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 elasmobranches. 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 elasmobranches 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, Dordrechet, 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-

trols, have been viewed at limited and specific aspects of one or at most a few specific aspects of the biological process. In recent years, however, thanks to the technological advancements, regulations in biological processes can be viewed globally[1].

Photosynthesis, which involves not only numerous metabolic fluxes (see ref. 2) is also governed by large numbers of external factors like light, temperature, carbon dioxide levels and water status, and these factors constitute a network of regulatory controls of photosynthesis.

Indeed, as the editors state, this is a new, evolving area of photosynthesis research and the overviews by the experts in these emerging areas of photosynthesis research serve as examples, as also trends in the other areas of efforts involving signal perceptions, signal transduction and regulatory switches in turnover and synthesis and assembly of protein complexes. Truly, this volume would serve as a 'guide approach' book on regulation in plant biology. The thirty-two chapters in the book have been grouped under six parts.

Part-I discusses the evolution of photosynthetic structure – it deals with the plant genome structure, regulatory process in plant genome rearrangements, including maintenance and acclimation of thylakoids. The photosynthetic machinery has been put by the authors on a new canvas that shows the genetics of biochemical novelties of terrestrial plant cells as well as their 'spaceo-temporal' morphogenetic potential.

The second part containing eight chapters deals with gene expression and signal transduction. These chapters elucidate the role of plastid-encoded plastid RNA polymerases and nuclear plastid gene expression; phytochrome signalling and interaction of phytochrome and other signalling pathways, sugar regulation of gene expression as well as RNA editing and plastid mRNA degradation. Further, the fascinating aspects of redox-regulations of photosynthetic genes involves the regulatory feedbacks between electron transport and gene expression. Equally fascinating is the chapter dealing with chloroplasts–translational regulatory system which is a hybrid between prokaryotic and eukaryotic regulatory system, and describes how the regulation depends on the specific RNA–protein interactions and how they influence the ribosomes to start translation.

The third part of the volume addresses the topics relating to biogenesis of thylakoid membranes, plastid envelopes, chlorophyll biosynthesis, pigment assembly, etc. This section also discusses the families of peptide-prolyl isomerases, which assist in protein folding. These enzymes have been shown to be involved in protein biosynthesis, protein trafficking and intracellular signalling.

Chloroplast protease has gained importance in recent years, so also are the topics on programmed chloroplast senesence. Researchers working on molecular biological approaches to study foliar ageing senescence and necrosis will find insights into this complex aspect in the chapter. Part-4 includes five chapters dealing with regulations of CO_2 fixation and productivity. These chapters serve as excellent complimentary text for volume 9 of the AIP series[2].

Besides the enzyme carbonic anhydrase whose role on light reactions is gaining importance, the involvement of thioredoxin/glutaredoxin as regulatory links is a new subject that is likely to provide new research directions not only in the area of carbon metabolism, but also in the area of plant adaptive strategies.

Photosynthesis research now largely focuses on stress biology. Part-V containing nine chapters, is devoted to discussions on the current state of progress in the field. These include photo-damage–repair mechanisms of PSII and PSI, zeaxanthin–violaxanthin conversions, regulatory pbs-proteins, stress proteins, including control of electron transport chain and interactions between mitochondria and chloroplasts. Part-6 contains two chapters – *Arabidopsis* functional genomics and genome information and databases, including proteomics and transcriptome analysis.

All the chapters in the volume provide thorough and authoritative views and they contain numerous illustrations and sketches. Each chapter includes numerous references which are valuable for researchers. For the experts in the field, this volume is likely to generate debates and outlooks for new directions in research and new approaches to ongoing research. The book points towards unsolved problems; and for the non-initiated readers this volume will be a source for new information and enjoyable reading.

The chapters in each part or section are interlinked and thus, they provide a complete state of development. These chapters also present a frame-by-frame exposure of the many and varied regulatory networks in photosynthesis – the most vital biochemical process on earth – with an open-frame outlook.

The understanding of the regulatory processes or controls in biology holds the key to the understanding of biological complexities. The 'regulations' in biology which include signal perceptions, transduction and rhythms, including biological clocks (the clock aspects in photosynthetic regulation have not been included in this volume; see ref. 3 for details), may in future, challenge and possibly change the current dogmas in modern biology[4,5]. This book will serve as a forward-looking volume in photosynthesis research. As the series editor, Govindjee states, this volume will remain an important resource book for not only photosynthetic research but also for other areas in life sciences. The editors and the contributors deserve to be applauded for the scholarly presentation.

Like the previous volume in the series, volume 11 contains excellent references which are well indexed. The cartoons and sketches are beautiful and can be easily used as teaching material. Teachers and students of advanced plant biology, life sciences and biotechnology courses/programmes will find this book a unique reference source. Those who have the earlier volumes would surely include this one to their libraries. Institutions and universities should encourage ordering a copy for their libraries.

This book contains a wide range of topics that are relevant to plant, agricultural and environmental biotechnology and plant productivity.

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