

BOOK REVIEWS

from which the information was taken, a play on the phrase 'Who knows')! The index is also not exhaustive in both the books, and is not of much use in finding the topics discussed in the books.

There are a few useful aspects of the books – a wide range of topics have been discussed and the procedures have been given in points – a form that beginners would find easy to follow. The glossary in both the books is fairly detailed and this would be useful for students to understand the meanings of various terms. The books would have been assets if only care had been taken to infuse some originality and order in them, and if they had been edited and proofread adequately.

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Annual Review of Physiology, 2010.

David Julius and David E. Clapham (eds). Annual Reviews. 4139 El Camino Way, P.O. Box. 10139, Palo Alto, California 94303-0139, USA. 2010. Vol. 72, xiv + 658 pp. Price: US\$ 89.

The *Annual Review of Physiology, 2010*, opens with 'A conversation with Rita-Levi-Montalcini' based on the interview by Moses V. Chao. Rita Levi-Montalcini who turned 100 in April 2009, is credited with the discovery of the nerve growth factor (NGF) that gave credence to the 'neurotrophic theory' which is one of the very few theories in biology that has survived. It postulates that the survival of neurons during development depends on the successful competition for 'neurotrophic factors', and explains why only half of the neurons survive during development to form the nervous system. The interview goes to the past and it leaves one awed by the grit, determination and patience during the adverse situations prevailing in the midst of the Second World War, when the important discovery was made.

This particular volume has emphasis on the global climate change on the physiology of the organism. How do

organisms respond to the global climate change? Three reviews related to this topic indicate that, besides the importance of physiological information, integration with analyses of behaviour, population dynamics, genetics and evolution are important in understanding the long-term impact of the global climate change. For instance, although the organisms might adapt through genetic change through the process of evolution, phenotypic and physiological plasticity that allows the organisms to tolerate the new conditions is important. The homeoviscous adaptation can occur through remodelling of membrane lipids. Organisms also adjust gene expression to achieve physiological plasticity – the transcriptomic response of organisms. Accompanying the poleward movement of terrestrial surface isotherms, there is a poleward expansion of species that have to adapt to the altered timing and seasonal events.

People have to constantly move around the globe in current times, crossing time zones, and readjustment of the circadian clocks to the local night-day cycles have to take place. The physiological basis of the circadian clock is dealt with under the special topics section. The circadian clock of the organism is under the control of the master circadian pacemaker in the brain, the suprachiasmatic nucleus. Animal studies indicate that in jet lag, there is a rearrangement of neuronal activity in the master circadian pacemaker, and full synchronization by neurons in the pacemaker requires at least eight days. The other articles are related to the systems biology of circadian rhythms, circadian organization in the drosophila where the molecular changes at the transcription and phosphorylation level involved in clock regulation can be better understood, and the Per-Arnt-Sim (PAS) proteins that function as environmental sensors and are important in adaptation to a changing environment.

Cardiac diseases are on the rise, and there is a shift towards understanding the physiological basis at the molecular and cellular levels. In the section on cardiovascular physiology, Jeffrey Robbins, the section editor has put together articles related to the current developments in understanding protein-conformation based cardiac diseases. In the new therapeutic approaches, a basic cellular process, or a signalling pathway is altered to control the progression of a disease. A disease

free organ function fundamentally require two events: (i) the effective response of the cell to stress and cellular damage, and (ii) a good protein quality control that is regulated by the cell signalling pathways. The failure of these systems lead to a subset of disease called the 'protein-conformation based diseases', and errors in the signalling pathways might contribute to this. In long-lived cells in the body such as cardiac and neuronal cells, autophagy – a process in which a cell removes protein aggregates and organelles including dysfunctional mitochondria, is important. A decrease in autophagic capacity with age accounts for neurodegenerative diseases and cardiac failure. Autophagy has to be balanced by the capacity of the cell to generate lost components, and when this is disturbed, it leads to cell death. The articles relate to death maps in the cell involving the proteins associated with apoptosis and necrosis, the death pathways involving the uncoupling of oxidative phosphorylation in the mitochondria due to activation of the mitochondrial permeability transition pore, role of KATP channels and connexin-43, role of Fox-O signalling in the heart and its importance in cardiac biology.

Ion channel physiology has a lesser representation in this volume. Anionic channels have generally been neglected by physiologists, mainly because their physiological role in the cell is more mundane like fluid secretion and cell volume regulation, unlike the cationic channels. The review is timely, summarizing the developments in the last five years, with new emerging facts like, half of the chloride channel (CLC) family members are antiporters, and not channels; with additional information about 'bestrophins', and the newest family of chloride channels the 'anoctamins'.

The variability in microarray data is now well known, with the result that it becomes difficult to find answers to simple questions like, the number of genes regulated by a single hormone. In the endocrinology section, genomic methodologies using microarrays, the recent RNA-Seq sequencing technology and the Global nuclear Run-On and massive parallel Sequencing (GRO-Seq) are discussed. One of the severe constraints in exploiting the nuclear receptors for drug discovery is that many genes are activated by a single nuclear receptor. The challenge is in identifying ligands that

control only a subset of genes under the control of the nuclear receptor. There is an update of the current work related to the development of steroidal and non-steroidal ligands, with structural overview using crystal structures of the binding sites that are useful in designing ligands of therapeutic importance. Obesity is becoming a major problem and current work indicates that it is associated with insulin resistance in adipose tissue, liver and muscle that can lead to type 2 diabetes mellitus. The pathological connections between macrophages, inflammation and insulin resistance in obesity have been summarized.

There is a growing concern about the rise in respiratory diseases, particularly the obstructive diseases of the lung such as asthma. Hitherto, the narrowing of the airways in the lungs has been primarily attributed to the contraction of the smooth muscle cells. In the respiratory physiology section, current work on the involvement of non-smooth muscle cell elements such as the lung parenchyma, and luminal contents of the airways in increased resistance of air flow are summarized. Further, the role of a subset of T-lymphocytes in causing asthma that does not respond to steroids is reviewed.

Glial cells are abundantly present in the brain, and the role of astrocytes – a glial cell type, in neuronal function is reviewed in the neurophysiology section. Astrocytes in the brain respond to neuronal activity, and release gliotransmitters – ATP, D-serine and glutamate that in turn modulate synaptic transmission and network activity of neurons and regulate behaviours such as sleep. The purinergic signalling in astrocytes and the implication of astrocytes in neurological and psychiatric disorders are reviewed.

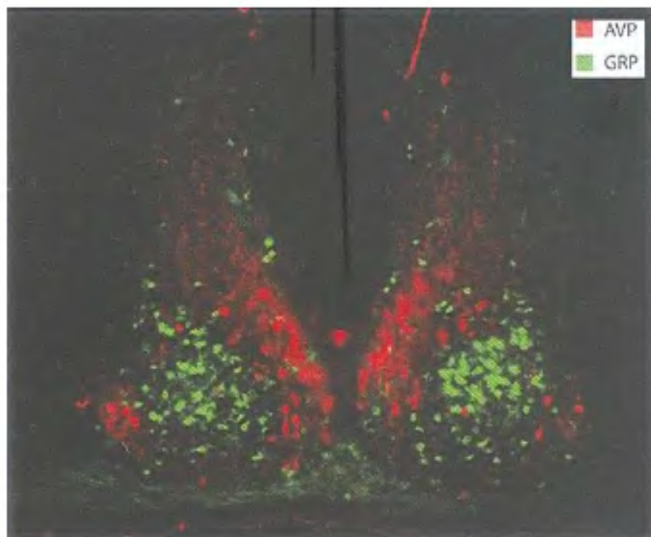
In the renal and electrolyte physiology section, the physiological significance of the cardiotonic steroid/ouabain binding site of the Na, K-ATPase is considered. Using transgenic mice, the importance of the ouabain binding site of the Na⁺, K-ATPase in causing changes in blood pressure during pregnancy has been delineated. The other topics relate to the intra renal purinergic signalling where locally released ATP is involved in sensing renal tubular flow and regulates renal tubular transport. Filtering and reabsorption of the plasma contents in the kidney is accomplished by a complex arrangement of functional cells that are vulnerable to cell injury. The development of

different cells and the methods for regenerating the damaged cells using stem cells in the adult kidney are reviewed.

Patients who are under antibiotic treatment have symptoms of diarrhoea. The physiology associated with this is reviewed in the gastrointestinal physiology section. Current work indicates that antibiotics kill the commensal bacteria in the colon that produce short-chain fatty acids from undigested carbohydrates. Shortchain fatty acids are charged, form the principal anions in the colon that help in fluid balance, and its decrease in the colon results in diarrhoea. Massive amounts of hydrochloric acid are secreted by the parietal cells in the stomach. Current work on membrane recycling of proteins like H, K-ATPase and lipids involving membrane flow from endosomal tubulovesicular membranes to the apical secretory surface of the gastric parietal cells that secrete hydrochloric acid is discussed.

The book under review would supplement the advanced texts in physiology used by students pursuing postgraduate physiology courses like the MSc or the MD physiology in India. It would also be useful to researchers since it gives recent information in a concise form. From the reviews in this volume, it is clear that physiological research is increasingly becoming molecular. With the emphasis of current biomedical research in linking research at the bench to clinical practice and therapy, and the ability to create disease models either in cell lines or organisms, understanding physiological processes at the molecular and cellular levels are inevitable. The current volume has dealt with contemporary issues that affect health, like global climate change, circadian clocks, cardiovascular and respiratory diseases. The topics under organized themes will be of interest to other biologists as well.

S. K. SIKDAR



Coronal section of mouse SCN – the master circadian pacemaker in the brain showing the ventral core region delineated by green fluorescent protein (GFP) expressed in GRP neurons (green) and the dorsal shell region delineated by immunofluorescent labeling for AVP (red). Between left and right SCN is the third ventricle, and below is the optic chiasm.

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