In this issue

Forskolin in *Coleus*

'Coleus: An aromatic perennial, with tuber-like roots and erect stem, reaching 60 cm (2 ft).' *The Encyclopaedia of Medicinal Plants* (1996). *Coleus forskohlii* is prescribed under the Indian Ayurvedic materia medica. Its roots are often used for pickles, and large plantations are common in Gujarat. Forskolin, a diterpenoid, is the major active principle and was first isolated in the 1970s. Forskolin is indicated in dermatitis, asthma, cardiovascular disorders and a few other ailments. ForsLean, a commercial preparation from herbal roots, is used for maintaining lean body mass and fat loss.

Pushpa Narayanan *et al.* (**page 945**) describe an *in situ* staining protocol that identifies the presence of forskolin in different tissues of the *Coleus* roots. Hand cut transverse sections of fresh root samples were stained with 10% vanillin in acetic acid to which a few drops of 70% perchloric acid was added. In another sample, the transverse section is first washed with 75% chloralhydrate solution, and then stained with the vanillin reagent. The former showed presence of yellowish red masses under the microscope, whereas the latter lacked such patches, indicating a specific staining of forskolin particles that were apparently washed away in the second preparation. The intensity or extent of staining is related to the quantity of forskolin. This simple staining procedure is of diagnostic importance for the plant.

S.G.

Expressed sequence tags of cereal genomes

Cereals are the staple diet for almost all of us. The cereal genomes, all related to the grass families, can be a good lesson in tracing their evolutionary history. From the biotechnological and bioinformatics point of view, they provide significant genomic and proteomics information to improve upon the crops, often with the help of transgenic technology.

Sreenivasulu *et al.* (**page 965**) review the emerging areas of data mining as related to cereal genomics. The article briefly describes the several features of generating and utilizing expressed sequence tags (ESTs) and the various bioinformatics tools available to a researcher. A collection of authentic bibliography and a large number of software and websites relevant for research in this field are discussed. The diagrammatic representations of EST-array technique explain the step-by-step procedure in layman's terms. The review attempts mining of data from seven cereal genomes and EST databases that are available in the public domain and demonstrates the use of the technique. Such an approach towards plant biology is welcome and timely, keeping in mind the genomic approaches to therapeutic and prophylaxis of malaria, by mining information from the parasite, mosquito and human genomes.

S.G.

Microbes in Antarctica

Ever since Amundsen established the first base at the South Pole in 1912, the Antarctica attracts the adventurous in large numbers. The British have been involved in the research and exploration of the Antarctica for about 200 years. Indians have also begun to explore a landmass, that was once contiguous with India as a part of Gondwanaland. The first modest research station was opened in 1983, called the Dakshin Gangotri, which is bolstered by the second permanent base in 1989, named Maitri, near the Shirmacher Oasis in Antarctica. The Indian presence is felt primarily in the study of meteorology, and geomagnetism in addition to biology and the greenhouse effects (http://dod.nic.in/vsdod/bio1.htm). Antarctica, the fifth largest continent with an area of 14 million square kms, is a land of many unique features. Technically a desert, it is the 'coldest, windiest, highest and driest continent' making it virtually uninhabitable.

The ice sheet covering the Antarctic waters could be 4 km thick and the continent contains an estimated 70% of the world's freshwater and 90% of the world's ice. The study of Antarctica helps us gauge its effect on world climate and the ocean currents (http://www.antarctica.ac.uk). With no known indigenous human population, the research teams from about 27 countries focus entirely on research, their numbers varying with the seasons.

Though cold and icy, the Antarctica is unusually rich with flora and fauna that have learnt to adapt to freezing and desiccation. Alam and Singh (**page 1000**) analyse bacterial populations obtained from the samples collected during the fourteenth Indian expedition to the Antarctica. Antarctica free water is available only in oases during the summer, which experience seasonal variation during late fall and spring. A natural source of a concentrated population of bacteria is the cyanobacterial mats of freshwater lakes. Samples of the blue green algal mat from freshwater lakes of Schirmacher oasis of Antarctica have been collected in sterilized polypropylene bags during the fourteenth Indian scientific expedition. The enrichment of halotolerants and thermotolerant bacteria has been carried out by varying culture conditions.

Alam and Singh report twenty seven unique bacteria in all, that belong to different physiological and morphological groups, a third of which are pigmented. Nine proteolytic isolates are seen to grow under extreme conditions. Based on the diagnostic tests, the isolated strains are tentatively assigned to the genera *Planococcus*, *Pseudomonas* and *Bacillus*.

S.G.

Satpura, Godavari and gravity modelling

Mishra *et al.* (**page 1025**) model the gravity profile across the Satpura Fold Belt (SFB) and the Central Indian Shear suggesting that gravity 'highs' and gravity 'lows' are caused by high density up thrusted crustal rocks and low density rocks respectively. Several features of the highs and lows are reminiscent of early-middle Proterozoic period. It is suggested that the SFB is a typical Proterozoic collision zone between the Bundelkhand and the Bhandara cratons.

S. Ganguli

Nuclear tests, seismic magnitudes and estimation of nuclear yields

Estimation of yield of an underground nuclear explosion is based on measured magnitudes of seismic signals originating from the explosion, taking into account the geology of the site and applying corrections for instrumental and geophysical aspects. Yields are also estimated by radiochemical assay of the nuclear debris of the explosion and by hydrodynamic method. These two latter methods need access to the site of the test; even weapon design information may be required in the case of radiochemical method. The radiochemical method is considered more reliable than the others.

The seismic magnitudes of the *P*-wave (body-wave) and the Rayleigh wave (surface wave) denoted by m_b and m_s respectively are arrived at by taking into account instrumental magnification and distance-dependent correction. Mostly m_bs are used for yield estimates as Rayleigh waves are not that intense at tele-seismic distances. The distance-dependent corrections are region dependent too.

The yield is related to seismic magnitude by an empirical equation of the general form, $m = A + B \log Y +$ bias correction. A and B depend on which magnitude (m_b or m_s) is used. 'The bias correction is to correct for the differences in how effectively seismic waves travel from the various test sites. The correction is particularly important for m_b because short period body waves are strongly affected by the physical state of the medium, especially its temperature, through which they travel.'

Uncertainties in yield estimates arise due to several reasons: The very fact that the earth is inhomogeneous and asymmetric leads to scatter in the magnitude–yield plots. Geological features near seismic stations may focus or amplify seismic waves. There could be variations in the coupling between the explosion and the surrounding rock medium. The depth at which the explosion is initiated and the physical properties of the surrounding medium would also affect the magnitude of the seismic waves. Of course, if data were available on calibration shots and the like, corrections could be made that would greatly reduce the uncertainty.

Like any quantity derived from measurements, estimated yields of nuclear explosions have errors associated with random and systematic errors. Attenuation of *P* waves varies from region to region of the earth. If not corrected for, this will cause sizeable systematic errors in estimate of yields. The yield estimates of Soviet tests are said to have resulted in much larger values than true values because of lack of proper corrections due to 'bias-correction'. The bias being a systematic error, one can account for this and correct. In this context one may quote an interesting observation: 'If everything about the Earth and seismic waves were known, almost all errors in seismology would be systematic. In general, random errors turn out to be systematic errors once the reason for the error is understood. However, if the systematic errors are not understood, or if there are lots of systematic errors all operating in different ways, then the systematic errors are often approximated as random errors. In such cases, random uncertainties are inflated to encompass the unexplained systematic uncertainties'.

The yield estimates of the Pokhran II nuclear explosions (POK2) have provided enough fodder for several publications. In this issue there are two papers: The paper by A. Douglas *et al.* (**page 989**) points out that two assumptions made in earlier publications by Indian scientists 'appear unjustified'. 'These (assumptions) are that: (i) interference between *P* waves from the two largest explosions in the test reduces the observed body-wave magnitude; and (ii) the NEIC estimate of surface-wave magnitude is reliable' and then proceed to provide a discussion, concluding that 'the yield of the 11 May test is significantly less than 60 kT'.

In the second paper by S. K. Sikka *et al.* (**page 992**), the authors have pointed out how 'some seismologists have... underestimated the yield of POK2'. They state that 'it will be necessary to take (body-wave magnitude) bias into account before estimating the yield of POK2 using a yield–magnitude relation that is applicable to the SRTS (Shagan river test site) alone'.

The debate on yields of POK2 continues. Whereas there are good reasons for protagonists and participants of POK2 to claim correctness of their yield estimates, there are equally compelling reasons for others 'to prove that the seismic monitoring system (under CTBT) projected as the scientific safeguard that guarantees against secret violation of the treaty, is as good as it is claimed to be'.

Designing of nuclear weapons, be they of the simple implosion type or more sophisticated hollow-core-implosion type or whatever other type, involves contributions from several experiments, computational modeling and technology. Shock wave propagation and behaviour of equation of state of the fissile material decide the nature of the initial fast compression at low temperature, followed by rapid rise of temperature and then the explosion itself. It is all over within fractions of a second or so. Theoretical calculation based on computer simulation of this complex chain of processes is rather demanding as it involves crucial input of reliable data of materials as a function of pressure and temperature. Hydrodynamics and neutronics are also involved. How many of these are based on experiments and how many are based on theories is a matter of sophistication involved. Uncertainties are bound to arise at different levels of sophistication of theoretical estimates. This has to be weighed against estimates post-facto based on seismological methods or other methods mentioned in the beginning.

By the very nature of strategic importance of nuclear weaponry, it is obvious that certain data are classified information. It appears that until and unless the 'sensitive' data are declassified and available in open literature, arguments and counter arguments on nuclear yields will continue to be open-ended.