

IIIM celebrates the CSIR Foundation Day

The 66th Foundation Day of the Council for Scientific and Industrial Research (CSIR) was celebrated at the Indian Institute of Integrative Medicine (IIIM), Jammu on 26 September 2008.

On this occasion, students from different schools in the city were taken on a guided visit to the laboratory. They were informed about the various scientific and technological activities being carried out at the IIIM. Students along with their science teachers visited the laboratory and also interacted with the scientists. This activity was meant to develop a scientific temper and also a taste for a career in science among the students.

Later, a function – simple but impressive – was organized in the IIIM auditorium to celebrate the CSIR Foundation Day. The function began with an invocation by students of the IIIM school.

S. C. Taneja in his welcome address, introduced the chief guest R. C. Sobti who delivered the Foundation Day Lecture on ‘Science education – Universalization with quality in the Indian context’, also highlighted the achievements of the institute. Taneja mentioned that IIIM has consistently developed into a centre of excellence in natural product chemistry and herbal drugs. He also mentioned that the institute is running 25 consultancy projects, various network projects and has collaborated with several big companies to develop new and better products for the global food industry.

Sobti, in his Foundation Day lecture, described the various contemporary issues concerning science education in the country. He was concerned about the lack of skilled manpower and infrastructure to achieve the goals of science edu-

cation. While expressing his distress over the problem of duplicacy in the country, Sobti stressed on improved and better communication and integration of institutions at various levels so that there is synergy, symbiosis and symphony. He also suggested that we should concentrate on our own contemporary needs oblivious of the Western trends.

Sobti also presented the best research paper awards (first, second and third) for the year 2007–08 to Pankaj Gupta, Ashwani Kumar and Monika Verma respectively. He also gave away prizes to winners of essay and quiz competitions.

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MEETING REPORT

Wheat genetics in the post-genomics era*

Wheat is grown worldwide on more land area than any other crop, and ranks third after rice and corn in the world's total grain production. It supplies about 20% of the food calories for the world's growing population, and is also a staple food in many countries. The present favourable status of world wheat productivity (yield per unit area) and production is the outcome of significant progress made through the use of high-yielding dwarf varieties during the last 50 years, particularly in the developing world. However, some kind of stagnation/decline in wheat production has been witnessed during the last few years, although production of 622.2 million tonnes (mt) this year (2007–08) has been satisfactory, and the forecast for 2008–09 is 645 mt, according to International Grains Council. In India also, although wheat production in 2007–08 reached 76.8 mt (almost same as

76.37 mt in 1969–70), and is projected to be 78.4 mt for 2008–09, in the recent past the production had declined for several years (ranging between 69 and 73 mt per year during 2001–06), which had become a cause of concern.

The improvement in wheat productivity and production world over witnessed during the past five decades has been mainly attributed to genetic improvement of this crop, although improved agronomic practices also played a pivotal role. In order to take stock of the understanding of genetics, molecular biology and breeding efforts to increase the productivity and grain quality of wheat, the International Wheat Genetics Symposia (IWGS) are regularly being organized every five years, starting in 1958, when the first IWGS was organized at the University of Manitoba, Winnipeg, Canada. The latest of these symposia, the 11th IWGS was organized in Brisbane, Australia, which was attended by ~400 scientists belonging to as many as 40 countries. These included 30 scientists from India,

including 19 working in India and the rest currently working abroad.

The symposium began on the morning of 24 August 2008 with an Open Business Meeting of the International Wheat Genome Sequencing Consortium, that was followed in the afternoon by a Business Meeting of the ‘International Triticeae Mapping Initiative’, and the ‘Ug99 Rust Workshop’ (Ug99 is a devastating strain of black stem rust that was detected in Uganda a few years ago, and is causing severe damage to wheat production world over, although it has not been noticed in India so far).

The regular sessions started on 25 August, with a brief half-an-hour inaugural session, followed by 16 sessions of oral and poster presentations, and a closing session, all spread over five days (25–29 August 2008). In addition, four workshops were also organized in the evenings: Generation Challenge Workshop on ‘Application of Genomics in Wheat Breeding’; Wheat Genetics Resources Workshop; CIMMYT Users Group Work-

*A report on the 11th IWGS organized in Brisbane, Australia during 24–29 August 2008.

shop, and Wheat Genome Databases Workshop. The 16 sessions involved 59 oral and 302 poster presentations covering a wide range of subjects, including the following: (i) Exploring and exploiting genetic resources; (ii) Chromosome biotechnology; (iii) Genome biotechnology; (iv) Coping with wheat in a changing environment (biotic and abiotic stresses; quality, varying development); (v) Breeding in a changing world and (vi) Integration from molecule to function.

As expected in the current post-genomics era, the major emphasis throughout the symposium was on biotechnology/genomics and its implication on the study of genetics for wheat improvement. Sessions 1 and 2, held on 25 August included several oral and poster presentations on the exploration and utilization of genetic resources for wheat improvement. The first of these oral presentations by Cary Fowler (Global Crop Diversity Trust) laid emphasis on the need of maintenance and utilization of genetic resources for wheat improvement. It was further argued that for more efficient utilization of the resources, greater emphasis be placed on the conservation of unique collections having higher regeneration capacity, because many gene banks are currently maintaining a large number of duplicate collections. In several other oral presentations on the same day, emphasis was laid on the study of genetic diversity in the available germplasm using either the metabolic profiles (involving chemical information, soluble metabolite fingerprint and metabolite-QTL analysis), or a variety of DNA-based molecular markers, the most important of these markers being DAR_T and the little known ISBP (Insertion Site Based Polymorphism) markers. Application of 'Focused Identification of Germplasm Strategy' (FIGS) was also stressed for developing core collections for use in allele mining for desired genes/traits and for developing synthetic wheats with a goal to utilize them for wheat improvement. Success of FIGS strategy in allele mining was demonstrated by the discovery of novel alleles of the *Pm3* gene for powdery mildew resistance.

Sessions 3 and 4, held in the afternoon of 25 August were devoted to 'chromosome biotechnology'. A wide range of subjects were dealt with in these sessions and included the following: centromere function, introgression of alien segments into wheat chromosomes, unequal distri-

bution of recombination on chromosome 3B (the largest chromosome in the wheat genome), meiotic pairing, physical mapping of rye chromosome arm 1RS and chromosome sorting. Recombination gradient from centromere towards telomere with 90% recombination in distal 40% region with a strong decline in the telomeric end of the short arm of 3B was demonstrated. The molecular analysis of wheat homoeologous pairing suppressor gene, *Ph1*, was shown to have similarity with mammalian cell division cycle gene *Cdk-2* involved in chromatin remodeling. The role of flow cytometry in successful sorting of individual chromosomes/arms for preparation of BAC libraries, and development and use of chromosome arm-specific markers for genetic mapping were also demonstrated.

Sessions 5 and 6 were titled 'genome dynamics', which dealt with a variety of topics, including the following: structure and function of wheat genome using examples of 3B chromosome, ABCDE MADS-box genes, *Brachypodium* genome, radiation hybrid mapping, etc. Catherine Feuillet (INRA-UBP-GDEC, France) described the work done on 3B towards sequencing of wheat genome. The other sessions (sessions 7–16) similarly covered a variety of subjects. A major highlight of the symposium was an update and future programme for wheat genome sequencing that is underway. In this connection, the progress on completion of construction of the physical map of 3B chromosome was presented by Feuillet as a proof of concept for physical mapping of all the 21 chromosomes, which is a pre-requisite for whole genome sequencing¹. Also, there was emphasis on the inability to estimate the correct number of protein-coding genes present in the wheat genome on the basis of currently available data (the estimate ranges from ~100,000 to 300,000). There were also a number of oral presentations on genetics of resistance against biotic and abiotic stresses, which included the work on cloning of a number of genes/QTLs for resistance against several fungal diseases including leaf rust, powdery mildew and *Fusarium* head blight (*Lr1*, *Lr10*, *Lr21*, *Lr34*, *Pm3*, *FHB-3BS* QTL). Cloning of a temperature-dependent major yellow rust resistance gene (*Yr36*), discovered in an isogenic line containing a high grain protein-content gene (*GPC-B1*), was reported by Jorge Dubcovsky (University of California, USA). There

were also several presentations dealing with the genetics of resistance against abiotic stresses like drought, temperature (both high and low) and tolerance to low nitrogen input stress. An important presentation by R. A. Richards (CSIRO, Australia), involved a discussion on using more than one trait (e.g. crop water use, water use efficiency and harvest index) for improving wheat productivity in dry environments. The exploitation of *Rht5*, *Rht8*, *Rht12* and *Rht13* dwarfing genes showing association with early seedling vigour in breeding genotypes for dry environments was discussed. It was suggested that the available markers for seedling establishment and vigour, root health, stem carbohydrates (contribute to 50% of grain yield) and tillering may be exploited in breeding for drought tolerance, an important trait from the Indian perspective too, where wheat is cultivated over a large rainfed area and a rapid drop in underground water table is currently witnessed. The role of stay green habit and ABA signalling in providing abiotic stress was also discussed.

A forenoon was also devoted for discussing the genetics of wheat quality traits, including composition of storage proteins, and other end-use quality traits. Cloning of polyphenol oxidase (*Ppo*) and phytoene synthase (*Psy*), the two important genes controlling noodle quality, and development of their functional markers and their validation was reported. Several presentations also covered proteome analysis in wheat. Proteomics analysis of endosperm response to heat stress, and the effect of heat shock proteins on accumulation of grain components, dough properties and quality characteristics were presented. Keith Edwards made an excellent presentation on a newly designed 244,000-feature Agilent array containing homoeologous and paralogous-specific oligonucleotides representing >10,000 sequence clusters. This array should prove useful for the study of transcriptome of wheat and its diploid progenitors.

On the closing day (29 August 2008), several presentations covered wheat breeding, both conventional and marker-assisted (including population breeding). P. S. Baenziger (University of Nebraska, USA) presented an overview of wheat breeding in the 21st century. Challenges of integrating the marker technology in wheat breeding and effectiveness of marker-assisted selection for breeding

for resistance to *Fusarium* head blight were discussed by George Fedak (Canada). A study on the breeding for biofuel production was also presented. There was an excellent presentation by Mike Bevan (John Innes Centre, UK) on the progress made on *Brachypodium* genome sequencing, which has been completed at 8X level, and can be used for comparative genomics as a guide to the wheat genome, although the possible difficulty

in using this approach was evident from an earlier presentation of Katherine Devos, who showed much more rearrangements in wheat relative to *Brachypodium* and rice. The symposium ended with a presentation on 'Priorities for the future of wheat' by the Patron of the symposium, Bob McIntosh (University of Sydney).

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MEETING REPORT

Mid-year meeting of Indian Academy of Sciences*

The 19th mid-year meeting of the Indian Academy of Sciences held at Bangalore, revolved around present-day challenges faced by the scientific community, covering diverse topics ranging from nuclear power benefits and neutron stars to molecular tools for studying emerging diseases. The gamut of topics spanned biological, chemical, mathematical as well as earth sciences.

The opening talk on 'Joy of exploring the rich repertoire of carbohydrate motifs and their shapely lectin receptors' was presented by A. Surolia (National Institute of Immunology (NII), New Delhi). He described the significance of functionally important proteins, including lectins, amylase and protease inhibitors from the widely studied legume. Lectins known for their red blood cell agglutination property are attracting much attention due to their involvement in cellular recognition. The diversity of the specificities of legume lectins emanating from their ability for bonding hydrogen with a distinct pair of monosaccharide hydroxyl groups formed a framework for carbohydrate specificities such as peanut agglutinin's specificity for tumour associated T-antigen, an important marker for prognosis and diagnosis of cancer in humans.

S. Mittal (IIT, Kanpur) in his talk entitled 'Flow in the air intake of a high speed aircraft' discussed concepts of fluid

mechanics, shock waves and types of air intakes, and laid emphasis on mixed compression air intake as well as a transient phenomenon known as buzz.

Transient solar events such as coronal mass ejections and 'ionospheric irregularities known as plasma bubbles and their possible effect on the satellite-based communication systems were explained in a talk on 'The variable sun and an irregular ionosphere' by Archana Bhattacharya (Indian Institute of Geomagnetism, Navi Mumbai).

Keeping in tune with the current global energy problems, K. P. Vijayamohan (National Chemical Laboratory, Pune) presented a viable solution of nanomaterials in his talk entitled 'Impact of hybrid nanomaterials on energy research'. The unique importance of nanotechnology in creating fuel cells, synthetic trees, and solar energy storage as well as hybrid vehicles was illustrated. He propagated the need for utilization of nano-structured hybrid materials for energy generation and storage ultracapacitors.

'Chemical control using electrons' was discussed by E. Krishnakumar (Tata Institute of Fundamental Research, Mumbai). He stated that 'electrons play a major role in fields ranging from atmospheric chemistry to radiation waste management and pollution control'. Yashwant Gupta (National Centre for Radio Astrophysics, Pune) described how magnetic fields are responsible for the generation of beams of radio radiation that enables one to detect these stars as radio pulsars, in his

talk on 'Magnetism of neutron stars'. He shed light on the nature and arrangement of the radio emitting regions in pulsar magnetospheres.

Considering the critical role of Indian monsoon in agrarian economies, Anil K. Gupta (IIT Kharagpur) spoke about the 'Spatial and temporal changes in the Indian monsoon system during the past 450,000 years'. He explained the driving forces of the monsoon caused by the differential sensible heating of the Himalayas–Tibetan plateau, and the Indian Ocean, further elucidating the impacts of Indian monsoon and its variability over 450,000 years using SW monsoon proxies from the equatorial Indian Ocean and eastern Arabian Sea.

P. Senthil Kumar (National Geophysical Research Institute, Hyderabad) spoke on the 'Meteorite impact cratering processes' and described geomorphologic features of meteor crater leading to gully formations, on the basis of his studies on Lonar Crater, central India and Meteor Crater, western USA. His declaration on the 'recently formed gullies on Mars to be indicative of liquid flow' showed adherence to the oft-quoted reports on the presence of water on Mars.

Talking about the 'Paradox of vitamin D deficiency faced in sunny India and its significance', R. Goswami (All India Institute of Medical Sciences, New Delhi) explained the role of vitamin D in bone mineral homeostasis. It has been observed that vitamin D deficiency causes ailments such as osteoporosis, cardiac dysfunction, arthritis and, prostrate as well

*A report on the 19th mid-year meeting of the Indian Academy of Sciences, Bangalore held during 4 and 5 July 2008 at the Indian Institute of Science, Bangalore.