Hence, micropropagation through organogensis of *A. calcarata* (K. P. Martin and Molly Hariharan) will be of interest. *In vitro* plant regeneration study of *Curcuma aromatica* as well as clonal propagation study of *Acorus calamus* L. may be of great help to pharmacologists.

The paper on 'Use of Molecular Markers in Coffee' (H. L. Sreenath) offers innovative knowledge to geneticists. Better information on the degree and distribution of genetic variation is essential for developing more efficient ways of evaluating, utilizing and conserving biodiversity. For this, Restriction Fragment Length Polymorphism (RFLP) analysis seems to be time consuming and in its place a novel technique RAPD (Random Amplification of Polymorphic DNAs) by the polymerase chain reaction is finding extensive application in plant genetics. It can be used for clone identification, pedigree studies, genetic mapping, estimation of outcrossing rates, population differentiation, etc. Yet another new technique known as AFLP (Amplified Fragment Length Polymorphism) overcomes the disadvantages of the earlier techniques and can be effectively employed for coffee genome analysis.

Optimization of PCR-based DNA fingerprinting in rhizobial bacteria done at the Institute of Microbiology, Prague, Czech Republic comes across to the readers as an invaluable article. In this study, RAPD has been optimized by using two arbitrary oligos individually in eight strains of rhizobial DNA isolated from different cultivars. A very important finding is that optimum conditions have been standardized for generating the genomic fingerprints of each individual bacteria.

Indeed, this book comes as a collection of scientific papers on diverse scientific investigations on plant tissue culture and biotechnology. Readers will certainly be enlightened with new trends in this field of research in India.

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The major focus of research in the next millennium will be the brain. Anatomy, biochemistry and physiology will give way to an integrative approach. Multidisciplinary research aimed at understanding the nervous system functioning will have to begin with educating the uninitiated and reorienting the practitioners. The sheer pace of progress and volume of new discoveries and thoughts make it difficult to keep pace with the literature. More and more current information will go electronic and the only printed material that will not be dated will be reviews. One will need to have comprehensive reviews to guide one through the mass of information on the super highways. The *Annual Review of Neuroscience* that has been eminently successful in help update one's understanding each year may then fill in this role even better. The current issue reflects a breadth that is likely to set the trend in neuroscience research in the coming years.

The nature vs nurture debates have been the most bitter in the context of human intelligence. The lack of real biological perspectives and biased views of what is desirable or undesirable have often resulted in unresolved intellectual controversies and dubious interventions by the unscrupulous based on faulty or tailored results of so-called measures of intelligence. Thus, even a discussion on genetic basis of human behaviour, leave alone a systematic study of such, has acquired a shade of taboo. But one cannot escape paying attention to genetic influences on human behaviour even as one has to be cautious. Genes do determine the basic structure and circuitry as well as lay the foundations for the substratum on which environment can imprint its influence. What is important is that the environment can enrich this in many ways. Decidedly hence, genetic changes will put certain limits resulting in deficits or cause pathological conditions and understanding these will be of value in alleviating them in an informed manner. In one sense, every human being is a different combination of genetic alterations and we are several billion such. This will thus provide the largest pool of variants if properly studied. Given the rate at which the human genome is being sequenced it will not be too long before we can identify a whole slew of behaviourally relevant molecules if the genetics of complex human behaviour can be objectively analysed. McGue and Bouchard's review of recent studies on genetic and environmental differences in psychological and psychopathological characteristics is of great significance and timely. This theme appears once again in the review by Price and Sisodia.

Eve Marder focuses on computational implications of synaptic mechanisms. A rich repertoire of behaviour reflects the dynamic changes in neural circuits resulting from synaptic activity. The neuronal and synaptic properties that are provided by cellular and molecular neurobiology need to be assimilated into the system neuroscience attempting to understand the ensembles of neurons that underlie behaviour. This review is an attempt to highlight information on cellular and synaptic properties that will have important implications in network properties. The review stands out as an example of the more desirable in content and style.

The visual cortex is a much-studied system and a model for analysis of nervous system function. A detailed understanding of functional architecture that began with electrical recordings has been in recent times enhanced by functional imaging and *in vivo* optical recordings. We now have a better understanding of orientation and ocular dominance columns, direction selectivity, movement encoding and frequency tuning. The review details new studies on the macaque. These animals being close to humans afford useful extensions to our own visual perception. A companion review by Parker and Newsome (Sense and the single neuron) traces developments in cognitive neuroscience and methods of analysing relationships between neuronal firing and perception. The focus is on enlightening the relationship between cellular neuronal signals and psychological processes.

The cell biology of synapse has become one of the most exciting and expanding areas of research in the past five years. Thomas Sudhoff has contri-

buted much to our current state of knowledge about molecular players in the exocytic release process. This is one area, which has produced dozens of reviews and seems to need them with ideas getting obsolete rapidly in spans of months rather than years. In this review, he concentrates on roles of Rab3 and synaptotagmin. A well-documented case is argued out for synaptotagmin as the calcium sensor and inducing release in the presence of calcium and Rab3 which works in the opposite direction limiting the number of vesicles that can be released.

Cell adhesion molecules were first proposed and discovered by Gerry Edelman who asked simple questions regarding tissue structure and morphology. The remarkable growth of numbers and functions of these molecules has resulted in an enterprise so big, it is not surprising that one sees a review without a single reference to Edelman. Cell adhesion molecules have critical roles it seems now, from tissue organization to axonal growth and guidance and even memory, learning and perception. Kamiguchi *et al.* discuss adhesion molecules in the context of human nervous system and particularly inherited neurological disorders. It is clear that multiple clinical syndromes result from mutations in single genes and as would be expected similar syndromes can result from changes in different genes. This reflects the fact that molecules have roles to play in different contexts and combinations. How these roles are played out will be of great significance in the coming years.

A wide variety of cellular responses are mediated by changes in Cyclic AMP concentration. The Cyclic AMP Response Element (CRE)-dependent transcription is regulated by CREBS (CRE binding proteins) which in association with CBPs (CREB binding proteins) recruit basal transcription factors and RNA polymerase on to the promoter and initiate transcription. This affords regulation of the biology of the cell by the best known biological messengers: cAMP and calcium. Recent studies have demonstrated a specific requirement of CREB-dependent transcription in both long-term and short-term memories. From simple conditioning studies in *Aplysia* and *Drosophila* to genetic and pharmacological studies in rats and mice, it is clear that CREB is crucial to simple as well as complex forms of memory including social and spatial learning. Considerable amount of data suggest these changes may happen at the level of synapse by increasing CREB-regulated changes in synaptic release machinery as well as by long-term changes to synaptic architecture. The universality of CREB activation in memory formation is underscored by the elegant mapping of CREB activation in bird song perception. The review by Silva *et al.* helps give us their perspectives in an area in flux.

Plasticity in the central nervous system has come to occupy the central stage in all studies on brain and behaviour in higher primates. Both synaptic strength and connectivity are modified by experience and this ultimately is the basis of cortical plasticity or changes of cortical representations. Elementary forms of synaptic plasticity lead to such changes. This synthesis is the theme of the review by Buonomano and Merzenich. Progress in our understanding of how activity of the cells in the nervous system lead to sensory perception is the major goal of neuroscience research. This is a recurrent theme in many reviews in this issue.

Tim Tully has made the study of learning and memory in *Drosophila* incomparably precise and it is possible to talk of different forms of memory even in flies and they have attributes similar to those in higher brains. If such diverse forms are amenable to mutational analysis and homologues of the molecules coded can be identified in higher systems, one then could in principle use such knowledge more gainfully. Chemistry of the brain is reasonably understandable and principles of its development, although crucial to function, are not likely to be far different from those worked out in *Drosophila* embryonic development. What is needed is an analysis of neural circuits and cellular physiologies that underlie complex behaviour including perception, learning and memory and all other things so unique to the wired nervous system as a whole. Given the great complexity of the nervous system and the need for an integrative approach, genetics of behaviour will possibly be the most important if not the only worthwhile thing to do in brain research. The review by Dubnau and Tully is just a preview of some great stuff waiting to happen in the coming years. *Caenorhabditis*, despite a limited behavioural repertoire and few neurons has had some remarkable contributions to make to our understanding of nervous system functioning. The worm has 302 neurons, 118 types, with between 1 and 13 members in each class. It has 5000 chemical synapses, 600 gap junctions and 2000 neuromuscular junctions. This precision with the study of several mutations affecting the movement of the worm has already had a very profound impact on neuroscience research. Bargmann and Kaplan write about signal transduction mechanisms in *C. elegans* in a review of great clarity.

Some of the reviews like ephrins and neural development, zinc and brain injury and even the one on inducible gene expression do not belong here. New thoughts on functioning of the nervous system are unlikely to come from such studies, which in a sense deal with the brain no different from any other organ like the liver or kidney. There are a couple of other reviews, which again are useful but not stimulating. Altogether, this is an exciting collection of reviews and one hopes that in future volumes of more and more real neuroscience will displace the belaboured accounts of cut, crush and grind biologies.

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