

Electrical Engineering Department of the Indian Institute of Science, have contributed a paper in Game Theory. Thathachar was actively involved in the programme of 'Applicable' (Ramanathan preferred this adjective to the more familiar 'Applied') Mathematics initiated by Ramanathan, a collaborative enterprise between TIFR and IISc in Bangalore. This programme which has produced some excellent work was helped greatly by a group of French mathematicians led by J. L. Lions, a major figure in French mathematics. Both he and one of his close associates and a distinguished mathematician P. G. Ciarlet have contributed papers in their fields (Control Theory and Elasticity respectively).

The mathematical spectrum covered by the contributions is truly impressive as also the diverse nationalities of the contributors. Ramanathan was a respected figure in the world of mathematics and the present volume bears ample witness to it. The contributors are internationally well-known personalities in mathematics. The Academy deserves to be congratulated for undertaking the venture and doing justice to the excellent purpose it set out on.

There are other friends, colleagues and admirers of Ramanathan, who would no doubt have liked to pay their homage through this volume, but creative work does not always comply with demands of a time frame.

The Memorial Issue also carries an obituary note on Ramanathan giving some interesting information about him.

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Annual Review of Cell Biology 1993. Volume 9. Palade, G. E., Alberts, B. M., Spudich, J. A., eds. Annual Reviews Inc., 4139, El Camino Way, Palo Alto, P.O. Box 10139, California 94303-0897, USA. Price USA \$ 46, elsewhere \$ 51. 659 pp.

Cellular biology is growing at a relentlessly rapid pace. Modern instrumentation techniques and highly sophisticated microscopes have illuminated the inner working of the cell as never before. Major advances have been made in recent years in areas as diverse as intra-

cellular trafficking of molecules, signal transduction pathways, cell-cell interactions, membrane organization and supramolecular assemblies. Moreover, the fields of cellular and molecular biology are now so intertwined that the series *Annual Review of Cell Biology* reflects what is new and exciting in both these areas. This is of special advantage to the researcher, who is thus encouraged to take a holistic view of the cell.

Five reviews are devoted to recent advances in understanding intracellular transport and signal transduction pathways. S. Subramani gives a detailed account of peroxisomal protein import, peroxisome biogenesis and the genetic basis of human peroxisomal disorders. The conservation of peroxisomal targeting signals as well as genes involved in peroxisome import and assembly have revealed a unified mechanism for peroxisome biogenesis. Considerable progress has been made in understanding human peroxisomal disorders by the use of peroxisome-deficient mammalian and yeast cells, and should eventually lead to better diagnosis and possible therapeutic intervention for these debilitating diseases. I. S. Trowbridge and coworkers have discussed recent findings on membrane protein trafficking in the endocytic pathway, the chief route for recycling of plasma membrane-bound receptor proteins. The importance of this pathway is evident when one realizes that an amount of membrane equivalent to the entire cell surface is internalized and recycled every 1-2 h. New insights have been obtained into the nature of signal sequences required for internalization and their ability to form distinct three-dimensional structures. S. Ferro-Novick and P. Novick have documented the different types of GTP-binding proteins involved in vesicular transport along the exocytic pathway wherein proteins are recruited to form vesicles that migrate from the endoplasmic reticulum through the subcompartments of the Golgi complex to the cell surface. Although GTP-binding proteins have been implicated in most steps of the pathway, comprehension of their exact role must await future studies, and hence the title of the review is somewhat misleading.

The heat shock proteins are essential components in diverse biological processes. Their role as molecular 'chaperones' whose function is to ensure that proteins fold and assemble

properly in the cell has been highlighted by C. Georgopoulos and W. J. Welch. Discussion of recent findings such as the role of hsp90 in steroid receptor activation makes this review highly topical. Despite the authors' best efforts, however, the confusion in nomenclature of this large family of proteins persists. A comprehensive review on signal transduction in guard cells (which control the stomatal pores in plants) by S. Assmann is the only article in plant cell biology. The signalling systems that sense hormones, light and CO₂ in the guard cells have been clearly defined and placed in perspective with what is known about signal transduction in animal cells, for the benefit of non-plant biologists. The advent of antibody and recombinant DNA technology has opened up a whole new area of investigation into the macromolecular organization of functional domains within the cell nucleus, which has been ably reviewed by D. Spector. New evidence on the dynamic order of DNA replication, the localization of transcriptionally active domains and distribution of splicing factors, together with a model for the functional organization of the nucleus, strengthen the view that the nucleus is a highly organized system of defined structural and functional activities. Newly emerging concepts on gene regulation in eukaryotes by transcriptional repression have been highlighted with chosen examples in a review by B. M. Herschbach and A. D. Johnson.

Several reviews cover different aspects of the host immune response to foreign antigens via both B and T lymphocytes. The antigen receptor of B lymphocytes plays a critical role in regulating B cell behaviour, in addition to its primary function of antigen presentation. New findings on the signal transduction function of the antigen receptor have been reviewed by A. L. De Franco. Although low concentrations of host proteins called cytokines have been implicated as essential for various immunological responses, current thinking is now focussed on the pathogenic aspects of cytokine action. The injurious and beneficial effects of one cytokine, tumor necrosis factor- α , have been documented in detail by K. J. Tracey and A. Cerami. M. R. Jackson and P. A. Peterson have discussed the impressive progress in the area of assembly and intracellular trans-

part of major histocompatibility complex class I molecules. The role of these molecules is to display peptides derived from proteins within the cell, for surveillance by killer T cells. The molecular interactions involved in peptide binding to major histocompatibility complex molecules are described in an accompanying review by L. D. Barber and P. Parham. These studies have important implications for vaccine development, treatment of autoimmune diseases and graft rejection. A specific class of bacterial and viral antigens called 'superantigens' have the unusual ability to stimulate a high frequency of T cells by unconventional mechanisms, and these have been reviewed by M. T. Scherer and co-authors. Several possible avenues for use of superantigens in diagnosis and therapy have been pointed out by the authors.

Cell-cell interactions play a major role in the determination of cell fate and regulation of differentiation, morphogenesis and growth. C. Birchmeier and W. Birchmeier have reviewed the biology of mesenchymal-epithelial interactions, with special emphasis on signalling factors such as cell adhesion molecules and tyrosine kinase receptors. Abnormal cell-cell interactions result in tumour metastasis. W. G. Stetler-Stevenson and co-authors have described recent findings on tumour cell invasion and metastasis. These have become useful in developing new targets for therapy by disruption of tumour cell attachment by peptide analogues of cell adhesion molecules and the use of protease inhibitors to limit extracellular matrix proteolysis required for tumour cell invasion. K. Drickamer and M. E. Taylor have documented the different types of animal lectins that have been discovered recently. As yet there is little understanding of the functions of most of these lectins in animal cells.

The role of the cytoskeletal framework of the cell in diverse phenomena is dealt with in three reviews. E. D. Schejter and E. Wieschaus have focussed on the emerging role of the cytoskeleton as a mediator of morphogenesis in the early *Drosophila* embryo. Aspects of organelle transport, functional compartmentalization of the cytoplasm, interactions between cytoskeletal networks, and cell division have been highlighted. J. Condeelis has described our current understanding on the formation of cell

protrusions, and proposed a model for this process based on nucleation and growth of new actin filaments followed by actin cross-linking and further actin polymerization. The erythrocyte plasma membrane continues to be a favourite for studying the membrane skeleton. V. Bennett and D. M. Gilligan have reviewed the role of spectrin, ankyrins and accessory proteins in the organization of the plasma membrane and proposed a function for these proteins in the assembly and maintenance of specialized domains on the cell surface.

Finally, C. T. Esmon has described the mechanisms that control blood coagulation. This well-studied process continues to yield new insights, with hopes for better therapeutic agents to control coagulation and prevent thrombosis.

This volume truly reflects the amazing advances in our understanding of biological processes in recent years. Most authors have tried to build up a composite picture of the phenomena they have described. Some gaps are evident but these are bound to occur in a description of 'life at the leading edge'. An essential book for all libraries and research groups in biology.

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The Physics of Karma. V. Dwaraknath Reddy. MAPIN Publications Pvt. Ltd. Chidambaram, Ahmedabad 380 013. India 1992. 167 pp. Price not indicated

Some scientists feel an urge to explain the 'unmanifested' in terms of the laws of physics deduced through experiments, measurements and mathematical analysis. The book under review is the product of such an urge. It has 38 chapters, each consisting of two to four pages.

The literal meaning of the word *Karma* is action – as envisaged in the word *Karmachari*, an unskilled labourer. In its spiritual context *Karma* represents the resultant effect of all the actions carried out by a particular *Jiva* (the life spirit) during the past several lives while occupying different physical, material bodies, human or animal. Often this resultant effect is also connotated by the word 'fate'. The logic presented by the author for the continuation of this *Karma* from one life to another of the same *Jiva* has a semblance to the

logic employed in physics. Hence the title of the book: *The Physics of Karma*. This logic is expounded in pages 113 to 143 of the book. Deaths and re-incarnations are only stages in the endless pursuit of happiness. Enduring happiness is achieved only when the finite *Jiva* merges with the Absolute, variously called *Brahman*, *Paramatman*, *Supreme Consciousness*, etc.

Our *Upanishads* deal with time, space, creation of this manifested universe accessible to human senses, the *Jivas* habiting the human and other bodies, *Karma*, death, re-incarnation, *Brahman*, etc. They are dealt with in cryptic language and require detailed commentaries and explanations by scholars like Adi Sankara or seers like Shri Ramana Maharshi.

Shri V. Dwaraknath Reddy M Sc (Louisiana USA), the author, has been a successful industrialist. After retirement he settled at Ramanashram, Tiruannamalai, South India, in 1983. At Ramanashram, he has pondered over the Upanishadic thoughts and deductions with the help of the expositions and personal life of Shri Ramana Maharshi, all available in the atmosphere of the Ashram. In the book under review Shri Dwaraknath brings a scientific, rational approach to the intricate Upanishadic expositions, using terms of physics, leading the reader to conclusions arrived at by the author. The reader is called upon to evaluate them in terms of his/her personal experience. Terms occurring in physics like energy, potential, mass, relativity, gravitation, acceleration, continuity, dynamics, particles, etc are employed sometimes as analogies and often as physical entities, in the expositions.

A proper comprehension of the book requires a good familiarity with the literature on Upanishads, the Bhagavad Gita, and the Brahma Sutra. It can be had through the commentaries on them in Sanskrit by Adi Sankara, or in English by Dr S. Radhakrishnan, the late President of India.

The book has several illustrations by Rajny Krishnan, artist and sculptress. They hold aloft many of the ideas presented by the author verbally.

In keeping with the reputation of MAPIN Publishers, the printing and the get up of the book are good.

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