

**Annual Review of Neuroscience, 2010.** Steven E. Hyman *et al.* (eds). Annual Reviews, 4139, El Camino Way, Palo Alto, California 94303-0139, USA. Vol. 33. ix + 530 pp. Price: Rs: US\$ 86.

Neuroscience is a complex subject whose understanding requires knowledge extending from molecules to cells, development of neural circuits and the plasticity therein and interaction between different neural circuits to process the incoming information that manifests as a behaviour expressed through motor responses. It is difficult to segregate the knowledge base at individual levels and categorize them. This is reflected in the way the review articles appear in this volume of the *Annual Review of Neuroscience*.

The volume has many review articles that are related to the more complex issues concerning the understanding of the working of the brain and its function, and information that bridges psychology and neuroscience. The first review for instance is related to attention. Attention is focusing the train of thoughts to a particular task, like writing a review for this volume, for instance, and requires the act of concentration. Bisley and Goldberg review the role of parietal lobe and the lateral interparietal area in particular, in generating a 'priority map' that sorts out the behavioural importance of objects in the visual field.

Goal-directed movements are fairly fast, accurate and complex and rely on sensory feedback and require the ability to predict and correct systemic errors to produce accurate movements. Shadmehr, Smith and Krakauer review the current state of knowledge about how the brain does this and go into the details of the forward models, and how the brain remains continuously calibrated through motor adaptation.

Will or volition has generally been a subject of interest to theologians and philosophers and seemingly, it is a topic that appeared to be difficult to understand using neuroscience. Recent experimental approaches in the cognitive and neural sciences to understand the role of brain structures in volition are reviewed by Roskies.

Traditionally emotion has been associated with the amygdala and cognition has been associated with the prefrontal cortex in the brain. The review by Salzman and Fusi indicates that the two mental

states are represented in dynamic neural networks composed of an interconnected prefrontal and limbic brain structure which will help understand shifts in mental states that underlie adaptive cognitive and emotional behaviour.

When a doctor associates the symptoms in a patient with a particular disease, or when a tea taster rates tea for its aroma and flavour, his/her brain is doing complex categorization of information. Category learning requires acquisition of details, picking up the generalities amongst the detailed information acquired and categorizing the information in a meaningful manner; it is related to highly sophisticated thought processes. Seger and Miller review recent studies on how categories are learned by the brain, the importance of certain brain areas in categorization learning and the interactions of neural systems in category acquisition. Category learning is compromised in autistic brains.

Social cognition is related to social psychology and involves the encoding of information related to members of the same species. Moral judgement is appropriateness of one's behaviour in the context of social perceptions of right and wrong. The review by Forbes and Grafman examines the role of the human prefrontal cortex in social cognition and moral judgement.

Motor vision is important in insects and animals, where they have to perceive changes in visual space that are in motion. These are situations where the whole image of the prey being chased moves across the predator's retina, while the predator itself moves while chasing the prey. Such situations are associated with motion vectors and the resulting distribution of motion vectors is called optic flow. In some organisms with poor spatial vision, optic flow is the prime source of visual information. The review by Borst, Haag and Reiff on fly motion vision, highlights the importance of combined genetic, physiological and behavioural approaches in understanding the cellular processing of optic flow.

The next set of reviews is related to neuronal circuits and development. Neuronal circuits are assembled from a large number of neurons and synapses, and functional neuronal circuits require establishment of specific connectivities between the neurons and synapses. The review by Shen and Scheiffele gives examples of direct pre- and post-synaptic

matching decisions, and the role of glia and guidepost cells in circuit formation and remodelling of the synaptic connectivities by molecules at the transcription level. The review is exhaustive, covering invertebrate and vertebrate model systems using genetic and cell biological approaches.

Subplate neurons are the first to be generated and mature in the cerebral cortex, and are important in the development of orientation selectivity and ocular dominance columns. The subplate neurons are vulnerable to early hypoxia during pregnancy, and their dysfunction results in brain developmental disorders like cerebral palsy, autism, schizophrenia and epilepsy. The development of the subplate and early cortical circuits is reviewed by Kanold and Luhmann.

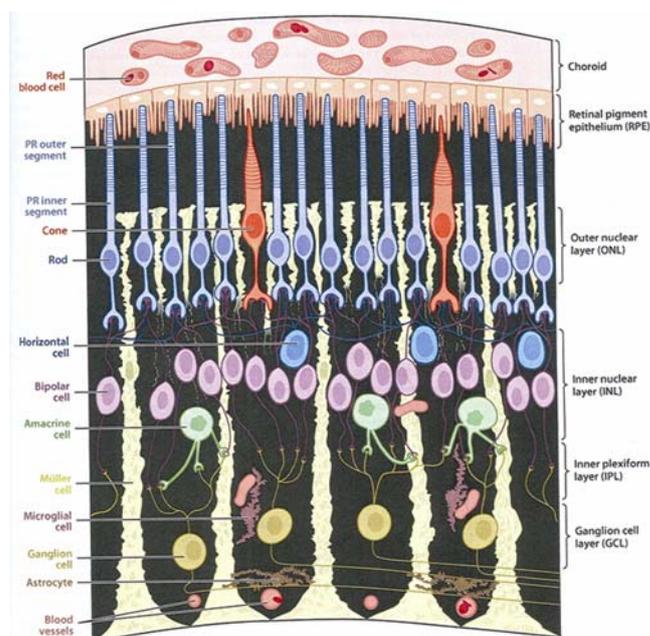
New neurons are added to brain structures such as the olfactory bulb and the dentate gyrus of the hippocampus, and have to integrate with the existing neuronal circuitry. The review by Kelsch, Sim and Lois highlights the application of recent developments using genetic labelling and imaging techniques to understand synaptogenesis in the adult brain, the flexibility of adult neurogenesis and its importance in transient plasticity, and the flexibility it offers to mature circuits.

There are anatomical similarities between the vascular and nervous system, and the relationships are now being recognized at the molecular and cellular level. The development of these two systems is reviewed by Tam and Watts with emphasis on developmental signalling cues associated with angiogenesis and the formation of the blood-brain barrier.

A third set of reviews is related to the understanding the molecular and cellular basis of neurological and psychiatric disorders.

Kullmann reviews neurological channelopathies associated with epilepsy, migraine, movement disorders, peripheral nerve, muscle and cognition. Most of the channelopathies cause paroxysmal symptoms, i.e. symptoms that occur suddenly and frequently, and the genes known to cause paroxysmal neurological disorders with Mendelian inheritance code for ion channels. Mutations in voltage-gated and ligand-gated ion channels are reviewed.

Voltage-gated Na channels are important in the rising phase of the action potential and conduction of electrical signals. Injuries in the nervous system



A schematic representation of the human retina showing photoreceptors (PRs), other retinal neurons, Müller glia, microglia, astrocytes and vessels. The outer nuclear layer (ONL) is composed of the cell bodies of rod and cone PRs; the inner nuclear layer (INL) contains the cell bodies of several types of neurons (horizontal cells, bipolar cells and amacrine cells) as well as the bodies of Müller glia. The ganglion cell layer (GCL) contains ganglion cells.

result in upregulation of voltage-gated Na channels in the pain signalling pathways, and a Na channel subtype has been associated with inherited human pain disorders. Dib-Hajj *et al.* review the current state of knowledge on the role of Na channels in normal and pathological pain.

Axons are long tubular extensions of the neuron. Wallerian degeneration refers to the degeneration in the distal end of the axon from the site of cut. The review by Coleman and Freeman describes the molecular and cell biology associated with Wallerian degeneration, in particular the role of a single protein *Wld<sup>S</sup>* that delays Wallerian degeneration and has relevance in understanding axonal injuries.

The motor neurons in the spinal cord are highly diverse in morphology and function, and the muscle fibres that they connect to. In neurodegenerative diseases like amyotrophic lateral sclerosis (ALS) and spinal muscular atrophy (SMA), fast fatigable motor units degenerate first, while motor units serving slow muscles, like those involved in eye movement, degenerate last. The developmental regulation of growth and survival of motor neuron subsets and the role of GNF (glia derived neurotrophic factor) and Cu-Zn superoxide dismutase (SOD2) in motor neuron diseases is reviewed by Kanning, Kaplan and Henderson.

Lin and Koleske highlight the different molecular and cellular mechanisms related to actin cytoskeleton and scaffolding proteins in the stability and maintenance of dendrites, and how destabilization of dendrites results in neuropsychiatric disorders like depression and schizophrenia, and neurodegenerative disorders like Alzheimer's disease.

The photoreceptor in the retina is one of the most genetically vulnerable cells in mammals, with more than 140 genes associated with death of the photoreceptor. The article by Bramall *et al.* reviews the genomic, biochemical and cellular responses of the retina in inherited photoreceptor degenerations and the prospects of treating these disorders using gene therapy.

The neurocutaneous disorder, neurofibromatosis type I, is a genetic disorder associated with loss of cognitive function, problems with motor control and learning disabilities. The review by Shilyanski, Lee and Silva examines the role of the *NF1* gene that encodes neurofibrin with efficient Ras-GAP activity, and its cellular importance in regulating the balanced release of the inhibitory transmitter, GABA, whose disturbance lowers the inhibitory network activity which in turn results in cognitive deficits.

Most recent developments in the molecular pathways involving progranulin

and the 43 kDa transactivating responsive sequence DNA-binding protein (TDP-43) affecting neuronal viability in frontotemporal lobar degeneration are reviewed by Slegers, Cruts and Broeckhoven.

What I have done above is to categorize the information content in the articles broadly which might help the readers to make reading choices that are sometimes useful in the age of information overload. The *Annual Reviews* are always useful in one's research and teaching, since the advanced developments in the field are put together concisely and this volume is no exception. Neuroscientists, neurologists and psychiatrists will find it useful.

S. K. SIKDAR

*Molecular Biophysics Unit,  
Indian Institute of Science,  
Bangalore 560 012, India  
e-mail: sks@mbu.iisc.ernet.in*

**Eyes on the Sky – The Story of Telescopes**, Biman Nath. Vigyan Prasar, Department of Science and Technology, A-50, Institutional Area, Sector 62, Noida 201 307. 2009. vii + 159 pp. Price: Rs 140.

Telescopes were known as 'spy glasses' until Ioannes Dimisiani, a Greek mathematician used the word 'telescope' (meaning far-seeing) for the first time in 1612.

The book under review is a meticulous weave of historical threads into a comprehensible narrative account on telescopes. *Eyes on the Sky*, a part of the Vigyan Prasar publication series, was brought out to mark the International Year of Astronomy in 2009, and also to commemorate the 400th anniversary of the first astronomical observations with a telescope by Galileo Galilei and the publications of Johannes Kepler's *Astronomia nova* (new astronomy). Vinay B. Kamble, Director, Vigyan Prasar, reiterates the theme in his Foreword.

Within its 159 pages, Biman Nath has been able to produce an easy-to-understand narrative. The book is basically written for pupils from schools and colleges or early buds in this field.

Interesting facts on the history of telescope, its making, coining of the term and developments in India, Europe, Greece and Arabic countries have been