In this issue

Inferring from Interferometry

Waves of joy in astronomy research

The General Theory of Relativity revealed the possibility of the existence of gravitational waves. But how do we detect them?

About 45 years ago, it was proposed that a Michelson interferometer could be used as a detector of gravitational waves. The Michelson interferometer can measure the path difference of light between two perpendicular arms. But to build Michelson interferometers so that the effective arm length is a sizeable fraction of the wavelength of gravitational waves? That took time and effort.

In August last year, the advanced Laser Interferometer Observatories at Washington and at Louisiana were ready. With an arm length of 4 km each, light reflecting back and forth 300 times on two special mirrors, the observatories can measure a displacement a billion times smaller than an atom. They are capable of detecting gravitational waves with frequencies between 30 Hz and 1000 Hz – the orbital frequencies of binary neutron stars and black holes near the end stage. When two neutron stars merge, the aLIGO detectors should be able to record a *chirp* of gravitational waves.

Astronomers waited with bated breath. And on 14 September 2015, they recorded a roar: two mighty black holes collapsing into each other – black holes of about 30 solar masses, at an estimated distance of about 410 Mpc from the earth!

Both the aLIGO interferometers, separated by more than 3000 kilometers, recorded signals 100 times their base sensitivity. So it could not be random noise. Scientists shouted with joy at the unexpected findings.

Indian scientists are setting up one of their own aLIGO to network with the detectors in Europe and elsewhere. To make earth a giant eye in space looking for gravitational waves. Scientists, who were hitherto constrained to an electromagnetic spectrum to look at the universe, can now see much more. Because they stand on giant shoulders.

Read more on **page 1146** in this issue.

Isotopes in Ecology Research

Biogeochemistry of live interactions

We are carbon based beings with a great need for nitrogen, calcium, and many other atoms that exist in more than one form, with different atomic weights. The existence of isotopes allowed the discipline of biogeochemistry to emerge – a discipline that examines the flux of these elements from the earth through water, air and living systems and back to the soil, air and water.

The existence of isotopic forms of elements allows ecologists to draw conclusions about interactions between species and populations and their interactions with their habitats. A Review Article on **page 1288** in this issue will convince you about the value of isotopes in ecological research.

Ecosystems ecologists and ecophysiologists, including global change scientist may find the review very informative about the research tools that are applicable in their fields.

Computational Biology in Patents

Are we losing due to legalities?

Biological research is being transformed by the new computer software tools. Sequence comparison of nucleotides or amino acids, functional genomics or proteomics, hybridization and gene expression, data mining, biostatistics, machine learning, molecular structure, modeling and simulations in system biology, data visualization… the research tools that biologists use have expanded in recent years. The market trend suggests computational biology market continues to grow but shortage of expertise in this information technology (IT)-driven discipline remains an issue. Therefore, one should consider including programming tools and database systems in biology education at different levels.

In addition, the global business of computational biology is growing rapidly and has been providing numerous entrepreneurial opportunities. The demand for more sophisticated computational solutions is expanding opportunities for 'informatics' startups to gain knowledge from massive data generated by modern biology. The commercialization of computational biology has spawned support industries that provide customized support tools, a function that was previously confined to IT professionals.

A Research Article on **page 1307** in this issue maps the inventions in computational biology using patents as raw data. The article examines more than 7000 patents issued from 1985 to 2011. By analysing and classifying them it brings out some of the neglected facets of research – political, economic, legal, administrative and historical aspects of computational biology.

Alien Invasions

in Andhra and Telangana

We, the humans, get engrossed to plants, especially if they look beautiful. If they are useful, it is an added benefit. And we carry cuttings and seeds home, sometimes across the world, not considering the ecological impact of the species introduced to new surroundings.

A Research Communication (**page 1337**) examines plant invasions in Telangana and 'residual' Andhra Pradesh comparing the historical documents from British India on flora in the region and the present extant species. Out of more than 70 alien species introduced in the recent past, some have become invasive and wide spread. These include *Parthenium hysterophorus*, *Chromolaena odorata*, *Ageratina adenophora*, *Mikania micrantha*, *Acmella* spp. and *Calyptocarpus vialis*, *Conyza bonariensis*, *Erigeron canadensis* and *Synedrella nodiflora*. Of these, *Parthenium hysterophorus* (rag weed, congress/carrot grass; locally called *gajar ghas*, *chatak chandani*, *vayyari bhama*) is known to cause dermatitis, allergy, bronchitis, asthama, etc. and has been the health concern to the people of metropolis like Bengaluru. A single plant can produce 620 m pollen grains and cause allergy to humans and livestock. With its stay, the rag weed has put up a minimum residence time of 202 years in India. By its prolific seed setting habit (154,000 seeds per sq. m), ability to spread and residence time in India, it has become a competitive, persistent and pernicious (noxious) environmental weed from Kolkata to Mumbai and from Kashmir to Kanyakumari. These aliens outcompete the indigenous species leading to loss of native biodiversity aside taking away the habitats and vital food sources of native insects, birds and other fauna.

From lawns in gardens and urban environments to wetlands, highlands, valleys, river beds and coastal areas – the invasive species specialize in the specific environments they colonize. And thus, the administrative action that may need to be taken to control the detrimental invasive species for their economic, environmental and social impacts can be focused.

Udham P K.