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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

iuse-effect relationship has been tablished. Deepti Deobagkar and ohan Modak report experiments age 483) that show that 5-methyl-tosine level in mouse liver DNA creases stepwise, rather than steadi-, over the life-span.

egetation dynamics

eforestation and coversion of, for stance, tropical forest to grass-nd, 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 gras land sites shows that carbon inp through net primary productio was similar in both ecosystems. Th grassland ecosystem may be mai taining the same productivity forest through fast-growing speci of shorter life-span at the cost carbon storage in the biomass. Th authors therefore conclude that co version of dry tropical forest int grassland increases carbon flux rel tive to storage.