computationally early in their training and understand the intimate connection between judiciously chosen numerical methods, analyses of physics models which underpin them and the observational data they are required to explain. In my experience, 'arithmetizing' realistic problems in this way is a mind-clearing exercise which invariably yields deep insights into the *physics* behind them. It is not always true that one needs enormous computing power to do this; modern PCs can do a lot!

Part II of the book treats plasma physics in general with remarkable clarity, authority and felicity in the variety of applications. However, I do have some reservations, especially relating to choice and treatment of some topics. Landau damping is treated in a pedagogically awkward 'formulaic' manner, with no mention made of the key concept of 'phase mixing'. Why not introduce a small collisional rate and exhibit the damping result as an ordered limit? This is more 'realistic' and does away with mysteries having to do with the complex plane, regularity requirements and such artefacts. Further, it should be stressed that only the electric field and velocity moments damp, if at all, and not the distribution function itself (*H* and an infinity of invariants are conserved by Vlasov's equation). There is no mention of Case and Van Kampen's essential clarifications of the issues related to 'continuum damping' which can (and does) occur in ordinary fluids without any 'wave-particle' interactions. This issue is also of importance in fusion plasmas where shear Alfvén 'continuum damping' can occur. References to readily accessible, recent literature are somewhat incomplete: I missed mention of Braginskii's famous article on plasma transport theory and the derivation of two-fluid equations (treated magisterially by Lifshitz and Pitaevskii, who are referenced), as well as recent excellent texts by Bateman, Goldston and Rutherford, Hazeltine and Meiss, and Wesson. The author does not mention effects due to trapped particles in confined systems (so-called 'neoclassical theory') which are significant in strongly magnetized plasmas. More surprising still is the lack of discussion of such key topics as the famous ideal MHD 'energy principle' of Bernstein *et al.*, low-frequency 'drift waves' in a two-fluid, spatially inhomogeneous plasma (plasma analogues of Rossby waves in rotating fluid systems), current-driven tearing and pressure-driven 'ballooning' instabilities. There are now many accessible treatments of linear and nonlinear tearing modes, which, together with drift and ballooning modes, are currently thought to be the most important low frequency plasma instabilities relevant for stability and confinement. These topics surely belong to the 'minimum foundation' for every student of modern plasma physics, and a brief introduction to them is more important than many of the 'fundamental' theories such as BBGKY, which could be safely left for self study projects. In spite of the above caveats, I have nothing but praise for the topics the author does discuss, and the refreshing way he has set about his task. In my view, he has largely succeeded in achieving the ambitious aim of providing a systematic, eminently readable and enjoyable introduction to two great continents of classical physics: fluid mechanics and plasma physics. The spirit of Eugene Parker's teachings pervades this book, and it is justly dedicated to that great pioneer of plasma astrophysics.

A. THYAGARAJA

Theory and Modelling Division,
UKAEA Fusion,
D3/179, Culham Science Centre,
Abingdon, Oxon,
OX14 3DB, UK

Cyanobacterial Biotechnology. G. Subramanian, B. D. Kaushik and G. S. Venkataraman (eds). Oxford and IBH Publishing Co. Pvt. Ltd., 66, Janpath, New Delhi 110 001, India. 1998. pp. 465. Price: Rs 990.

This book is a compilation of papers presented in an international symposium in 1996. It is an excellent and timely collection covering a wide range of topics in the frontline area of cyanobacterial biotechnology. Areas such as cellular and molecular characterization, biochemical pathways, stress and adaptation to applied aspects such as use of cyanobacteria as food additives and fertilizers have been highlighted in this book.

The last two decades have led to major advances in research with cyanobacteria. Cyanobacteria with their free living autotrophic nature, prokaryotic genome and organization and commercial applications form an extremely interesting discipline in biology. Several scientists who have made contributions in the area of cyanobacteria have contributed articles in this book. The opening chapter by Lindbald highlights the role of hydrogenase and hydrogen evolution in cyanobacteria along with their gram-negative prokaryotic genome but with the same type of photosynthetic apparatus as seen in higher plants. Mohanty has highlighted the effects of stress on photosynthesis. The role of primordial cyanobacteria in the evolution of life on our planet 3 billion years ago has been discussed by Brown in his article. He has emphasized the involvement of alternative bioenergetic patterns in cyanobacteria as factors in biochemical adaptations.

The chapters on 'Spirulina Farms' by Fox and on 'Spirulina by 2001 AD' by Venkataraman throw light on the importance of cyanobacteria in the future. Stress regulated gene expression has been extensively reviewed in Apte's article while the genetics of heterocyst differentiation has been elaborated by several authors. Kaushik and Subramanium have reviewed several biotechnological applications of cyanobacteria as biofertilizers, fine chemicals and pharmaceuticals.

Novel applications of cyanobacteria such as their use in the control of diabetes mellitus as well as biosensors for environmental protection have been discussed. Research in USA, Germany, Hungary, Ukraine, Sweden along with Thailand, India and Sri Lanka has been highlighted. The chapters by various authors on the basic physiology, photosynthetic activities and stress response provide a lot of information.

This book thus provides an excellent review of basic and applied information on cyanobacterial biotechnology. However, there are several things which could have been avoided. Firstly although the meeting was conducted in 1996, the book was published in 1998. Thus recent material and research is not

highlighted in this collection. Also since the papers have not been peer-reviewed, this has resulted in poor quality of some of the presentations. The fragmentary and at times repetitive nature of the information presented is distracting. Some of the results presented are therefore very preliminary and in some aspects extensive review of the available literature has not been done before writing the articles.

In spite of some shortcomings, overall, this book will be a valuable reference material for students and researchers working in this area, and biologists and biotechnologists.

DEEPTI DEOBAGKAR

Department of Zoology,
University of Pune,
Pune 411 007, India

Annual Review of Physiology. Joseph E. Hoffman and Paul De Wear (eds). Annual Reviews Inc., 4139, El Camino Way, Palo Alto, California 94303-0139, USA. 1999. vol 61. pp. 936. Price: $67 – Individual; $134 – Institutional.

The *Annual Review of Physiology*, 1999 has been a pleasure to review. For one, it is becoming difficult to find physiology-related journals or reviews in the library shelves which reflects the rather subdued pace of research in physiology in the country, and the competition that it faces from the more recent areas of biological research. Part of the problem has been the shift in emphasis from systems physiology to molecular physiology, which physiologists in the country have not been able to keep up with. Much of the excitement in physiological research comes from hands-on laboratory work, ability to choose important and workable questions and then designing experiments requiring standardization of relevant preparations, that would yield the desired information. Experimental physiology as a discipline requires skill and talent in putting up an experimental set-up together or designing and fabricating small apparatus in-house which are not always commercially available. It is indeed difficult to communicate this need in physiology to colleagues trained in other research disciplines. Carlton C. Hunt has communicated this rather well in the 'Perspectives' section with an interesting title 'Pulling the Cart and Enjoying the Ride'. He has also put forth ideas on how science ought to be nurtured in a scientific institution, for which he quotes Peter Medawar in the end.

What comes out rather clearly in this volume of the *Annual Review of Physiology* is the increasing research emphasis on the role of ion channels in different cellular functions and the importance accorded to them. Thus, Horowitz, Ward and Sanders review the different ionic channels present in the gastrointestinal (GI) smooth muscle cells and their involvement in the regulation of GI motility. The importance of voltage gated ion channels in determining the resonant frequency of electrically tuned hair cells besides determining the action potential firing pattern is reviewed by Fettiplace and Fuchs. Acoustic tuning in the hair cells involve feedback processes between the voltage gated channels in the basolateral membrane and mechanotransduction channels in the apical hair bundle. Acoustic frequency analysis by an animal is an important aspect of sensory perception, and competition and reproduction in most species depend on this. An organ unique to amphibians for instance is tuned to the major frequency component of the mating call (1–3 kHz). The role of ion channels in other transduction mechanisms is reviewed by Geoffrey Gold for olfaction where cyclic nucleotide gated channels are important. In the review on taste transduction mechanisms by Herness and Gilbertson, the role of amiloride sensitive sodium channels in the transduction of salt through amiloride sensitive sodium channels present on the apical membrane of taste cells becomes apparent. Ward, Hammond and Harris give interesting insights into how the peptide hormone vasopressin regulates water absorption in the kidney by insertion and removal of aquaporin2 water channels in the apical membrane of the kidney inner medullary collecting duct. The trafficking occurs via specialized population of vesicles that resemble synaptic vesicles in neurons.

Nociception is a fascinating field of research and involves many aspects starting from the transduction of painful or noxious stimuli into a form that can be conducted along nerve fibres in the form of action potentials. Hot green chilli peppers, so common a sight in the Indian kitchen, contain a compound called capsaicin and it is of interest to note that much of pain research at the molecular level is shifting towards understanding how the capsaicin or vanilloid receptor functions, following the successful cloning of the receptor by Caterina *et al.* The review by McCleskey and Michael Gold touches on a handful of putative nociceptive channels other than the vanilloid receptor, viz. ion channels that are activated by heat, ATP gated channels, proton and certain voltage gated sodium channels. The nociceptive channels are becoming important targets of analgesic therapy.

Besides understanding the biological roles of different ion channels, how mutation in the genes encoding these result in pathological changes is attracting a lot of interest. Connexins, which are intracellular channels present in gap junctions, and which allow cells to share small molecules, coordinate a wide range of functions. Some of the human pathologies associated with connexin mutations are hearing disease, congenital cataract, peripheral neuropathy which results in progressive degeneration of the peripheral nerve, and abnormal cardiac conduction. White and Paul review this quite extensively, and it may particularly interest reproductive biologists to know that disturbance of bidirectional signalling between oocytes and granulosa cells through connexins can lead to female infertility.

Like single-channel analysis which has become practicable with the patch-clamp technique and gives insight into how a single protein molecule functions, analysis of elementary Ca signalling events in single cells are now becoming possible with imaging techniques. It is now possible to sort and analyse discrete and localized Ca signalling events as Ca sparks and quarks, and it is an area which continues to draw a lot of interest. Niggli's review on these phenomena which are best observed in muscle cells is quite exhaustive.

The other areas in cellular physiology which are drawing a lot of attention are