

In this issue

Image within image . . .

Common mathematical descriptions often describe diverse natural phenomena. Two such mathematical ideas that are being applied widely are fractals and chaos. Fractals are a geometric description of irregular forms—from geographical features such as coastlines to the tree-like patterns of diffusion-limited aggregation. This description looks at irregular or disordered objects and phenomena in terms of noninteger dimensions. Associated with the concept of fractals is the property of self-similarity or scale invariance, which means that, over a range of magnifications, any part of a fractal object looks the same as the whole. Fractal descriptions are being increasingly used in physics, chemistry, biology and geology. Chaos, or chaotic dynamics, describes dynamical systems that are so sensitive to initial conditions that, even while being purely deterministic, they are complex and inherently unpredictable. Interesting links between fractals and chaos have been discovered, such as the fact that the strange attractor of chaotic systems is usually a fractal. Indeed, while fractals describe objects that are irregular spatially, chaos describes processes that are disordered on the temporal scale. Chemical reactions far from equilibrium can show chaotic behaviour, and so do features of atomic and molecular collisions (Page 442). Sathyamurthy describes various kinds of collisions and scattering processes in which chaotic regions of theoretical plots that describe the dynamics show the fractal property of self-similarity. Thus the existence of fractals can be used to identify and characterize chaotic routes in molecular interactions.

Going nuclear

The sorting of cellular proteins to their correct locations in the cell involves signals that target the proteins. The targeting signals for

proteins of several organelles are now known. Techniques of cell and molecular biology have been used in conjunction with recombinant-DNA methods to show, for instance, that specific short sequences of amino acids in organellar proteins are crucial for targeting and hence that these sequences are the signals. Nuclear proteins, like all proteins other than a few mitochondrial and chloroplast proteins, are synthesized in the cytoplasm, and must find their way to the nucleus through the nuclear envelope. Veena Parnaik (page 454) describes the structure of the nuclear envelope, the nuclear location signal (NLS) of nuclear proteins, the mechanism of translocation, regulation of the process, and the role of nuclear transport in embryonic development. While the NLS of nuclear proteins is also a specific amino-acid sequence, in some proteins, like the influenza virus polymerase, two amino-acid stretches serve as the signal. Translocation through the pore complex of the nuclear envelope has been shown, for instance, in electron micrographs of colloidal gold particles coated with nucleoplasmin, a nuclear protein. Regulation of nuclear transport of transcriptional factors clearly has consequences for transcriptional activity and cell division, and hence for tumorigenesis and development. Inactive cytoplasmic complexes of transcription factors, regulated nuclear entry of the *fos* cellular protooncogene product, and a dorsoventral gradient of nuclear localization of the *Drosophila dorsal* gene product, which is involved in establishing the dorsoventral axis in the embryo, are examples of control of nuclear entry of proteins involved in gene expression.

A host of parasite tricks

The cell surface molecules of unicellular parasites, such as the protozoan *Leishmania*, are important in host-parasite interactions. Establishment of infection depends on many

factors, some parasite activities and others an interplay of parasite and host factors collectively causing parasite-induced host immunosuppression. Ishaya Haruna Nock and Jayashri Devi Sharma (page 460) describe three main aspects of *Leishmania* infection. In the first, surface lipophosphoglycan provides a barrier against the membrane attack complex of the host's serum complement system; parasite factors, including a surface glycoprotein gp63, may favour contact with the host macrophages, within which the parasites multiply; and specific ligands on parasite antigens bind receptors on the macrophage surface. Within the macrophage, the parasite actively suppresses various defence mechanisms. Thirdly, recruitment of T lymphocytes is inhibited via suppression of expression of major histocompatibility complex (MHC) glycoproteins, with which parasite antigens must be complexed and presented on the macrophage surface to induce T-lymphocyte activity. In an indirect effect, parasite-induced increase in production of prostaglandin E also causes T-cell unresponsiveness.

Methyl riddle

Methylation of DNA, usually as 5-methylcytosine, is important for a number of reasons. For one thing, transcriptionally active regions of chromatin are generally undermethylated while inactive regions are hypermethylated. DNA methylation may cause changes in DNA structure and alter DNA-protein interactions. Genome integrity, and repair of lesions, have also been found to be related to methylation status of DNA. Interestingly, decrease in DNA methylation has been seen over the life-span in organisms such as the mouse, and in certain short-lived primary cell cultures. Changes in DNA methylation have therefore been linked with the normal process of ageing, although no definite and universal

use-effect relationship has been established. Deepti Deobagkar and Anhan Modak report experiments (page 483) that show that 5-methyl-tosine level in mouse liver DNA increases stepwise, rather than steadily, over the life-span.

Vegetation dynamics

Deforestation and conversion of, for instance, tropical forest to grassland, has implications for the global

carbon budget. Increase in human and livestock populations, global warming due to increasing carbon dioxide in the atmosphere, and changes in vegetation pattern are interconnected in a complex web. Clearly, knowledge of carbon storage and carbon flux characteristics of ecosystems is essential for modelling the global system. Carbon stored in forest biomass is more than that in an equal area of grassland. But J. S. Singh *et al.* report (page 477) that their study of

three dry tropical forest and grassland sites shows that carbon input through net primary production was similar in both ecosystems. The grassland ecosystem may be maintaining the same productivity as forest through fast-growing species of shorter life-span at the cost of carbon storage in the biomass. The authors therefore conclude that conversion of dry tropical forest into grassland increases carbon flux relative to storage.

INTERNATIONAL SOCIETY FOR THEORETICAL CHEMICAL PHYSICS

An International Society for Theoretical Chemical Physics was established in 1990. The main purpose of the society is to promote, through international, national and regional meetings, as well as through newsletters, organization of exchange of preprints and reprints and establishing personal contacts, the dissemination of information about research in the field of theoretical chemical physics in the broadest sense (any kind of basic theory that can be applied to chemical problems). Some typical fields are: theory of electronic structure of molecules and their interactions, theoretical spectroscopy, chemical dynamics (quantum theory of chemical reactions), theory of large number of coupled chemical reactions (specially biochemical reactions), statistical-mechanical treatment of chemical problems, mathematical and physical methods for chemical problems, theory of molecular biology (theory of biopolymers, theory of carcinogenesis, regulation theory applied to biological systems), etc.

The society has 38 founding members. Prof. J. Ladik (Erlangen) has been elected president for three years. Dr R. LeFebvre (Paris) and Dr W. H. Miller (Berkeley) are vice-presidents. The remaining founding members constitute the first board of directors. Prof. Girjesh Govil (TIFR, Bombay) is one of the directors.

The society invites researchers in the field to join as life members. The life membership fee is Rs 300. Applications with brief coordinates (addresses, telephone, telex, fax numbers) and a cheque for Rs 300 drawn in favour of International Society for Theoretical Chemical Physics (add Rs 10 for outstation cheques) should be sent to: **Prof. Anil Saran, National Representative, International Society for Theoretical Chemical Physics in India, Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay 400 005.**

Drosophila meeting

Drosophila Stock Centre, of the Department of Zoology, University of Mysore, will organize a two-day meeting (**6 and 7 March 1992**) of **Drosophila** researchers in India (organizers: H. A. Ranganath, S. N. Hegde, V. Vasudev and S. R. Ramesh). This is the maiden attempt to get all **Drosophila** researchers in India together. To participate, interested persons should submit an abstract of about 200 words on or before **16 January 1992**. All participants should pay a registration fee of Rs 200, which also covers food and accommodation charges. The payment should be made by demand draft in favour of Treasurer, Drosophila meeting, Department of Zoology, Manasagangotri, Mysore. For further information contact Dr H. A. Ranganath, Drosophila Stock Centre, Department of Zoology, University of Mysore, Mysore 570 006.