In this issue

Symmetry: An underlying theme in all subjects

Symmetry is a concept which has universal appeal. When recognized, it evokes a strong emotional response. In his famous poem on the Tiger, William Blake is awestruck most of all by its *fearful symmetry*. The feeling of delight, and even upliftment, is stronger when we discover the role of symmetry in physical laws. It satisfies our desire for recognizing order amidst chaos.

Chemists derive immense pleasure from the possible existence of highly symmetrical objects at the molecular scale. They are willing to take great pains to create these systems in the laboratory. Their notion of symmetry is, however, not restricted to molecular architecture alone. It extends to 3-dimensional packing of atoms and molecules in crystals and partially-ordered assemblies. The role of symmetry in determining the presence or absence of spectral lines as well as their intensities has also been well recognized. In a more subtle manner, symmetry provides a beautiful framework for predicting whether certain classes of reactions can occur readily or not and also whether heat or light is the right choice for triggering the processes.

Interestingly, a majority of molecules, especially those which occur in nature, do not possess much symmetry. But the very absence of certain elements of symmetry has interesting consequences. Isomeric forms can be created which are non-superimposable. This feature of handedness or chirality critically determines biological functions.

These and various other contexts in which symmetry is exploited by chemists are lucidly described by M. Hargittai and I. Hargittai (**page 818**). The profusely-illustrated article is meant to be a general overview of the topic and not a critical review of the subject for specialists. The authors are eminently suited for the task, having written a highly acclaimed book *Symmetry through the Eyes of a Chemist*. The authors make an interesting comparison of the emphasis on symmetry in different disciplines. They argue that concepts like symmetry provide common links between different areas and also between the arts and the sciences.

J. Chandrasekhar

Invincible microbes

Biology is in the midst of a major revolution as genome sequences of diverse organisms pour into computerized databases. A little over two years ago, the genome of *Methanococcus jannaschii* was completely sequenced providing an unprecedented view of protein and nucleic acid sequences in a remarkable organism. *Methanococcus jannaschii* is an extraordinary microbe, living and multiplying at hot spots with temperatures close to 100°C at depths of 3 km below the ocean. The organism produces methane and belongs to a family of one-celled organisms called Archaea, which are distinctly different from Bacteria and the more complex Eukarya, leading to three main branches in Carl Woese's 'tree of life'. Woese's recognition in 1977, that the Archaea constitute a new domain of life was slow to be accepted, but today his classification is central to modern microbial biology (see *Science*, 2 May, 1997 for a special section on Frontiers in Microbial Ecology). The boundaries between earth scientists and microbiologists have blurred as there is growing appreciation for the role of microorganisms in the constant process of subsurface geochemical change. Microbes have now been tapped from as far down as 2.8 km below the earth's surface, providing clues to the subsistence of life in oxygen-free conditions, utilizing inorganic elements like iron and manganese for oxidative processes that are central to biochemistry.

In compelling testimony to the power of adaptive evolution driven by selective pressure, microorganisms have learned to survive at high temperatures, pressures and in chemically inhospitable environments. These organisms and their constituent molecules must provide important clues as to the origin of their hardiness and chemical versatility. Considering the importance of stabilization of enzymes at high temperatures in industrial processes, it is not surprising that there has been enormous recent interest on thermophilic organisms. Prasad and Sarkar review this area on **page 842**. They conclude by raising the tantalizing possibility of extraterrestrial life under apparently extreme conditions. The remarkable survival instincts of microorganisms, refined over millions of years, suggest that it would be unwise to underestimate their abilities to grow and flourish in bizarre environments.

P. Balaram