In this issue

Controlling gene expression

The control of gene expression is primarily at the level of transcription, the step where information stored in the sequence of bases in DNA is transcribed into messenger RNA. The regulation of genes is then predominantly effected by the binding of specific proteins to control elements in the non-coding stretches of DNA.

Protein–DNA interactions are the molecular switches that modulate gene expression. Much of our present day understanding of gene expression dates back to the pathbreaking work of Jacob and Monod, which led to the operon model. Several decades later the structures of protein repressors, the operator DNA segments and sometimes their complexes are available as a conconsequence of NMR or crystallographic studies. This wealth of molecular information promises to reveal the functioning of these regulatory switches at near-atomic resolution. Siddhartha Roy (**page 100**) describes biophysical studies on an important regulatory protein, the λ-repressor, which is crucial in switching the bacteriophage λ from the lysogenic to lytic mode of growth. Transcriptional control of gene expression is an area where the fusion of molecular genetics and structural biology has had a major impact.

P. Balaram

High energy physics

At the November 1995 meeting of the Indian Academy of Sciences, held in Madras, a special session was hosted by the Indira Gandhi Centre for Atomic Research, Kalpakkam. This was devoted to the topic of 'High Energy Physics in the 21st Century'. This issue contains a special section (**page 109**) with written versions of many of the talks given, as it was felt by many that the theme and content would be appreciated by a wider audience.

The special section opens with G. Rajasekaran's overview, which itself introduces the articles that follow. It also states the basic driving force for high energy physics research. In spite of tremendous progress from the beginning of this century, our current basic idea of space and time is that given by Einstein and the quantum theory we use today is just a descendant of Planck's creation. But surely these ideas must give way to new ones as we probe shorter scales, and the only way to discover these new principles is to pursue higher energies, theoretically and experimentally.

D. P. Roy's article on the current very successful 'Standard Model' describes phenomena at energies less than a hundred times the rest energy of the proton, and correspondingly, length scales about a hundred times smaller than the size of the atomic nucleus. The very success of this model, which is by now rather complex with many parameters, raises the question of what lies at higher energies, and this is addressed in the next article by R. K. Kaul. Traditionally, much of this range has been regarded as unexplorable, but some of the daring ideas to reach such high energies are reviewed by A. Sen. R. Ramachandran sums up with the kind of questions one would like to answer, but with the cautionary note that such exercises in the past have missed the new surprises thrown up by the subject. In addition, he outlines a scenario for the development of the subject in our country.

R. Nityananda

A new look at an old concept

The idea of steric inhibition of resonance is well established and forms part of the standard organic chemistry curriculum. The concept is easy to understand. A substituent on a phenyl ring is generally twisted out of conjugation if two bulky groups are present in the ortho positions. Many examples are known which demonstrate this effect as well as its spectral and chemical consequences.

A more subtle effect is seen in anisoles and related molecules with a single ortho substituent. Instead of a partial reduction in conjugation, an enhancement was proposed by V. Baliah and M. Uma. They argued that in order to reduce steric repulsions, the methoxy group would remain in the plane of the phenyl ring, with the methyl group pointing away from the ortho substituent. Importantly, this preference was suggested to be greater than in the derivative without any ortho substituent (some degree of non-planarity is possible in the latter in view of the absence of steric interactions). This effect was called steric enhancement of resonance (SER). It represents one of the original contributions to stereo-electronic theory to be made from India.

The proof for SER was initially based on trends in dipole moments in a number of phenyl derivatives. Many additional spectral and reactivity features were also interpreted in terms of this effect. Since the magnitude of SER is usually small, results had to be interpreted with caution.

An attractive means of establishing and quantifying SER would be to use modern computational methods, for example by calculating structures and rotational barriers in representative systems. In a complimentary manner, S. R. Gadre and coworkers use the methodology they have perfected over the years to study the problem of SER (**page 130**). Using *ab initio* MO wave functions on a number of model systems, the authors have examined the topological features of molecular electrostatic potentials. They find characteristic signatures in the MESP minima which reflect the inhibition of resonance in di-ortho substituted derivatives and also enhancement in mono-ortho counterparts. By placing an additional substituent at the para position, they have established consistency in the computed data.

J. Chandrasekhar

Perception of science

Support for the scientific enterprise depends greatly on the public perception of science. This is especially true in the West but is becoming an increasingly important factor in India.

In an article reprinted in this issue (**page 148**), Martin Rees analyses the conditions under which discovery and invention flourish best. While his preoccupation with science in Britain may appear somewhat misplaced in this journal, readers would do well to ponder on many aspects of his analysis. Parallels can be readily drawn to the Indian situation, where science today does not have unqualified support and where attracting the best to scientific careers has become extremely difficult. The increasing pressure for research to yield visible dividends is transforming attitudes of scientists and those connected with organizations and funding of science. What are reliable indicators of success? Interestingly, public perceptions are rarely guided by utility. Martin Rees points out that 'irrelevant subjects' fascinate people most, with dinosaurs and cosmology topping the lists in Britain. In India the 'publish or perish' syndrome appears to have given way to the cry of 'patent or perish'. How do we create an intellectual climate for discovery and invention? How do we emphasize considerations that 'transcend the purely economic'. The article by Rees focusses on these and related issues and should provide a stimulus for future discussions.

P. Balaram