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Molecular wires

In a brief note (**page 216**) on electron transfer through a network of conjugated organic molecules, Varsha Deshpande and N. Kumar show that a side chain of appropriate length can regulate charge transmission at the branch node. This takes us back to a workshop on molecular electronic devices held in the US a few years ago, where scientists dreamed of replacing transistors and other solid-state electronic devices with molecular functional groups—organic or inorganic—constructed to exhibit the appropriate electrical behaviour when hooked together in networks. They dreamed further of making molecular assemblies with specific electronic functions by an adaptation of the technique of synthesis of polypeptides developed by R. B. Merrifield. A suitably prepared clean surface is exposed to reagents that add only one subunit of a supramolecular assembly. A series of reactions with the same or different reagents builds up 'molecular wires'—conductors or insulating regions, switching and memory devices. It was realized that there would be problems of overheating of the organic molecules when current flowed through them, and therefore the possibility of solitonic transmission, which had not been completely discovered experimentally, was hinted at. Mathematically, solitons are solutions of known linear partial-differential wave equations. One of the strangest properties that came out was that solitons are localized in spaces and do not smear out with time, i.e. they do not dissipate energy as they travel. Certain water waves do exhibit the properties of solitons. Solitons are hypothesized to occur as fractionally electrically charged entities in organic linear chain molecules, the so-called one-dimensional conductors. A recent meeting in Hawaii discussed progress in the field.

B. P. Pal

M. S. Swaminathan writes (**page 237**) an obituary of B. P. Pal, one of the most distinguished agricultural scientists of India. Pal was a very remarkable man and influenced greatly the growth of agriculture and agricultural science in India. He was a man with a vision and a taste for things scientific and things human. He was also full of compassion and humour.

Molecular Meccano

There is something mysterious and even mystical about geometry that attracts people as the proverbial flame does a moth. Says the scientist, 'We like to look at symmetrical things in nature, such as perfectly symmetrical spheres like planets and the sun, or symmetrical crystals like snowflakes, or flowers which are nearly symmetrical.' (Richard Feynman)

'Why is symmetry so pleasing to the eye? What is symmetry? It is an innate feeling, I answered myself, but what is it based on?' (Leo Tolstoy) The ancient Greek geometricians proved that there can only be five regular polyhedra, the platonic solids, viz. the tetrahedron, the cube, the octahedron, the dodecahedron and the icosahedron. According to Martin Gardner, 'inhabitants of the most distant galaxy cannot play dice having the shape of a regular convex polyhedron unknown to us'. So enthralled was the great Johann Kepler with these platonic solids that he thought he had succeeded in explaining the structure of the entire solar system using the sphere and the five platonic solids. Not that Kepler was unconscious that he could be wrong, for he says, 'I was not afraid ... whether my joy was to vanish with smoke.' The bug of geometry has also bitten organic chemists, who have always delighted in playing with their geometrical molecular pieces to form beautiful jigsaw puzzles never before thought of.

J. Chandrasekhar writes (**page 193**) about some remarkable feats of organic synthesis in the eighties—part of the story of organic chemists' attempts to construct molecules that resemble the platonic solids—a task that Nature herself has not so far dared attempt. Their arduous but exciting attempts can only be described again in the words of Kepler: 'The great joy I experienced cannot be put into words. I did not regret any of the time spent and felt no fatigue.'

Fishing afresh for family trees

The science of taxonomy has been touched by and has received much impetus from several major developments in biochemistry. The best known of these are of course protein and nucleic-acid sequencing. Before direct sequencing of proteins and genes (DNA) was employed in species comparisons, serological methods of comparing proteins had given rise to much literature and debate in molecular systematics.

In an article on **page 209**, Maria R. Menezes describes the use of another well-known biochemical method to derive information on relationships among species. The so-called zymogram method, in which enzymes separated by electrophoresis in gels are visualized specifically, allows detection of polymorphic enzymes and easy comparison of species in terms of individual enzymes. From a sufficiently large sample, one can then estimate gene or allele frequencies for the enzyme loci examined and, in turn, calculate genetic distance between species. Menezes examines 15 loci in three species of fish and obtains, as one might expect, a smaller value for genetic distance between two congeneric species than that between genera.

The zymogram method is of course limited to examining proteins for which specific *in situ* staining methods are available. Electrophoresis cannot also reveal amino-acid changes that do not alter electrophoretic mobility of the protein, and hence estimates of genetic distance based on electrophoretic methods tend to be underestimates.