

## In this issue

### Radiation for protection?

Hermann J. Muller was awarded the Nobel Prize in 1946 for the discovery of the relationship between radiation dose and mutagenic effects. He thought that the effect was linear: any amount of radiation exposure, however insignificant, is deleterious to human health. 'There is no escape from the conclusion that there is no threshold,' he said.

After the Chernobyl, K-19 submarine and Fukushima disasters, in public perception, the linear-no-threshold model has taken deeper roots. A Review Article, **page 46**, unravels the genesis of the threshold model and challenges its scientific basis. On the one hand, there is the bystander effect, discovered in the early nineties, where unirradiated cells near the radiated cells also exhibit mutagenic changes, thus amplifying the harmful effect of radiation. On the other hand, later studies have cited no adverse effects of low doses. Recent studies even attest to the stimulation of cell division at lower doses, and also to the significant lengthening of life-spans of mice. Further, low levels of radiation seem to be a protection against further radiation by switching on a cellular response to radiation. In fact, a basal level of radiation appears to be vital for certain organisms, whose growth rates are adversely affected when they are shielded from the natural ambient radiation. The article underlines the presence of a threshold of radiation dosage, above which it is deleterious; and below, beneficial.

Today, we live in a cobweb strung by beams of ionizing radiations. It is, however, naïve to respond with fear when one sees the clover of the hazard trefoil. A clear understanding is antidote to fear.

### Murky waters

Heavy metals have been used by human civilizations for thousands of years – as wine sweeteners by the ancient Romans, as a remedy for syphilis by quacks in the 1500's, and even as pigments by renaissance artists. But in the last century, the same heavy metals, discharged as industrial effluents into water bodies, have led to the deaths of tens of thousands of people. With urbanization and consequent evolution of dumpsites near populated

areas, leaching of heavy metals from dump sites into soil and aquifers pose an insidious threat to the public.

In a Research Communication, **page 78**, researchers develop models to predict elemental flux from dumpsites into the soil and aquifers around Hyderabad, India. As a case study, they assess three dumpsites receiving a total of half a million tonnes of municipal and industrial waste. Water samples from bore wells and soil samples from 10 to 25 cm beneath the top soil are analysed. The elemental composition of water was assessed based on sodium absorption ratio and the residual sodium carbonate concentration. Whereas the elemental composition of the soil was determined using an X-ray fluorescence spectrometer. The study uses the dataset so generated to develop approximate linear and quadratic regression models to predict the concentrations of heavy metals in water and soil.

The study reports high concentrations of  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$  and  $\text{F}^{-}$  in groundwater, making it unsuitable for domestic purposes but usable for irrigation. The study also reports higher than threshold limits of Zn, Ni and Cu in soil. Thus, apart from generating datasets to train modeling software, the research is perhaps relevant for administrators of water resources in the region and underlines the need for innovations in urban waste management.

### Ancient croaks

Deep in the wet undergrowth of Amboli, Western Ghats, an ancient mating song croaks: *kruuk*. These soft mating calls are characteristic of the male *Indirana* frog who lacks vocal sacs needed to croak with a heavy baritone. The female responds to this subtle call and approaches the male, slowly. She nears. He croaks faster. She comes closer still. And he mounts, clutching her under her armpit, and consumates his primitive courtship. She is much larger and their embrace is inefficient – one tenth of the eggs remain unfertilized. The act complete, the fertilized eggs are left unattended on barks and crevices of rocks. The development of the fertilized egg is 100% and rapid, hatching into tadpoles after four days. These tadpoles are well adapted to life on land. A muscular tail, a

unique jumping style, and an algae foraging behaviour, are characteristic of this adaptation.

This mode of reproduction and development indicate an ancient lineage of the *Indirana* genus dating back to the Cretaceous. Therefore, the genus has had ample time to evolve in the niches of the Western Ghats. The Research Communication, **page 109**, hesitates to identify the species since there is a move to reorganize the genus and rename the species.

The study uses an SLR camera. But one can not help wishing that similar studies use video data also, so that reproductive and feeding behaviour of the species under observation is available to the scientific community to study.

### Science scenario of SAARC

A General Article, **page 31**, presents a scientometric analysis of academic research output in the SAARC countries over the last 50 years. A bibliographic database of one million academic records, which pertain to the South Asian countries, was created by sifting through 50 million records. Therefore, only a paltry 2.86% of the research output of the world stems from the South Asian region, home to a substantial 20% of the world population.

The analysis, by researchers from the South Asian University, highlights the disparity in research output between India and the rest of South Asia. The output of India is ten times the total output of all the other countries put together. In a twist of fate, the research output of India, which ranks 10th in the world, is only one tenth of the output of powerhouses such as the USA and China. This makes one wonder whether there are power laws in operation here, as found in some other human endeavours.

The research in the South Asian countries has been on the upswing for the last few decades. But this statistic only veils the undercurrent of poor infrastructure, inefficient earmarking of resources and parochial policies. The article feeds the evidence needed for chalking out policies to steel the future of the academic nexus of the SAARC countries.

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