

SERB to fund India–US collaborative research initiative on molecular materials

In December 2013, the New Delhi-based Science and Engineering Research Board (SERB) has approved financial support to the Chemical Research Society of India (CRSI) to organize future meetings (in particular, joining the Chemical Sciences and Society Summit – CS3) in collaboration with the American Chemical Society (ACS).

In July 2013, the ACS, Department of Science and Technology (DST) and CRSI together organized a three-day Indo-US symposium at the Indian Institute of Science (IISc), Bangalore to facilitate collaborative research between the two countries on molecular materials. The theme of the symposium was identified during a closed door meeting between T. Ramasami (Secretary, DST) and US officials at Washington DC in 2012.

Francisco Gomez (Office of International Activities, ACS) told *Current Science* that the idea behind organizing the symposium was to bring together like-

minded scientists and work towards addressing challenging societal problems to make lives better. Sanjay V. Malhotra (coordinator from the US side) indicated that the meeting provided opportunities for fruitful discussions and that some of the US participants will be visiting few Indian institutions to initiate scientific collaborations. Based on the feedback and evaluation of the meeting, the symposium was seen to serve as a platform for instigating discussions, push forward science at the policy level and draw a plan to do future science.

According to Uday Maitra (IISc), a series of presentations were made during the symposium by delegates from both India and USA on topics ranging from synthesis of new materials – manufacturing challenges; their applications in tissue engineering, low-cost diagnostics, healthcare, drug delivery and other industrial processes. He also mentioned that it was planned to bring out a book

on molecular materials during this meeting, which will be published by the CRC Press. A group of editors has been identified and the work has started.

Several other recommendations were made during the symposium. Murali Krishna Cherukuri (National Institutes of Health, USA) opened up the possibility of instituting fellowships and Darell G. Schlom (Cornell University, USA) had proposed starting a junior faculty or student-exchange programme. Now that SERB has agreed to provide financial assistance to conduct future meetings, we hope to build a roadmap to direct future plan of action, and identify key areas of research, said G. Mugesesh (CRSI and Department of Inorganic and Physical Chemistry, IISc).

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MEETING REPORT

Strategies for increasing production and productivity of wheat and barley*

The 52nd Wheat and Barley Workers' Meet attracted over 400 delegates from India and abroad. The Meet, an annual feature of the All India Coordinated Wheat and Barley Improvement Project (AICW&BIP) of the Indian Council of Agricultural Research (ICAR), was inaugurated by M. S. Swaminathan. Participants were from the International Maize and Wheat Improvement Center (CIMMYT), Mexico; International Center for Agricultural Research in the Dry Areas (ICARDA), Lebanon/Morocco;

Coordinating centres in various ICAR institutions and State Agricultural Universities, progressive farmers, State Agriculture Departments, KVK personnel and representatives from private seed companies, fertilizers and agro-chemical industries.

The pre-meet started with a welcome address by Indu Sharma (Directorate of Wheat Research (DWR), Karnal) highlighting the progress during 2012–13 and indicating marginal production decline to yellow rust incidence and adverse weather during maturity stage. This was followed by a talk by R. R. Hanchinal (Chairman, Protection of Plant Varieties & Farmers' Rights Authority (PPV&FRA)) elaborating the importance of the PPV&FR Act to breeders and farmers and stressing on patenting of genotypes

to protect their rights. He informed that out of 400 wheat varieties, only 94 are registered with PPV&FRA and only two are patented by farmers, indicating the need for awareness programmes. Subsequently, discipline-wise (Crop improvement, Resource management, Crop protection, Quality and barley network) concurrent sessions were organized to review the research during 2012–13 and plan for 2013–14.

The inaugural session was chaired by Ashok Kumar (Vice-Chancellor, Chandra Shekhar Azad University of Agriculture and Technology (CSAUA&T), Kanpur) with M. S. Swaminathan as Chief Guest, Anand Singh (MOA, UP) as the Guest of Honour and Swapan K. Datta (DDG (Crops), ICAR) as Special Guest. Indu Sharma presented research highlights for

*A report on the 52nd Wheat and Barley Workers' Meet held at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during 1–4 September 2013. The meet was organized by the Directorate of Wheat Research, Karnal.

2012–13 and informed that the main emphasis was on developing biotic and abiotic stress-tolerant genotypes. Datta in his speech favoured additional funds from Central and State Governments for reaping potential benefits. Thereafter, researchers whose varieties were released by the Central Varietal Release Committee (CVRC) during 2012 were honoured. Out of nine varieties, five were wheat, viz. WH 1105, PBW 71, MP 336, RAJ 2384 and US 304; three were barley, viz. RD 2786, RD 2794 and VLB 118 and one was triticale, namely TL 2971. Swaminathan, in his inaugural address lauded the wheat and barley researchers for their efforts. He mentioned about the estimated 1.3 billion tonnes foodgrain wastage worldwide and stressed upon scientific post-harvest handling, indicating that the saved foodgrains will suffice the needs of about three billion people. Moreover, in view of declining groundwater table, he stressed on rainwater harvesting for subsequent use in irrigation.

In the next session chaired by Datta on 'Review of programme', brief presentations were made by the respective Principal Investigators (PIs) followed by discussions. There was another special session again chaired by Datta on 'Advances in wheat and barley research'. Karabi Datta (Calcutta University) made a presentation on 'Transgenic rice and perspective for wheat and barley'; S. N. Islam (IASRI) explained the utility of the wheat expert system for farmers; R. Charath (DWR) shared the development of 'Indian wheat database – an online initiative', a basic e-guide on wheat genotypes and Sujoy Dutta (ISRO) spoke on the application of remote sensing in wheat rust forewarning and detection. Post special session, discipline-wise brainstorming was organized for finalization of recommendations and work plan.

On the third day, the session on 'Global efforts in enhancing wheat and barley production' was chaired by Thomas R. Lumpkin (DG, CIMMYT, Mexico). Etienne Duveiller presented an overview of CIMMYT–India and ICAR–BISA collaborations for enhancing wheat production in Asia, and Sukhwinder Singh elaborated the recent advances in wheat improvement at CIMMYT. The new avenues and challenges in barley research were enumerated by M. Baum and R. P. S. Verma (ICARDA, Lebanon/Morocco). They also provided an overview of ICARDA–India collaboration

and research planning for 2013–14. Further, a presentation on 'BBSRC–ICAR collaboration: strategies and planning' was made by Ian King and Martin Broadley.

The next session on 'Developmental issues in wheat and barley' was chaired by J. S. Sandhu (Agricultural Commissioner, India). Subhash Zadoo (FCI) spoke on the scenario of wheat export from GoI central pool stocks highlighting the process of procurement, proper storage and distribution. Kiran Reddy discussed the quality characteristics of Indian barley for malt and mentioned that the future demand for malt barley will increase. G. K. Choudhary highlighted the success of NFSM in achieving the target of producing 8 million tonnes more during 2007–12 due to the synergy between research, extension and development programmes. Following this, strategies for 2013–14 crop season were presented by the respective State Directors/Commissioners of Agriculture.

The last day of the Meet had a session on reviewing the progress of research in peninsular and southern hill zones in which presentations were made by the leaders of the respective centres. In the plenary session, the respective PIs presented the subject-wise recommendations and work plan for the next year.

Recommendations by the crop improvement groups are: promotion of test entries for AVTs on advantage in yield over best check, separate trials for rain-fed and restricted irrigation in CZ and PZ, more focus on developing genotypes for limited irrigation, deposit at DWR a set of RILs/NILs seeds to save for posterity, and testing durum entries in NIVT-3 within the allocated quota of centres.

Recommendations by the resource management groups are: sowing during 12–18 November is optimum for maximizing wheat productivity in CZ; narrow spacing of 15–18 cm increased productivity and reduced weed infestation in PZ; application of metsulfuron + carfentrazone (Ready mix) + 0.2% NIS at 25 g a.i./ha controlled broadleaf weeds in NWPZ, NEPZ and CZ; application of ready mixture (Vesta and Total) for broad-spectrum weed control across NHZ, NWPZ, NEPZ and CZ; mulching and spraying KCl and CaCl₂ @ 0.2% at booting/post-anthesis produced higher yield and may help climate change mitigation; system of wheat intensification (SWI) had no advantage over conven-

tional drilling and application of hydrogel @ 2.5–5.0 kg/ha produced higher yield under restricted irrigation.

The crop protection group recommended that a number of genotypes were resistant to rusts; both rusts and powdery mildew; rusts, powdery mildew, Karnal bunt and flag smut; rusts and leaf blight; rusts, leaf blight and powdery mildew and rusts, leaf blight, powdery mildew, Karnal bunt and flag smut. Some genotypes had a multiple disease and insect pest resistance. TL 2975 is resistant to rusts, leaf blight, powdery mildew, Karnal bunt, flag smut and shoot fly. HUV 640 is resistant to rusts, leaf blight and shoot fly. MACS 3742 is resistant to rusts, powdery mildew, Karnal bunt, flag smut and shoot fly. The group emphasized the need for regular surveys, strengthening and validating remote sensing-based monitoring, and frequent awareness programmes to control losses due to diseases and pests.

The quality and basic sciences group recommended quality evaluation of initial plant protection screening nursery (IPPSN) entries, interaction with industry to carry forward the advances, showcasing quality-rich materials, and use of superior lines in crossing programme by breeders. The group also emphasized the use of quality traits like sedimentation value, protein content, test weight and grain appearance for promoting varieties.

The social sciences group emphasized timely (before 30 September) release of funds by the DAC, Ministry of Agriculture, GoI in a single instalment to enable the conduct of frontline demonstrations (FLDs), increase funds to Rs 8000 for each demonstration of 1 ha, and an additional Rs 3.5 lakhs per year for effective monitoring.

The barley group stressed on more availability of quality seeds through public–private partnership, strengthened dual-purpose barley programme including linkages with animal sciences institutions, strengthened crossing programme using international and NBGSN genotypes, efforts to counter lodging, health benefits of barley and identifying superior genotypes, improving huskless barley, supporting price comparable to wheat, allocation of more FLDs, and contract farming by private companies.

Several prospective varieties identified for various production conditions were also announced. In wheat, HS 542 for

rainfed early sowing in NHZ; HD 3086 and DBW 88 for irrigated timely DBW 90 and WH 1124 for irrigated late and PBW 660 for rainfed sowing in NWPZ; NW 5054 and K 1006 for irrigated timely sowing in NEPZ; MACS 6478 for irrigated timely, HD 3090 for irrigated late and DBW 93 for restricted irrigation

timely sowing in PZ; and HW 1098 (Dicocum) for irrigated timely sowing in SHZ were identified. In barley, BHS 400 for rainfed early sowing in NHZ; DWRB 92 (malt) and BH 946 (feed) for irrigated timely sowing in NWPZ and HUB 113 for irrigated timely sowing in NEPZ were identified. These will be

submitted to the CVRC for release as varieties for cultivation in India.

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MEETING REPORT

Nanotechnology-based innovation for environmental, energy and biomedical applications*

In the last five decades, a significant progress has been made in the field of advanced materials for diverse applications triggered by the advent of nanotechnology. The design of materials at nanoscale with significant property enhancement has been possible due to the development of novel fabrication techniques and characterization tools. These techniques together with evolving scientific thoughts have enabled newer applications of advanced materials in the cutting-edge technologies. For example, the spark plasma sintering (SPS), a variant of field-assisted sintering (FAST) or pulsed electric current sintering (PECS), has been widely used to fabricate bulk nanomaterials. The chemistry of the materials is refined and various coating techniques are being adopted to obtain nanostructured coatings. Newer characterization tools (e.g. SQUID, HRTEM, NMR, FIB) and high-performance computational tools are now extensively used to characterize/quantify as well as to predict the microstructure and functional properties of the designed materials at multiple length scales respectively. The last decade has also witnessed the application of nanotechnology based innova-

tion to treat human diseases like cancer, osteoarthritis, osteoporosis, nerve repair, etc. Despite the projected advantages of nanotechnology, the application in various emerging fields as well as in the industry is still not commensurate with the research efforts in various laboratories and funding invested worldwide.

In lieu of the emerging trends, a five-day Indo-Japan bilateral symposium was organized to meet the following objectives: (a) to discuss the potential for future collaboration between Indian and Japanese

researchers on green and life materials innovation based on nanotechnology; (b) to serve as a platform for a large number of active researchers from various disciplines of biological sciences, materials science, ceramics and biotechnology to participate and share their latest research results; (c) to strengthen existing collaborations between scientists in India and Japan; (d) to stimulate the minds of a large number of young researchers. Some of the themes of the symposium are schematically shown in Figure 1. The

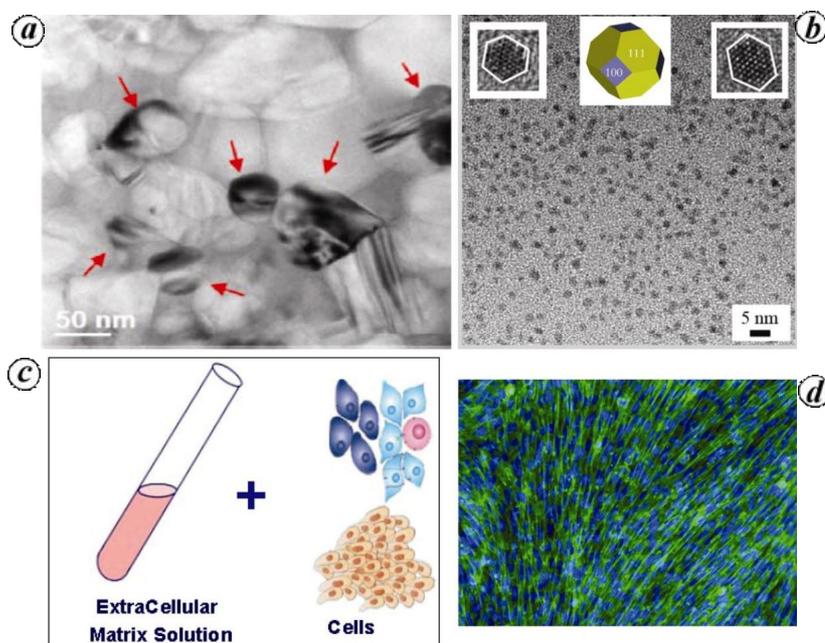


Figure 1. Illustration of the overall theme of discussion during the symposium. **a**, Bright field TEM image of sintered Si_3N_4 -SiC nanocomposite; **b**, Bright field TEM image of gold nanoparticles with characteristic shapes as insets; **c**, Concept of extracellular matrix-based scaffold synthesis; **d**, Oriented myoblast (muscle cell) growth on electroconductive hydroxyapatite (HA)-calcium titanate (CaTiO_3) substrate.

*A report on the Indo-Japan bilateral symposium 'Nanotechnology-based Innovation for Environmental, Energy and Biomedical Applications' held during 16–21 December 2013 at the Indian Institute of Science, Bangalore (http://mrc.iisc.ernet.in/~bikram/Bikram_Website/DST_JSPS_Symposium.html). This event was financially sponsored by DST, New Delhi and Japan Society for Promotion of Science.