country to follow?; (iii) The scientist has to work in an ecosystem which is full of committees. It has a labyrinth of committees, procedures and rules through which a working scientist has to meander his proposals for procurement of equipment and consumables before he can settle down to do some worthwhile research; (iv) Who needs scientific temper? When governments of the day are promoting sadhus, mendicants, pujaris and jyotishies with all the perks and privileges in the country; (v) In early twentieth century two linear models of the innovation process namely, science-push model and demand-push model, were in vogue. On what model, in India, the centralized research institutes were established?; (vi) Research in basic science at the universities, that could have been the harbinger of innovative technology, was missing; (vii) The dismal education system and lack of opportunities within the country lead to migration of talented Indian students for study and research in basic sciences in the western universities.

In chapter 11 (Is there a way?), the author gives some suggestions to improve the situation: (i) Since the universities form the backbone of western science and technology it is important to reinvigorate the universities. The universities should be made autonomous with no government control and political interference in all matters including academic appointments, curriculum and research. (ii) The scientist opting to remain active in research should be given all the financial and procurement powers which he can exercise independently of the administrator. The allocation of funds also should be suitably done amongst the scientists at various levels. The work of scientists should be evaluated by the citation index of their work or projects successively.

The author has left no stone unturned to dig up archives to prepare this comprehensive volume. I praise the daredevil feat of Rajiva Bhatnagar in calling a spade a spade to bring out the truth about the ethos of modern Indian science and its eco-system.

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Annual reviews are a source of in-depth reviews of most recent and exciting developments on specific topics for both interested academics and researchers. These reviews not only serve as a source of most relevant references but also enable readers to read a comprehensive and critical view of a specific topic and what is likely to be future research challenges in a particular field. Like any other field, if not more, the interest in neuroscience research has been growing at a fast pace both in basic and application areas. Researchers are consistently engaged in uncovering new cellular and molecular functional components of our mighty brains, whereas at the same time, there have been significant advances in the understanding of how brain shapes, orders and organizes its functions and downstream physiology and behaviour, and how brain and associated structures are closely linked with illness and general health. Growing evidence suggests that neuroscience research is far more important than has hitherto been appreciated, at least until recently in India. To a beginner in the field, two important cell types that make our brain and enable it to execute its over-arching control over body are the neurons and glia (astrocytes). For a long time, the neuroscience research focus has exclusively been on the neurons, perhaps because one could relatively easily measure the activity of neurons in the form of an action potential; glia has been considered as the supporting cells. Recent extensive researches have realized the importance of glia functions, and glia research has come into great prominence at the current time. In a significant *Cell Reports* paper in January 2017, based on gene expression studies, Soreq *et al*. claimed that the presence and function of glia, not the neuron number, differentiates between a young brain and old brain; this perhaps makes glia an exciting candidate for 'aging' research. Subsequent researches further implicated that stressful events could alter the epigenetic code of certain glial cell progenitors, and this might account for an increased susceptibility to chronic illnesses, most importantly the psychiatric disorders. Evidence suggests that glial dysfunction was a more likely cause of stress-related mental disorders. In this volume, three articles in different ways have addressed on the astrocytes diversity and neuronal–glia functional relationships. The overall take-away from researches that has been reviewed in this volume is that astrocytes influence almost much of the brain circuits; therefore, the functional relationship between neuron and glia could be perhaps future neuroscience research frontier because of its direct implication to health and diseases.

The nervous system integrates directly and indirectly with most, if not all, regulatory mechanisms underlying the body function in eukaryotes. Although this is reflected in several articles in this volume, the starting article treats this in a unique way. Romanov *et al*. presents a perspective of how the hypothalamus through its extensive synaptic connectivity with other tissues enables an efficient coding of the endocrine responses. The authors have reviewed different cell types based on molecular fingerprints matched with anatomical and biochemical principles. Importantly, the authors have attempted to present a novel classification that reinforces neuronal heterogeneity and neurotransmitter–neuropeptide relationships in the hypothalamus. I believe the proposed classification is timely, as it will help to understand the functional convergence of candidate molecules in the regulation of behaviour and physiology. Perhaps, such a taxonomic relationship would lead to the emergence of a better map of the neuronal circuits underlying the regulation of different behavioural and physiological processes. However, it remains to be seen whether the relationship as suggested in the review will stand with seasonal changes in the behaviour and physiology.

A unique example of brain-mediated important daily routines is sleep. Sleep is as crucial to us as eating and drinking. This is because sleep affects almost every tissue and system in our body including the brain, heart, and lungs to metabolism, immunity, mood, and disease resistance. Sleep is an outcome of several brain regions including the hypothalamus (suprachiasmatic nucleus – SCN, which provides timing of sleep during the day), thalamus (which relays sensory information), basal forebrain, midbrain,

pineal gland (secretes melatonin, which facilitates and consolidates sleep at night in diurnal species), amygdala and brain stem. The functional integration of these regions controls transitions between sleep and wake (interaction of hypothalamus with brain stem) and between NREM and REM (both thalamus and amygdala are active in REM sleep). The second article in this volume focuses on NREM–REM sleep and proposes an arousal–action (A–A) circuit for sleep–wake control in the brain. Sleep–wake control seems highly distributed with multiple brain state switches, in order to coordinate concurrent changes in the activity of the autonomic and somatomotor systems. The AA model conceptualizing a highly dispersed functional network of regulatory system, could provide a basis for discovering new sleep neurons, and eventually finding a better sleep therapy in the future. However, the AA model as conceptualized has ignored the circadian rhythm influence, and I believe that SCN-input to the sleep–wake system is necessary component of the mechanisms underlying sleep–wake control.

Different sensory systems are functionally linked to each other, since brain has an internal representation of body. That is, there is a mechanism that links the information processed by brain back to the prevailing surrounding environment, and enables to contextualize brain-mediated function. Kriegeskorte and Diedrichsen have critically analysed different encoding and decoding models with valid assumptions and limitations that potentially enable brain to give rise to a continuous stream of mental activities. A good example of such continuous mental ability is the reception (action of receiving inputs) and perception (organization, identification, and interpretation of sensory information). Perception includes the conscious reception, selection, processing and interpretation by brain of relevant information from all inputs to brain via different sensory cells. So, perception does influence both, the quality and the level of communication; this is reflected by all kinds of language signs, namely words, images, gestures, scents, tastes, textures and acoustics (sounds). Each communicating signal is so precisely perceived that one can differentiate between the sound coming to the left or right ear. This is important since a tiny interaural time difference helps in the spatial localization of sound; hence this adds to the environmental awareness. There have been increasing efforts in unravelling the neural correlates and mechanisms underlying the processing of communicating signals to treat perception-associated disorders. Joris and Heijden have provided an update on the progress that has been made on binaural neural circuits that are not only of academic interest but also have increased our understanding of the reasons, albeit partially, for an impaired hearing. In fact, the progress in auditory research is an excellent example of bench-to-bedside brain research, and successful biomedical engineering leading to the development and usage of cochlear implants. An article in this volume takes into account the development of modern cochlear implants and the relationship of developing brain with hearing acquisition and language spoken. Michalski and Petit have reviewed genes involved in the development and physiology of both peripheral and central auditory systems. As the authors themselves point out, 34 pinpointed genes represent a very limited list, and there is a need to find out more candidate genes and elucidate their roles in both the auditory system and auditory hindbrain. This opens a strong hope for similar treatment of disorders associated with other important sensory systems, e.g. vision. According to estimates, there are 39 million blind people globally, with India having its largest share. Hopefully, there is soon an improved version of 'bionic eyes', based on visual neuroscience research. Besides, studies on audition in animals have helped us to understand how sensory stimuli can be selectively encoded and decoded by brain into different behaviourally relevant patterns; e.g. social calls can be different from courtship calls in both invertebrates and vertebrates. The optogenetic tools in certain models have enabled us to study the patterns details, and hopefully, this is going to be advantageous for speech therapy to humans. This volume includes an article by Baker *et al*. covering the development of acoustics in insects, and propose that similar general principles of neural coding could be involved across sensory systems and across species.

One of the key challenges for neuroscience research is pain management during chronic illnesses. The pain syndrome presents an interesting paradox from a neuroscience perspective. Typically, pain seems to be originating peripherally, but brain with no pain receptors in it is the main organ tool to detect pain. At the current time, drugs that are used for pain management are addictive; so, an immediate need is to find an alternative and better un-addictive therapeutics. One idea to address this is researching intensively into the voltage-gated sodium channels. Dib-Hajj and Waxman have overviewed species-specific differences in the sodium channels, and they have critically analysed how the knowledge on sodium channels could possibly be advanced to find a better pain therapy for humans in the future.

The present volume presents an interesting mix of articles covering a range of topics. Many reviews have critically reviewed existing knowledge, and have also given future directions for the research. The articles in the volume are bound to be useful to many readers who have interest across subject areas, but may not be so much to a researcher whose interest is restricted; e.g. I missed out a review of circadian neuroscience, which is fast expanding at the current time. I also noticed the lack of a common theme or themes running through the present volume (maybe this is trend of *Annual Reviews*); if organized into loosely organized themes such a volume would require less efforts from a reader. Overall, nonetheless, the present volume continues with long-held tradition of Annual Reviews in providing a thoughtful account of selected topics.

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