In this issue

Weather forecasting

The evolution of meteorology in general and weather forecasting in particular to its present status as an objective scientific discipline has been a fascinating and tortuous journey. The use of complex mathematical models for dynamics of weather and climate, and their numerical integration occupies the central place in today's science of weather and climate prediction. This numerical weather (or climate) prediction, however, requires involvement of a number of seemingly unconnected disciplines. The progress made in the last few decades would not have been possible but for developments in physical and mathematical modelling, numerical methods, high performance computing and visualization, data management and analysis techniques and observing systems. In this issue Hunt (**page 520**) provides a succinct and captivating account of the current status, problems and future directions of the science of weather and climate prediction. The article provides a non-technical and encompassing survey of various methods currently in use for prediction and those which hold promise, such as expert systems, hybrid methods (man–machine mix) and neural networks. The article also provides a lucid account of emerging concepts and various problems that make the science of weather and climate prediction an exciting scientific challenge.

P. Goswami

Lichens of the Nanda Devi Biosphere Reserve

More often seen as grayish–greenish patches on tree-trunks, on stone walls of old buildings, or even on bare rocks, the lichen seem to be one of the least glamorous (and therefore most neglected) group of living organisms. However, they are one of most widespread group of plants, with many unique and fascinating characteristics.

A lichen is in some sense a single (but symbiotic) organism, made up of two distinct partners – who by themselves are capable of leading an independent life; the dominant partner is a fungus and the subordinate, photosynthetic partner is an alga (though sometimes cynobacteria take its place). Lichen can survive (as far as their natural history is concerned, on a global scale) in extremely inhospitable habitats and climates – from high latitudes (close to the poles) to hot, dry deserts. Paradoxically, at a local scale, they are very susceptible to adverse environmental conditions such as pollution, since they readily absorb pollutants dissolved in rainwater and dew. In fact, they are extensively used as bioindicators of pollution – including that caused by radioactive fallouts. Lichens grow very slowly – 10 to 25 millimeters in 100 years is the rate quoted in alpine and arctic regions. They are also very long-lived, surviving for more than a thousand years. In fact, the age of a specimen from Swedish Lapland has been estimated to be around of 9000 years old, making it one of the oldest living organisms.

About 25000 species of lichens have been described from all over the world. However, this is one of the least actively studied groups. An authoritative text-book published in 1967 estimated that it would take about 20 years for lichen to be as well described as fungi – and the 1983 edition of the same book has discreetly changed the phrase '20 years' to 'many years'.

From India, studies on nearly 2000 species of lichen and almost 700 species of macrolichen have been reported, mostly dealing with taxonomic aspects. One of the first investigations focusing on the community ecology of lichens is reported on **page 568** of this issue by Hans Raj Negi and Madhav Gadgil. Covering the altitudinal range from 2100 meters to 4500 meters in the western part of the Nanda Devi Biosphere Reserve, and a diversity of habitats ranging from roadside grass and scrub to pine forests and alpine meadows, the authors have recorded 76 species of macrolichens from 16 transects (each 50 m × 10 m).

Unfortunately, just like the more high profile mammal and bird species, the lowly lichens too appear to be under threat from human interference such as deforestation. More perceptively, the authors have identified a more subtle threat from the overgrowing weeds. These weeds, which rapidly deplete nutrients from the soils, have become more common due to a ban on grazing in the meadows – ironically introduced for protecting the biodiversity in the meadows! The authors also point out how the lichens, due to their essential oils and nitrogen-fixing capabilities, could play an important economic role in that region.

N. V. Joshi

'Mariner' element

Getting a free ride is second nature to humans, but this trait is often combined with good sense. On a Kanpur–Jhansi train journey some years ago, I asked my neighbour why, without reservations or even tickets, he and his fifty odd friends had entered a reserved compartment and made themselves comfortable. He looked with pity at my stupidity and replied that the reserved compartments were the only ones with space for them. Transposable elements are like humans taking a free trip. These elements, bits of DNA present in an organism can often hop around the host's chromosomes, often 'unnoticed' but sometimes causing serious trouble. Are these elements parasites? Where did they come from, how many of them can an organism tolerate? While many biologists delve into these basic questions, others have used transposable elements as tools for introducing foreign DNA into organism. Transposable elements have characteristic sequences at each of their termini which are required for integration and mobility in the host genome. In addition, these elements encode protein products, 'transposase' that are required for effecting their movement in the host's genome. In a major breakthrough in biology, Gerry Rubin and Allan Spradling, in 1982, manipulated transposable elements in the fruit fly *Drosophila* so that it could be used for the insertion of cloned genes into the germ-line of flies. They inserted these cloned genes in between the ends of a transposable element and injected this modified DNA into the cells of the egg that give rise to gonads of the fly. Adults that developed from these injected eggs carried the modified transposable element inserted in their 'germ-cells' and this integrated DNA could be detected in the next generation. Rubin and Allan Spradling's experiments transformed *Drosophila* biology from a study of an obscure fly by obscure humans to an area of immense general relevance. Since their pioneering work, scientists have been able to study the regulation of genes and gene products during animal development by putting genes back into flies. They have shown that the structure and function of many gene products are conserved during evolution. It seems that flies and human may actually be very similar in many aspects of their development, something that was not obvious at all.

While inserting DNA into fruit flies now appears trivial, similar transformation of other insects remains a challenge. Despite several attempts, insects such as mosquitoes and silk-worms remain refractive to transformation. Part of the reason for this has been that these organisms have been studied, genetically, far less than *Drosophila*. Another reason is the rather naive, in hindsight, assumption that transposable elements isolated in *Drosophila* will function in a similar manner in all insects. Initial attempts with *Drosophila* elements failed, for reasons that are only now becoming clear. The analysis by Hugh Robertson and colleagues of the Mariner transposable was a major positive step. The Mariner element is present in a very large variety of insects and appears to have been acquired by these insects relatively recently during evolution. Their recent appearance and spread make them a good general candidate as a vehicle for insect transformation. One of the insects of great commercial importance is the silkworm moth *Bombyx mori*. Initial attempts to assay for the presence of the Mariner element in this moth proved negative. However, recent experiments, reported by Mathavan *et al.* **(page 577)** demonstrate a Mariner-like element in silkworm. This suggests that Mariner can invade this organism and perhaps be used as a vehicle for transformation. There is a long way to go before germline transformation becomes feasible and of general use in silkworm. However, intense work on Mariner and other transposable elements and tests of their ability to integrate into the germline chromosomes may make commercial exploitation of this insect by introducing genes of interest a distinct possibility.

K. VijayRaghavan