

In this issue

Thinking like a Mathematician

Acting like a scientist

In recent decades, access to knowledge has opened up in the form of the Internet. And human memory has become externalized and is becoming less costly by the day. This disrupts an educational system which lays onus on memory and knowledge transmission. Hence planners have started experimenting with introducing research at the undergraduate level. The last 10 years of the IISERs, for example, have demonstrated that the tertiary education system can indeed shift its emphasis from knowledge transmission to knowledge creation.

However, to lay the foundations of such a system, there is a need to tweak the secondary education in the country. Though the education system is more appropriate to producing clerks, as Gandhiji once remarked, though it is also appropriate for creating the manpower needed for the military and the police, it requires modifications for advancing mathematics and the sciences.

A General Article in this issue discusses the foundations of a curriculum and fundamental educational outcomes that require attention, when future mathematicians and scientists are to be educated: the abilities to formulate definitions and axioms, stating and proving theorems, finding patterns in observed phenomena, formulating hypotheses and constructing theories, designing experiments... Besides hands-on activities, we need minds-on activities in inquiry oriented education, say the authors. Turn to **page 447** for more.

Reducing Road Kill

When wildlife is victim

The Valparai plateau in South India is surrounded by protected areas – the Anamalai Tiger Reserve, the Eravikulam National Park, the Chinnar Wildlife Sanctuary, the Vazhachal Reserve Forest and the Parambikulam Tiger Reserve. The 220 sq. km of the plateau has largely tea, quite a few coffee, eucalyptus and cardamom plantations besides a few rain forest fragments. The Tamil Nadu State Highway 78 acts as an artery to a road network that connects scattered human

populations and tourist spots, linking the plateau and the world outside. These roads are often splattered with wildlife corpses.

What are the management measures that can help prevent or reduce the incidence of road kill of vulnerable wildlife species in similar landscapes? Researchers from the Nature Conservation Foundation, Mysuru, started inquiring into traffic deaths that are not considered crimes.

They selected 80 kilometres that are representative of the different kinds of roads in the area. Using multiple transect walks, in summer and in rainy seasons, they carefully removed the bodies of amphibians, mammals, molluscs, insects, birds and other creatures that were beyond recognition. From the 80 kilometres, they thus recorded about 3000 organisms – some endemic and some endangered. The number of road kills was much higher during the rainy seasons – the area gets both the South-West and the North-East monsoons.

Empowered by the data collected, the authors suggest strategies to reduce road kill in the Valparai plateau as well as in similar areas elsewhere. Read the Research Article on **page 619** in this issue.

Dark Streaks on Martian Slopes

Since the last two decades, many high resolution photographs of the Martian surface have been acquired from the Mars Orbiter Camera. It was observed that many regions conspicuously exhibit black streaks on Martian slopes – streaks that look as if a Japanese watercolour artist had painted the Martian surface. These streaks, however, cannot have been made by brushes: they are a few kilometres long and a few hundred meters wide. So how do these dark streaks come about?

Scientists love such puzzles. And hypotheses to explain the streaks have been put forth, using present knowledge of the terrestrial processes, on the one hand, and the available data on Mars on the other. Are they equivalent to landslides on mountain slopes on the earth? Are they darker because of some involvement of liquid(s)?

A Research Article in this issue examines the streaks in the Nicholson crater located on the equatorial region of Mars to resolve the problem. The Nicholson crater is about the size of the National Capital Region. It has a mound in the middle about the size of New Delhi. The streaks are seen both on the crater's edges as well as on the slopes of the mound. From the characteristics of the streaks, their appearance and their disappearance, scientists from the Physical Research Laboratory deduce the mechanisms that might be involved in generating these dark streaks. Turn to **page 596** for details.

Light from the Firefly

Laser-like coherence

The process of bioluminescence involves conversion of luciferin into a luciferyl adenylate using up ATP, the energy currency of the cell, in the process. The luciferyl adenylate is then oxidized to oxyluciferin, a reaction that emits light – mainly red and green, with a narrow band of yellow in the middle. The process is highly energy efficient.

Now researchers from the Gauhati University find that the yellow light emitted by the Indian firefly, *Luciola praeusta*, is coherent, like the light from lasers. This light is more monochromatic than many a solid state laser, and reasonably directional, they say. To come to this conclusion, they resorted to simple but innovative methods: the Michelson interferometer and Young's double-slit found in most physics labs.

The firefly emits light from the photogenic layer. A dorsal reflector layer, filled with tiny uric acid granules of diameters close to the wavelength of the emitted light and this may be acting like a laser cavity, say the researchers.

Since the emitted light acts as communication between fireflies, we can perhaps now start decoding the signals. The Research Communication on **page 637** gives cryptologists clues about where to look.

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