In this issue

Alkaliphile without alkaliphile-specific features

Adenosine triphosphate (ATP) synthesis is one of the most commonly occurring reactions in biology. This is fulfilled by the transmembrane proton gradient (ΔpH) across the membrane. In neutrophiles and acidophiles, proton concentration inside the cell is less and Mitchell's model of chemiosmotic theories (i.e., generation of ΔpH and flow of protons from higher concentration to lower concentration) can satisfactorily explain ATP generation. In neutrophiles and acidophiles, as pH outside the cell is less, more protons are available to form ΔpH. In alkaliphiles this is totally reversed, as outside bacterial cell pH is at least 2 units higher than the inside of the cell. Mitchell's chemiosmotic theories fail to explain ATP synthesis in alkaliphiles. In alkaline conditions, the external pH is high, i.e. above pH 8.0, which poses a major thermodynamic problem for ATP synthesis. To survive in extreme conditions, micro-organisms devise specific adaptive mechanisms. Along with other transporter proteins, ATP synthase is widely considered as one of the key molecules for adaptation in alkaline conditions. Involvement of ATP synthase in bacterial pH homeostasis is extensively studied in alkaliphiles. Review of literature suggests specific conserved regions in the alkaliphile specific motifs in *a* and *c* subunits of ATP synthase. Although various studies reported alkaliphiles from Prestine alkaline Crater Lake Lonar, the basis of adaptation of Lonar Lake alkaliphiles in alkaline conditions was not reported earlier. An attempt has been made to isolate and identify Lonar Lake alkaliphile. Alkaliphile-specific amino-acid residues in ATP synthase *c*-subunit were compared with earlier reported and extensively studied alkaliphiles. See **page 1216**.

Lack of both specificity and (even) ordered structure is important for biological functions of the enzymes

Some fundamental notions about how enzymes work are being challenged in view of the recent knowledge. Organic chemists have often wondered why a big molecule like a protein is needed for catalysing a reaction which organic chemists can carry out sometimes even with a single proton or hydroxyl ion! It has been said that this big structure is needed so that the enzyme lands up at the right place within or outside the cell. It is also required for regulating the catalytic activity in real time. Now, it comes out that long range interactions controlling internal motions within polypeptide may be important for enzyme function.

It is said that specificity is the hallmark of biology. Also, that enzymes score over chemical catalysts in being specific. It turns out that we may have oversold ourselves on this point. It is the lack of specificity which is also important *in vivo* and is useful for biotechnology. Many protein purifications become possible because of this. Hydrolases can catalyse synthetic reactions (in low water media) or even help formation of carbon–carbon bonds (Catalytic promiscuity). Enzymes can moonlight; an eye protein can be a growth hormone (Moonlighting proteins). Finally, disorder in its 3-D structure maybe, in many cases, vital for cellular metabolism (intrinsically disordered proteins). Even further, the question what causes a molecule to bind an enzyme itself seems to need a serious relook. All this, of course, would not be possible if enzymes were not macromolecules. Finally, the area of enzymology (wherein it seemed nothing new was likely to happen any longer) is in for some upheaval. See **page 1178**.

The making of an indigenous scanning tunneling microscope

Pankaj Sekhasaria (**page 1152**) delves into the history of making one of the earliest sets of scanning tunneling microscopes (STMs) in India at the Centre for Advanced Studies in Materials Science and Solid State Physics, Department of Physics, University of Pune in Pune.

Using methods such as open-ended interviews, historical analysis and laboratory ethnography that are drawn primarily from sociology and anthropology, the author not only excavates how the instruments were made but also locates their making in the larger cultural, social and economic context. The concept of jugaad is seen to play an important role and junk markets, scrap materials, small workshops, entrepreneurs and traditional knowledge practices are seen to contribute to this enterprise of 'instrument-making' and doing scientific research.

The instruments have not only produced results that have been published in leading peer-reviewed scientific journals, students were also trained in making, using and modifying the instruments, creating in the process a skilled and confident cadre of scientists with a much-in-need skill set today.

The article also presents a conceptualization of 'technological jugaad', a kind of jugaad that prominently involves the reconfiguration of materials and materiality and can be seen operating as robustly in the street and parts of rural India as it is in the making of an STM in a modern physics laboratory.