

review contains a biographical article by Charles Janeway which reads like a beautiful story covering innate immunity to self and non-self discrimination, and positive and negative selection.

This volume contains twenty-six articles and covers a vast range of areas apart from the prefatory chapter mentioned earlier. The topics include receptor–ligand interactions in a variety of immune phenomena, stimulation and co-stimulation, regulation of immune responses, immune evasion, role of protein kinases and MAP kinases in the immune responses, immune effects of heat shock proteins, bacterial CPG islands, T-cell memory, etc. The coverage of topics is too vast and diverse to do justice in a short review like this.

Janeway, in his essay titled ‘A trip through my life with an immunological theme’, makes four points about the operation of the immune system, namely how the immune system does not mistake a pathogen for host antigen due to innate immune system regulation of co-stimulatory molecules CD80 and CD86; the adaptive immune system can mistake self for non-self; the self-referential nature of T&B lymphocytes of the adaptive immune system; and regulatory or suppressor molecules are the main defence against autoimmunity as they recognize antigen, like all T-cells, but secrete IL-10 and TGF β which are immunoregulatory cytokines. The article is fascinating, and provides much insight about immunology research today.

The article by Carreno and Collins (p. 29) on the B7 family of ligands and receptors highlights the fact that this family of co-stimulatory and inhibitory receptors and their ligands plays a critical role for activation of immune responses and tolerance. Vilches and Parham (p. 217) mention *KIR* genes, the killer cell immunoglobulin-like receptors (KIR) which recognize MHC Class I molecules. According to the authors, the diversity of KIR–HLA pairs functioning in different humans contributes to the variability of the function of NK cells and T-lymphocytes. Natarajan *et al.* (p. 853) discuss the structure and function of natural killer cell receptors. They also discuss, in functional context, the structure of these receptors and how they bind different regions of their MHC ligands and allow for self–non-self discrimination. Lawrence Samuelson (p. 371) discusses signal transduction by TCR and the role of

adapter proteins. The critical role of tyrosine kinases at LAT (linker for activation of T-cells) in the process is discussed. Dong, Davis and Flavell (p. 55) in their review ‘Map kinases in the immune response’, cover the role of these enzymes in a variety of processes, starting from the ‘initiation phase of innate immunity to activation of adaptive immunity and cell death when immune function is complete’. They delineate the role of all the three major groups of MAP kinases in helper T-cell activation, Th1 cell differentiation, cytotoxic function and lymphocyte apoptosis, IL-12 production in innate immune responses, regulation of TNF α production, etc. Another interesting article on protein kinase C θ in T-cell activation by Isakov and Altman (p. 761) deals with the selective expression of PKC θ in T-lymphocytes and its seminal role in TCR-triggered activation of mature T-cells.

Some areas about disease-related immunology that are covered in the volume are: prospects for vaccine protection against HIV infection and AIDS by Letvin *et al.* (p. 73), T-cell response in experimental autoimmune encephalomyelitis by Kuchroo *et al.* (p. 101), genetic dissection of immunity to mycobacteria by Casanova and Abel (p. 581) and immunology of mucosal models of inflammation by Strober *et al.* (p. 495). The foregoing article deals with inflammatory bowel disease (IBD), a canonical autoimmune disease.

Shastri *et al.* (p. 463) in a provocatively titled topic ‘Producing nature’s gene-chips: the generation of peptides for display by MHC Class I molecules’ have reviewed the processing of proteins for display on MHC Class I and have also touched upon the Rammensee paradox: the MHC I molecules influencing antigen processing. This review is particularly well written, devoid of jargon and easy to understand.

Like its predecessors this volume is loaded with facts on current immunology, and often contains tantalizing ideas. Reading the volume one can easily be overwhelmed by the enormous amount of information that is being added to immunology literature every year. Immunology is perhaps one of the most challenging fields where much remains to be known. It is more like a blind man’s elephant. Looking at the complexity of the system involving thousands of regulatory molecules, one wonders how it

ever works. Perhaps we are still missing something that may bring order into the chaos.

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Sensory Biology of Jawed Fishes: New Insights. B. G. Kapoor and T. J. Hara (eds). Oxford and IBH Publishing Co Pvt Ltd, 66, Janpath, New Delhi 110 001. 2001. 387 pp. Price: not mentioned.

A large part of the life of an aquatic animal is taken up with adjusting itself to different conditions, and these conditions may be of two kinds. There is the outside world with which the animal keeps in touch by means of its receptors in or near the skin which are primarily eyes, ears, lateral-line organs, and the skin itself. These are termed as *exteroceptors*. The movements which the animal makes in response to the outside world are largely locomotory, and are brought about by the muscles of the body-wall and limbs. These muscles are both striated and voluntary. In order that such movements may be properly coordinated, the animal must necessarily have some information about the existing state of its muscles, tendons, and joints. This in turn, is supplied by sense organs which are situated in these structures and are called *proprioceptors*.

At the same time, there is a ‘world’ within the animal and sensations arise from stimuli which start from organs such as the stomach, intestine, or bladder, and their respective functions. The sense organs of taste are largely of use in connection with what is about to enter the alimentary canal. Such sense organs are called *interoceptors*.

The subject ‘sensory biology in fishes’ encompasses a vast field of study, but the book under review is mainly devoted to the exteroceptors. While it is creditable on the part of the editors to bring together 36 foreign research workers spanning 12 countries who have contributed review articles in this book, sadly there was not even a single Indian contributor. One wishes this were not so.

The first four chapters deal with the eye of the fish. The retina is an accessible part of the brain. In the embryo it arises as an evagination of the diencephalon. It therefore provides an excellent experimental model for structural, physiological and pharmacological analyses of neural mechanisms and interactions in other centres of the central nervous system. The adaptation of the cornea to different aquatic environments is discussed in yet another chapter. This is an interesting aspect since the refractive index of the cornea is identical to that of water, and this therefore leaves the spherical lens as the only structure responsible for focusing.

Some fish possess electric organs derived from muscle or nerve tissue – a classic example is the electric eel which can produce electric discharges of up to several hundred volts, while weakly electric fish have electro-receptors in specialized organs of the lateral line. An entire chapter is devoted to electric organs in fish. One learns that apart from being specialized for electroreception, the lateral line organs of all teleosts are mechanosensitive and function as distant touch receptors. They are not only used for detection and localization of prey but also for schooling, communication and as a defence mechanism against predators. The specialized parts of lateral line organs also assist in hearing.

The role of the telencephalon in sensory information processing receives special attention. Another illuminating contribution deals with the 'ampullae' of Lorenzini, buried deeply in the skin, chiefly in the head of elasmobranchs. The ampullae were originally considered as thermoreceptors and later regarded as receptors for pressure changes. Chromatophores as sensors of environmental stimuli is another topic of interest in this book, and the maxillary barbells of the catfish are also elucidated.

In some fish, taste buds are found in the integument covering the whole body. However, in most of them they are generally confined to the oral region. Olfactory receptors which are particularly well developed in elasmobranchs are poorly developed in teleosts, although it has been interestingly found that olfaction aids homing in salmon.

Infrared photoretinoscopy has been used for the study of accommodation and eye movements in the oscar, *Astronotus ocellatus*. This work culminated in the

discovery that oscars use binocular inputs to localize their food targets.

In the aquatic environment, electric fields of biotic and abiotic origin have been in existence for millions of years and as such, fishes have developed the ability to detect these fields with specialized electroreceptor organs in the form of ampullary system of different types. South American weakly electric fish generate species-specific electric organ discharges (EODs) with variable waveforms and the flow of electric current during EOD is sensed by cutaneous electroreceptors.

The lateral line system in fishes and aquatic amphibians has evolved into a hydrodynamic receptor system which enables them to detect minute water motions generated by other living objects. The labyrinth of the internal ear fitted with a single type of sensory hair cell seems to have also evolved from the mechanosensory lateral line system. Studies have indicated that the conversion of mechanical energy into a kind of electrical signal is used in the nervous system.

It is of interest to know that the catfish *Parasilurus asotus* has developed strong electroreception capacity enabling it to detect earthquakes several hours before the actual perception of the tremor.

The five chapters, 7–11, put together, offer the reader good knowledge on the subject of sensory biology of fish.

In the teleost olfactory system, it has been detailed that specific molecules interact with the enzyme system on the surface of ciliated olfactory receptor neurons. Chapter 14 provides new information on neurobiology of fish olfaction.

The immunohistochemistry of taste buds of fish has shown that neuropeptides and serotonin are involved in the modulation of the taste function. Chromatophores which work as paraneurons because they originate embryologically in the neural crest, are sensitive to a variety of stimuli originating from xenobiotic toxicity which is present in the aquatic environment. These chromatophores are also under the control of autonomic nervous system. Their physiological responses frequently resemble those of smooth muscle cells. Non-muscle myosin molecules and the specific smooth muscle protein, calponin, have been recently detected immunocytochemically in iridophores and melanophores of the Antarctic fish, *Pagothenia borchgrevinki*.

Unfortunately, the chapter 15 on 'Adaptive transformation of the palatine – maxillary system in catfish: Increased mobility of the maxillary barbel' seems to be out of relevance in this specialized book on sensory biology of fishes. Some of the other drawbacks are: the diagrams 1–4 in chapter 1 are not properly labelled nor is there some sort of uniformity maintained in this regard in the book.

However, the plus points which far outweigh the drawbacks, are that the book contains several excellent articles exploring new information and insights on sensory biology of fishes and conclude with a list of useful and relevant references.

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Regulation of Photosynthesis. Eva-Marie Aro and Bertil Andersson (eds). *Advances in Photosynthesis and Respiration*, vol. XI [Series editor: Govindjee]. Kluwer Academic Publishers, Dordrecht, The Netherlands. 613 pp. Price: US\$ 226.

In biology the structure stores information, and the forms govern the functions. But what governs the macroscopic and microscopic biological forms and regulates their dynamic behaviour? Regulation of biological processes is complex, intricate and subtle, and this aspect of research is especially true for regulation photosynthesis as it is not only an emerging area but is also trendy. Volume 11 of Govindjee's *Advances in Photosynthesis (AIP)* (now *AIPR*) series is timely and a welcome addition to this magnificent series of books, edited by two distinguished scientists, Eva-Marie Aro, University of Turku, Finland and Bertil Andersson, University of Stockholm, Sweden. The volume under review contains 32 overview chapters contributed by 58 scientists who are well-known in the field of photosynthesis research.

Regulatory mechanisms of biological processes have always been considered attractive and important, and researchers at all levels do focus on learning the control mechanisms. Earlier studies on biological regulations, be it on genetic controls or enzymatic or hormonal con-