandrum, India) and Prof. J. T. Wiebes (Leiden, Netherlands).

Further details may be obtained from the Executive Editor, International Journal of Entomology, Department of Zoology, University of Calicut 673 635, Kerala, India.

THE MAX BORN CENTENARY CONFERENCE

The conference, honouring the centenary of the birth of Max Born, will comprise jointly the European Conference on Optical Systems and Applications (ECOSA 82), the biennial conference of the optical group (Optics 82) of the Institute of Physics. The working language will be English.

The conference will be held at the University of Edinburgh from 7-10 September 1982. This coincides with the last week of the Edinburgh Festival and Programmes and booking information will be provided.

The conference aims to cover a wide range of topics that come under the general heading of optics. These include: optical systems design. optical materials, detectors, manufacturing and testing method, optical measurements, fibre optics, laser systems, visual displays, electro-optical systems, holography, spectrography, interferometry, medical, biological and industrial applications, atmospheric optics, Lidar, nonlinear optics and optical industry.

Contributed papers will be received on these or any other topics of interest in the field of optics. Abstracts (maximum 100 words) together with title, name of author(s), affiliation and address should be sent to Mrs. Wormell, Honorary Secretary, Optical Group, Optics Section, Blackett Laboratory, Imperial College, London SW 7 U. K. to reach by 31 March 1982. Papers will normally last 20 minutes, 2 to 3 page summaries of papers will be contained in a Technical Digest available at the conference.

A poster and demonstration session is also planned and there will be a commercial exhibition of optical equipment and devices. The details of the exhibition can be had from Mr. J. N. Davidson, Director, Rank Pullin Controls Ltd. Langston Road, Debden Loughton, Essex.

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