In this issue

IISERs: 10 Years On

A comparison with IITs and IISc

IITs for Technology. IIMs for Management. But there was nothing for Science ten years ago. However, the concept of IISERs for science is a reality now: there are five fully active IISERs and more in the pipeline. It is time to take a reality check now. How do the IISERs compare with the IITs? Do they have the potential for the same level of international fame? How do they compare with the Indian Institute of Science, which has a longer history?

The IISERs are still too young to be compared with these, much older, institutions. But a yardstick is needed for evidence-based decision making in the era of the expansion of tertiary education in India. Though impact in terms of the educational endeavours in the IISERs will take at least one more decade to be felt, the research done in the IISERs can indeed be measured using scientometrics. And that is what a General Article on **page 307** brings to you.

Considering that the establishment of IISERs was staggered from 2006 to 2008, and that it takes some time for institutions to become fully operational, the analysis takes into account only the last five years of research output.

The results presented in the article are an indication that it is time now to review the IISERs, distill the best practices and to establish more such institutions. It is also perhaps time to study their educational paradigm of integrating research with education, to replicate it in traditional universities.

Time Series for Traffic Snarls

Surveying statistical tools

In the thirty years from 1976 to 2006, vehicular population in India increased from less than 3 million to about 90 million vehicles – an increase of 3000 per cent! Meanwhile, fatality due to accidents grew only a little more than 350 per cent. During that same time, the population in India increased from about 630 million to about 1100 million – less than a hundred per cent increase.

One could not have predicted this phenomenal growth of vehicles because it depended on many factors – economic prosperity, policies, politics… – factors beyond simple scientific analysis. But then, forecasting such unpredictable futures is not impossible. Time series analysis has proved to be useful in short-term forecasting of economic and financial future. And the statistical models available can be used for forecasting traffic too.

Autoregressive integrated moving average (ARIMA) is a model that many statisticians have used to forecast the future based on the time series data of the past. Here, the errors in forecast, due to innovations or random changes in the factors under consideration, are automatically measured in a time series and adjusted (autoregressive) for short intervals (integrated), taking into account the fact that the averages calculated are themselves changing, sometimes, depending on season. The ARIMA model has undergone refinements from its initial conception in 1970. Some versions are better than others, in forecasting traffic and, given enough data, they have proved to be useful for short-term forecasts.

This issue presents a research article that undertakes a time series analysis of the available traffic data, using different ARIMA models for different time windows. Though the focus of the article is checking the reliability of the models in reflecting the reality, the data itself is quite interesting. Turn to **page 373**.

Combating Insect Pests

From chemicals to microbial genes

Bacillus thuringiensis, a soil microorganism, produces certain toxins during sporulation. These toxins are fatal to some pests such as the cotton boll worm. Scientists succeeded in isolating the gene that produces one of the toxins and inserting it into cotton plants. Thus *Bt* cotton was born in 1996. The Indian Government allowed the use of *Bt* cotton seeds in a phased manner from 2002.

Today there are more than a thousand varieties of *Bt* cotton, some containing two or more genes for resistance against pests. And many of these varieties are developed in India itself. More than 90% of the cotton now cultivated in India is genetically modified. This growth and the development of genetic modification techniques have converted India from a net importer of cotton to a net exporter.

A Research Account on **page 311** examines the phenomenon in the context of the history of cotton production from the 70s when the first hybrids were introduced, to the liberalization of the seed market in the late 80s, to the introduction of *Bt* cotton in the beginning of the century.

Historically, even before human beings evolved, genetic modifications of plants were done by retroviruses. The process was random: infection of the plant by retrovirus, assimilation of the genetic material into the plant, packaging of daughter viruses that include nearby plant genes, infection of new plants and transfer of the gene. Today humans are doing it. But with a very specific purpose: improving agricultural production. To err is human. So too, to be innovative.

Polling the Pollinators

Traps and transect walks

All insects are not necessarily pests. In fact most of them are our collaborators in food production. Take for example, the case of apples. Imagine a world without insects. In such a world, there are no apples.

So which are the insects that pollinate apples? And how do their numbers and diversity vary from season to season? What methods do scientists use to find answers to such questions? Turn the pages of this issue to find out. Scientists from Almora toil and transect the apple orchards of Kumaun, seeking to survey insect diversity and factors that influence them in a Research Communication on **page 438**.

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