BRIDGING NATURE AND TECHNOLOGY

8th Annual Symposium by

INDIAN SCIENTISTS ASSOCIATION IN JAPAN

PROGRAM AND ABSTRACTS

6 DEC 2017

UNIVERSITY OF TOKYO
HONGO, JAPAN

ISAJ

Sneha, Convener
P.K.Hashim, Co-Convener
Rumit Maini, Co-Convener

ISAJ
INDIAN SCIENTISTS ASSOCIATION IN JAPAN

ISAJ is registered as a Japanese non-profit organization (NPO) under Japan's NPO law. Tsukuba has been decided to be ISAJ's headquarter. The Executive Body is ISAJ's governing body and is responsible for directing the affairs and determining the future of the Society. The Executive Body will appoint some of the Executive Body members to take responsibilities such as the Chapter Presidents of six different regions in Japan (Hokkaido, Tohoku, Tokyo, Tsukuba, Fukuoka, and Osaka).

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The Ambassador of India to Japan

Honorary Adviser:

Counsellor (Science & Technology), Embassy of India, Japan

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AMBASSADOR OF INDIA
भारत का राजदूत

Message

I am glad to learn that the Indian Scientists Association in Japan (ISAJ) is organising its Eighth Annual Symposium on December 6, 2017. This year's theme "Bridging Nature and Technology" is most appropriate and is very relevant to both India and Japan.

India and Japan are both knowledge-based economies with vast complementarities that create boundless opportunities for using the tools of science and technology to provide innovative and affordable solutions for the many challenges that we face today. The annual symposium is a great platform to build effective partnerships between Indian and Japanese scientists to promote collaborative research and to work to create harmony between the march of Technology and the inherent balance that Nature demands.

I am sure the deliberations during the Symposium will lead to constructive recommendations for further consideration by the scientific community and policy makers in India and Japan.

The Embassy is privileged to be associated with the Symposium. I wish the Symposium all success.

(Sujan R. Chinoy)

Tokyo
17 November, 2017

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एवम्
डी.ए.ई. – होमी भाभा प्रोफेसर
Dr. R. Chidambaram
Principal Scientific Adviser to the Govt. of India
&
DAE - Homi Bhabha Professor

सत्यमेव जयते

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MESSAGE

The 17 Sustainable Development Goals (SDGs) and targets, launched by the United Nations in 2015, are people-centered and planet-sensitive. Technology is essential for development. And sustainability requires equitable utilization of natural resources among countries and among generations. One of the SDGs, for example, is 'affordable and clean energy' for all. This also requires respect of nature and preventing the climate change that could be caused by excessive emission of greenhouse gases.

I am very happy that the ISAJ, which plays an important role in increasing scientific cooperation between India and Japan, has as its theme for this year's Annual Symposium: "Bridging Nature and Technology".

I wish the Symposium all success

R. Chidambaram

(R. Chidambaram)
21st November, 2017

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ISAJ
INDIAN SCIENTISTS ASSOCIATION IN JAPAN

I, on behalf of the ISAJ, would like to take this opportunity to sincerely welcome all the delegates and guests to the 8th Symposium of Indian Scientists Association in Japan (ISAJ) on Bridging Nature and Technology. Indian Scientists Association in Japan (ISAJ) is an eight-year-old Non-Profit Organization (NPO). It was orchestrated at the end of 2008 by coming together of many Indian scientists working in Japan. Formally inaugurated by Prof. R. Chidambaram, the Principal Scientific Adviser to the Government of India in January 2009, in the presence of His Excellency the then Ambassador of India, and since then it has grown into a NPO registered in Japan, with its functional chapters present at Hokkaido, Sendai, Tsukuba, Tokyo, Kyoto, and Kobe. By organizing regular seminars, free discussions, and networking by all the chapters and at all levels, ISAJ has been focusing on networking among Indian scientists in Japan.

After seven successful annual symposia at the Main Auditorium, Embassy of India, Japan, I am very happy to welcome you to the eighth one today at the University of Tokyo campus. In last seven symposia, we have always tried our best to make this event interdisciplinary to allow wide participation. Likewise, this year we have selected the theme entitled "Bridging Nature and Technology". I truly believe that this is a unique opportunity to interact and learn beyond our specialized domains and to innovate our thoughts and research outcomes in the interest of science and for the benefit to the society. We are looking forward to free and intense interactions over the poster presentations by the young researchers working in Japan, which have been the highlight of all the previous symposia. They have been highly productive and enjoyable as well. I am grateful to all our guests, members and participants for their efforts to organize and participate this event. I sincerely hope that we all will enjoy the symposium that will inspire India-Japan collaborations and friendships along with developing stronger ties in Science and Technology.

With best regards,

Sunil Kaul.

Sunil Kaul
Chairman
Indian Scientists Association in Japan (ISAJ)

December 6, 2017

Foreword

On behalf of the Organizing Committee, we express a feeling of great honor and privilege in convening the 8th Symposium of Indian Scientists Association in Japan (ISAJ) entitled "Bridging Nature and Technology".

The focus of this year's symposium is to reflect on and critically assess how various disciplines of science and technology are integrating the knowledge from nature and environment to innovate and develop latest technologies. A popular belief that has been growing recently is that nature and technology are merging and to develop better human centric technologies it is important to derive the learnings from nature and environment. This approach of learning from nature and integrating that knowledge with the latest technological advancements can be the answer to many challenges faced by the current generation such as in climate change, affordable healthcare, sustainable city development and many more. With this thought in mind, we invited for abstracts and poster presentations from across the various disciplines of science and technology. The overwhelming response that we received from the participants is clearly reflected in this booklet where we present 37 abstracts from disciplines like Chemistry, Biotechnology, Civil engineering, Agriculture and environmental biology, Material sciences and others from the universities and research institutes from all across Japan.

The scientific presentations will start with the keynote address by Prof. Toshihiko Koseki, Executive Vice President, University of Tokyo. There will be 10 plenary talks by the distinguished scientists. We are honored to welcome Mr. Mitsuhito Nemoto for giving a special talk about the Sakura Science Plan on behalf of Japan Science and Technology Agency. The symposium would not have been possible without the generous support and guidance received from H.E. Mr. Sujan R. Chinoy, The Ambassador of India to Japan and Dr. Purnima Rupal, Counsellor (S&T), Embassy of India. We are immensely thankful to Forecast Ocean Plus Inc., State Bank of India, EcoCycle Corporation and Ambika Japan for coming forward to sponsor this event. On behalf of the organizing committee of this symposium, we would like to express our sincere gratitude to all the participants for the enthusiasm presenting their latest research work, and contributing to the productive interactions in the symposium.

Sneha, Convener — Date: December 6, 2017

Padinhare K. Hashim, Co-convener

Rumit Maini, Co-convener

BRIDGING NATURE AND TECHNOLOGY
8th Annual Symposium by
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Time	PROGRAM	
8:00 – 9:00	**Registration of participants**	
9:00 – 10:00	**Inaugural Session**	
9:00	Welcome Address	Sunil Kaul, Chairman, ISAJ
9:05	Inaugural Address	Sneha, Symposium Convener
9:15	Special Address	**Purnima Rupal** S & T Counsellor, Embassy of India **"Transforming India through Science, Technology & Innovation"**
9:35	Keynote Address	**Toshihiko Koseki** Executive Vice President, University of Tokyo **"Materials Integration System for Developing Advanced Materials"**
9:55	Vote of Thanks	Alok Singh, Vice Chairman, ISAJ
10:00–10:15	**COFFEE BREAK**	
10:15–12:00	**Session – I, Invited talks**	
10:15	**Toshiji Mukai** Kobe University	**"Material Design of Magnesium Alloy for Biodegradable Implant"**
10:35	**Manish Biyani** Japan Advanced Institute of Science and Technology (JAIST)	**"Electrospray for Man-made Cell-like Compartments"**
10:55	**Horacio Cabral** University of Tokyo	**"Cooperative Fusion of Imaging and Therapy through Theranostic Nanomedicines"**
11:15	**Renu Wadhwa** National Institute of Advanced Industrial Science & Technology (AIST)	**"Ashwagandha Leaves: Bioactives, Biology and Biotechnology"**
11:35	**Shrihari Chandraghatgi** (Special talk) EcoCycle Corporation	**"Status of groundwater contamination due to industrial and agricultural activities in India and its impact on health and economy"**
12:00–12:30	**LUNCH BREAK**	

12:30–13:20 **POSTER SESSION-I**

13:20–14:40	**Session – II, Invited talks and young scientists talks**	
13:20	**Takahiro Sawaguchi** National Institute for Materials Science (NIMS)	**"A novel long-lived seismic damping alloy for safe and secure society"**

13:40	**Naokazu Kano** University of Tokyo	**"Creation of a Chemical Bond between Penta coordinated Group 14 Elements"**
14:00	**Rajkumar S Kalra** National Institute of Advanced Industrial Science & Technology (AIST)	**"CARF Enrichment Promotes Epithelial-Mesenchymal Transition Through Activation of Wnt/-Catenin Signalling: Clinical Relevance and Mechanism of Action"**
14:10	**Somesh Kumar Bhattacharya** National Institute for Materials Science (NIMS)	**"Ab initio study of the oxidation resistance of Ti surfaces at elevated temperature"**
14:20	**Takehiro Kamiya** University of Tokyo	**"Ionome screening of EMS-mutagenized Rice"**
14:30	**Mitsuhiro Nemoto** (Special talk) Japan Science and Technology Agency (JST)	**"Sakura Science Plan (SSP)"**
14:40–15:30	**COFFEE BREAK & POSTER SESSION-II**	
15:30–16:30	**Session – III, Invited talks**	
15:30	**Yoshiaki Onishi** National Institute of Advanced Industrial Science & Technology (AIST)	**"Circadian Rhythm: Under the Control of Surya"**
15:50	**Masayuki Takigawa** JAMSTEC	**"The impact of biomass burning and urban emissions on the air quality in India and other Asian countries"**
16:10	**Kou Okuro** University of Tokyo	**"Stimuli-responsive Molecular Glues for Modulation of Biomolecular Functions"**
16:30–17:00	**Session – IV, Poster talks (5 min each)**	
16:30	**Sunil kumar** Hokkaido University	**"Photocontrol of Motor Protein Function"**
16:35	**Ruzic Jovana** National Institute for Materials Science (NIMS)	**"Effect of Mo Segregation on Mechanical Properties of TiMo Alloy Studied by Nanoindentation"**
16:40	**Sajal Afzal** University of Tsukuba	**Black Cumin Seed Oil-in- Water Nanoemulsions - Preparation by High pressure homogenization & Evaluation of Stability**
16:45	**Ankita Kushwaha** Japan Advanced Institute of Science and Technology (JAIST)	**"Creation of smarter aptameric reagents for the global antigenic diversity of influenza viruses"**
16:50	**Subramani Thiyagu** National Institute for Materials Science (NIMS)	**High efficiency silicon hybrid solar cells via energy management by employing nanocrystalline Si quantum dots and Si nanoholes**
16:55	**Hubiao Huang** University of Tokyo	**Topological Defect-Mediated Kinetic Growth of Crystalline MOFs with Anomalous Morphological Complexity**
17:00–17:15	**CLOSING SESSION, POSTER AWARD AND BREAK FOR DINNER**	

List of poster presentations

No.	Name of presenter	University/Institute	Presentation Title
P1	Sunil Kumar K R	The University of Tokyo	Photocontrol of Motor Protein Function
P2	Ruzic Jovana	National Institute for Materials Science (NIMS)	Effect of Mo Segregation on Mechanical Properties of TiMo Alloy Studied by Nanoindentation
P3	Sajal Afzal	Food Research Institute, Tsukuba, Univ. of Tsukuba	Black Cumin Seed Oil-in-Water Nanoemulsions - Preparation by High pressure homogenization & Evaluation of Stability
P4	Ankita Kushwaha	Japan Advanced Institute of Science and Technology	Creation of smarter aptameric reagents for the global antigenic diversity of influenza viruses
P5	Subramani Thiyagu	National Institute for Materials Science (NIMS)	High efficiency silicon hybrid solar cells via energy management by employing nanocrystalline Si quantum dots and Si nanoholes
P6	Hubiao Huang	The University of Tokyo	Topological Defect-Mediated Kinetic Growth of Crystalline MOFs with Anomalous Morphological Complexity
P7	Prakhar Misra	The University of Tokyo	Land-use urban morphology identification using digital surface model over Indian cities
P8	Shreya Thusoo	Tokyo Institute of Technology	Numerical Study on Seismic Structural Performance of Hollow Steel-Encased Concrete Piles
P9	Kunal Kumar	University of Tokyo	Tuning of Multicolored Emission and Slow Magnetic Relaxation in Trimetallic EuxTb1-x[Co(CN)6] Coordination Polymers
P10	Gaddam Pruthvi Raj	University of Tokyo	Behaviour of Clay Brick Masonry with Soft Brick under Uniaxial Compression
P11	Tomohiro Kuroda	The University of Tokyo	Development of post-translational acyl transfer reaction toward in vitro synthesis of peptides with carbon-backbone
P12	Gayatri Chawda	Tokyo Institute of Technology	Content Analysis of EIA reports in India
P13	Mohamed Reda Batran	University of Tokyo	People Flow and Spatio-Temporal Density Representation in Maputo, the Capital of Mozambique
P14	Parijat Borah	The University of Tokyo	Development of Solid Base Catalyzed Stereoselective 1,4-Addition Reactions in the Batch and Flow System
P15	Farhan Mudasar	The University of Tokyo	Enhanced figure of merit in low thermal conductivity distrontium silicide (Sr2Si) by spark plasma sintering technique
P16	Shinde Harshraj	The University of Tokyo, Japan	Elucidation of relative drought responsiveness in pearl millet using RNA-Sequencing approach

P17	Nehpreet Kaur Walia	University of Tokyo	Investigation of Slow-mode shocks in Earth's Magnetopause with Magnetospheric Mutiscale Mission
P18	Fazalurahman Kuttassery	Tokyo Metropolitan University	Artificial photosynthesis catalyzed by earth-abundant metalloporphyrins
P19	Damini sharma	National Institute of Advanced Industrial Science & Technology (AIST), Univ. of Tsukuba	Molecular Mechanism of Anti-Cancer Properties in Fucoxanthin
P20	He Huifu	National Institute of Advanced Industrial Science & Technology (AIST)	Bioassays for Activities in The Grape Seed Extract: A Preliminary Study
P21	Jayarani Putri	National Institute of Advanced Industrial Science & Technology (AIST)	Demethylation Drug 5'-Aza-2'-deoxycytidine Works Through Multi-pathway: Bioinformatics and Experimental Evidence
P22	Priyanshu Bhargava	National Institute of Advanced Industrial Science & Technology (AIST), Univ. of Tsukuba	Honey Propolis for Cancer Treatment: Bioinformatics and Experimental Evidence to Mechanism of Action of Active
P23	Amr Omar	National Institute of Advanced Industrial Science & Technology (AIST), Univ. of Tsukuba	Establishment of CARF As a Stress Response Protein
P24	Sukant Garg	National Institute of Advanced Industrial Science & Technology (AIST), University of Tsukuba	Anti-Stress Potentials of Tamarind Seeds: A Preliminary Study
P25	Wang Jia	National Institute of Advanced Industrial Science & Technology (AIST), Univ. of Tsukuba	Skin Pigmentation is a Stress Response
P26	Anupama Chaudhary	National Institute of Advanced Industrial Science & Technology (AIST)	A Withaferin-A Derivative with Non-toxic and Anti-Stress Potentials: Molecular Evidence and Significance
P27	Jian Qiang	National Institute for Materials Science (NIMS), University of Tsukuba	Concurrent solid-state amorphization and structural rejuvenation in Zr-Cu- Al alloy by high-pressure torsion
P28	K. Venkata Rao	RIKEN, Wako	Thermally bisignate supramolecular polymerization
P29	Dudekula Althaf Basha	National Institute for Materials Science (NIMS)	Deformation induced interfacial segregation of zinc in Mg–Zn–Y alloy

P30	Ata Abbas	Nanyang Technological University, Singapore	Allenamides as orthogonal hondles for selective modification of cysteine
P31	Anirban Akhand	Port and Airport Research Institute	CO2 flux estimation from Indian Sundarban: Technology and advancement
P32	Hasna Puthen Peediyakkal	Tokyo Metropolitan Univesity	Pt- free Catalysts for Next Generation Proton Exchange Membrane Fuel Cells
P33	Ryo Kato	Tokyo University of Science	Magnetic properties and structure of high coercivity Sm-Co magnets
P34	J Kida	Tokyo University of Science	Magnetic properties of melt-spun Sm-(Co,Fe) ribbons
P35	Rahul Kumar	Tokyo Institute of Technology	Moving Beyond the Nature with Metamaterials
P36	Kiyoshi Morishita	University of Tokyo	Nucleotide Coordination With 14 Lanthanides Studied By Isothermal Titration Calorimetry
P37	Sahil Bansal	Tokyo Institute of Technology	Future of AI and Cyborgs

Abstracts (in the order of presentation)

IL1 (Keynote)

Materials Integration System for Developing Advanced Materials

Toshihiko Koseki

The University of Tokyo, koseki@material.t.u-tokyo.ac.jp

Development of new, advanced materials is a key to achieve structures and devices offering better performance, safety and reliability and lower energy consumption and CO_2 emission. Thus, the speeding up of the development of advanced materials is crucial in every technology field and in solving many social problems. Over the last century, a variety of materials have been developed, where relationships between structure, process, properties and performance of materials were clarified and the materials microstructure was optimized to achieve desired properties and performance. However, since the development was primarily made by trials and errors, it often required long time and large costs until achieving the properties and performances targeted, establishing production processes and evaluating long-term reliability.

It is getting recognized more that the use of computational science and data science can help reducing the time and costs for the development of materials. A number of numerical models with different length and time scales have been developed to predict structure, properties and performance of materials and to simulate materials processes, and also using experimental data, applications of machine learning and other methods of data science have been attempted for those prediction as well.

"Materials Integration System" that we are currently developing is a platform for predicting the relationships between structure, process, properties and performance of materials. We will be able to mount modules of materials models and simulations, modules of machine learning and data assimilation, databases, and modules of theoretical and empirical rules on the system, and connect and integrate them like a work flow of the development of materials. We currently put an emphasis not only on constructing the platform but also on providing modules for the prediction of time-dependent performances, such as fatigue and creep, since those performances require a number of long-term experiments while their evaluations are essential to the reliability of materials and structures. The concept and the progress of the development of the system will be addressed in this presentation.

"Materials Integration System" is being developed under Strategic Innovation Promotion (SIP) Program "Structural Materials for Innovation (SM4I)"

IL2

Material Design of Magnesium Alloy for Biodegradable Implant Devices

Toshiji Mukai
Graduate School of Engineering, Kobe University
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Currently, surgical clips and staples are made of pure titanium or its alloys since they are both strong and ductile enough to occlude blood vessels in soft tissue by forceps. However, because titanium has a high corrosion resistance, its clips remain in the body permanently. The X-ray absorption coefficient of Ti is much higher than human tissue resulting in computed tomography artifacts, which hinder accurate diagnosis around the area where surgery has been performed. Therefore, biodegradable clips are required for surgery. Recently, magnesium and its alloys have attracted much attention because of their excellent biocompatibility and biodegradability. However, the high anisotropy of magnesium crystal structure limits the movement of some slip systems. In the medical applications, the strength of magnesium alloys should be increased along with their ductility to improve the deformability required during surgery. Many studies have attempted to develop ductile Mg alloy by controlling the microstructure and it was revealed that the basal texture affects the ductility of alloys.

This research aimed to fabricate ductile Mg alloys containing calcium and zinc because these elements are present in the body. First principles calculations and three-point bending experiments revealed that toughness of magnesium was improved by alloying of calcium and zinc due to the reduced anisotropy of plastic deformation and enhanced grain boundary strength. Alloying Mg with Ca and Zn and controlling the microstructure produced a magnesium alloy with a high compressive fracture strain of 0.40, which was greater than the estimated maximum strain for fastening clip. This high fracture strain arose from the dynamic recovery during plastic deformation of the alloy. The alloy successfully occluded blood vessels. Micro CT images showed that the Mg-Ca-Zn clips degraded homogeneously, resulting in gradual gas formation and producing no inflammation of the tissue around the magnesium clips.

IL3

Electrospray for Man-made Cell-like Compartments

Manish Biyani

Res. Associate Professor, Japan Advanced Institute of Science and Technology, Japan
Director, Biyani Research Group, Biyani Group of Colleges, Jaipur, India
Founder, Biyani BioSolutions Pvt Ltd., Jaipur, India
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The bottom-up construction of artificial cells using IVC (in vitro compartmentalization) technology in synthetic biology has redefined the efficiency of cell-free system. The production rate of cell-free reaction has realized to be inversely proportional to the reaction-scale size. This is mainly because bulk-scale reaction (ranging from milliliters-to-microliter scale) in unconfined spaces leads to noise due to non-Poisson distribution of reaction components. Second, compartmentalization induces cell-like interfacial phenomenon by separating the inner vital chemical milieu from external environment, which increases with decreasing sizes of compartment. Therefore, a method of IVC that can perform cell-free reactions in confined space (ranging from femtoliter-to-attoliter scale) is an exciting prospect in synthetic biology.

This talk will highlight a recently developed new electrospray platform for minimal solute entrapment in femtoliter droplets for noise-free synthetic biology [Sci. Rep. 2016:6,26257]. Next, a combination of droplet technology and cell-free reaction enables to encapsulate biology in a cell-sized confined space and thus offers a means to parallelize biological and chemical assays inside of femtoliter-sized microdroplet compartments for in vitro molecular evolution and selection. This system is capable of continuous and rapid generation of large-scale and highly monodisperse cell-like compartments with volume <5 fL at the speed of 3 million per min using the application of electrostatic super-fine inkjet technology. We further extended the utility of this system by introducing a micro-hole array electrospray platform for ultra-large scale generation of attoliter-scale cell-like compartments. These droplets were utilized to perform in vitro biological reactions and further exploited for in vitro selection of highly functional biomolecules.

IL4

Cooperative Fusion of Imaging and Therapy through Theranostic Nanomedicines

Horacio Cabral

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Recent progress of nanomedicines into clinical evaluation has provided new insights on biological, material and design features, which are critical for achieving enhanced therapeutic responses, and has motivated the development of more sophisticated nano-scaled drug carriers. The integration of various imaging elements into the structure of nanomedicines is essential for their evolution into fully integrated vehicles suitable for advanced functions. Such imaging capability allows the direct visualization of the behavior of nanomedicines in biological environments, which can facilitate the validation of their design during preclinical development and identify parameters affecting their efficacy or toxicity in early stages, as well as offer decisive information on pathological characteristics and efficacy at clinical phases. Thus, several types of nanomedicines have been engineered for tumor imaging, image-guided therapy and seamless diagnosis and therapy, so called theranostics, by exploiting several imaging modalities. Among successful nanomedicines, polymeric nanoassemblies, particularly polymeric micelles, have shown significant advantages, including biocompatibility, stability, ability for co-loading multiple payloads, and controllable morphology and size for tumor directed drug delivery. Exploiting the compartmentalized structure of nanoassemblies favorably allows delivering both imaging and therapeutic agents for cancer multifunctional imaging and theranostics. Thus, nanoassemblies have high potential not only for cancer molecular imaging, but also for tracing nanoparticles in biological systems, studying their biological pathways, gathering pathological information, monitoring therapeutic effects, and guiding pinpoint therapies. By using fluorescent nanoassemblies, we could trace not only the tissue distribution of the carriers or their cargo, but also the blood circulation, the intracellular drug delivery, or their ability overcome biological barriers, in combination with intravital microscopy. Moreover, introducing MRI function capability to the nanoassemblies can provide anatomical images at high spatial resolution, while improving the signal-to-noise ratio for selective MR tumor imaging, enhancing the diagnostic sensitivity and selectivity compared to clinically used MRI contrast agents. Polymeric nanoassemblies also permit effectively tuning the drug/probe ratio, which is a major challenge for developing theranostic systems, thereby, avoiding plausible toxicities, while maintaining the function of drugs and imaging probes after reaching the target site. In addition, various imaging agents advantageously present dual functions for tumor detection and treatment, such as near infrared fluorescence dyes and gadolinium-based MRI contrast agents, which can be exploited for photodynamic therapy or Gd-neutron capture therapy, respectively. Thus, polymeric nanoassemblies incorporating such probes have the potential for achieving concurrent diagnosis, detection, and image-guided pinpoint tumor therapy with minimal side effects. Overall, polymeric nanoassemblies with balanced functions for imaging and therapy would be preferable for cancer theranostics, to satisfy both precision imaging and effective therapeutic requirements, aiming for their ultimate clinical translation.

IL5

Ashwagandha Leaves: Bioactives, Biology and Biotechnology

Renu Wadhwa and Sunil Kaul

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Ashwagandha (*Withania somnifera*) is an important and popular Ayurvedic herb used in Indian traditional home medicine. It has been known to possess various therapeutic and health-promoting potentials of which the molecular mechanism(s) remain obscure. We initially screened Ashwagandha leaf extracts for anticancer activity in *in vitro* and *in vivo* assays and reported that the alcoholic (i-Extract) and water (w-Extract) extracts of Ashwagandha leaves possess considerable anticancer activity. Bioactives for these activities were identified as Withanolides, Withanone (Wi-N) and Withaferin A (Wi-A) in the i-Extract, and Triethylene Glycol (TEG) in the w-Extract. In cell culture models, these components caused cytotoxicity to a variety of human cancer cells. Molecular insights into their mechanism of action revealed that they cause (i) activation of tumor suppressor genes and (ii) induction of oxidative stress. Based on our studies, we formulated a combination of Wi-N and Wi-A with potent anti-metastasis activity and have also developed a method of extraction that yield all the three bioactive components from the leaf powder, and hence is proposed to serve as a cheap, economic anticancer drug especially where modern medicine is either not available or is limited by severe side-effects. Most recently, we discovered that methoxy derivative of Wi-A that lacked anticancer activity but protected normal cells offering side-benefits at the time of stressful chemotherapeutics. Furthermore, low doses of the extracts and some of the constituents were seen to possess anti-stress, anti-aging and neuro-protective activities predicting its value for enhancing QOL during aging and stress environment.

Special Talk

Status of groundwater contamination due to industrial and agricultural activities in India and its impact on health and economy

Shrihari Chandraghatgi
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Fifty percent of the urban population and 85% of rural population in India depend on groundwater, the highest in the world. In fact, 98% of the groundwater extracted is used for agriculture and domestic purposes and industrial usage is only less than 2%. However, geogenic sources, industrial development, and agricultural revolution have been contaminating the precious life-line for millions with toxic chemical compounds. Groundwater in as many as 276 districts across 20 states and 86 districts across another 10 states are found to be contaminated with Fluoride and Arsenic respectively. Over 62 million rural population including 6 million children are estimated to be affected with bone deformities (dental and skeletal fluorosis).

Agriculture not only utilizes more than 85% of groundwater extracted in the country but also pollutes the groundwater with Nitrate, Phosphate and more toxic pesticides and herbicides. An eye-popping 387 districts in 21 states have groundwater contamination exceeding the permissible limits of Nitrate, the "Blue baby" syndrome causing agent. Pesticides contamination has been reported widely in Panjab, Gujarat, UP etc. A World Bank study reveals 6 million people, including 125,000 infants, are likely to be exposed to unsafe levels of nitrate in Andhra Pradesh alone.

Groundwater contaminated at some of the most infamous industrial contaminated sites across the country, like Ranipet (TN), Bhopal (MP), Vadodara (Gujarat), Kanpur (UP) have impacted the health of millions and threatened the precious agricultural lands. They make just the tip of the iceberg because no groundwater survey mechanism in place to account the overall impact of the industrial pollution in the country. Chlorinated hydrocarbons, Heavy metals (Mercury, Lead, Arsenic, Zinc, Cadmium, Selenium, etc.), Cyanide, Petroleum Hydrocarbons, Dioxins and PCBs top the list of contaminants that are known to cause cancer, neurological disorders, retardation of growth in children, abortion, disruption of the endocrine system, arthritis, cardiac problem, kidney failure, respiratory disorders, etc. Though India has the highest population in the world that depends on the groundwater, it lacks proper regulations. The government should prioritize forming proper groundwater regulations to prevent industries from contaminating the resource, educating the regulating authorities on the problem and bringing cutting-edge remedial technologies and cleaning the worst affected sites by creating superfund.

IL6

A novel long-lived seismic damping alloy for safe and secure society

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Metal fatigue is a serious problem in aging metallic and steel components in constructions and machines. It proceeds through accumulation of irreversible atomic rearrangement under repeated loading. Based on a ferrous shape memory alloy, a new fatigue-resistant alloy with 10-times longer life was developed. The former exhibits a reversible atomic movement on loading and subsequent heating, while the latter does on loading and subsequent counter-directional loading.

The reversible atomic movement under cyclic loading was discovered in a Fe-28Mn-6Si-5Cr-0.5NbC shape memory alloy in 2006 [1]. The controlling factors and the underlying mechanisms were then systematically investigated across a wide range of chemical compositions. As a consequence, we have drawn the design criteria for improving the low-cycle fatigue lives of the Fe-Mn-Si-based alloys as: 1) comparable thermodynamic stability between γ-austenite and ε-martensite, 2) suppression of α'-martensite, and 3) addition of approximately 4 mass% of Si. The applicability of the design concept to Co-Ni-Si system has also been reported.

As an optimum chemical composition, we developed a new Fe-15Mn-10Cr-8Ni-4Si (wt%) alloy with 10-times longer low-cycle fatigue life than the conventional seismic damping steels, and installed it in a 40-story skyscraper as fatigue-resistant seismic dampers [2]. Steel dampers absorb seismic energy with their elasto-plastic deformation hysteresis. The superior fatigue resistance of the new alloy can increase the durability of the seismic dampers against accumulated damage from earthquakes.

Acknowledgement

This work has been done academic-industry partnership of NIMS with Takenaka Corporation and Awaji-Materia Co., Ltd.

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IL7

Creation of a Chemical Bond between Pentacoordinated Group 14 Elements

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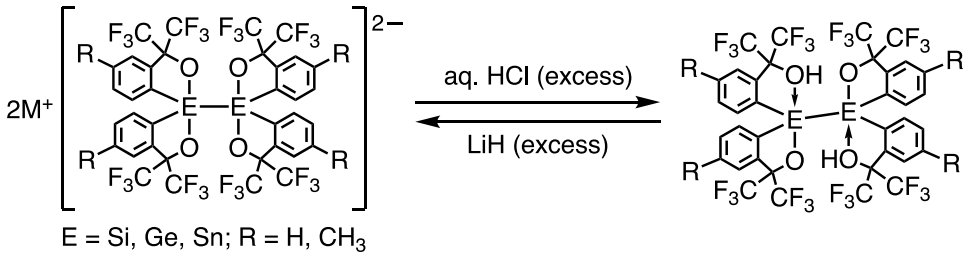
Carbon–carbon bonds are common in natural products. Homonuclear E−E bonds of group 14 elements E, where E is silicon, germanium, and tin, are fundamental and principal core units of the compounds containing these elements, such as polymers. The heavier group 14 elements can be pentacoordinated, and such a species is found as both a reactive intermediate and an isolated stable compound. A homonuclear bond consisting of two pentacoordinated group 14 elements will be a good candidate for a core unit to construct unprecedented structures in group 14 element chemistry. Herein, the synthesis and crystal structure of the dianionic compounds with a bond between pentacoordinated silicon,[1] germanium[2] and tin atoms[3] will be reported. The silicon and germanium derivatives interconverted reversibly into the corresponding neutral compounds by acid–base reactions. Intermediary monoanionic species could also be isolated and characterized.[4] Some properties of the E–E bond compounds will also be presented.



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IL8

Circadian Rhythm: Under the Control of Surya

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Circadian rhythms in behavior and physiology have an adaptive significance for living organisms from bacteria to humans and reflect the existence of an underlying intrinsic circadian clocks align behavioral and biochemical process with the day-night cycle. The most critical cue of the circadian rhythm on the earth is the sun light and therefore, most organisms on the earth are governed by the sun. Circadian dysfunction is considered to contribute to the incidence and severity of a wide range of clinical and pathological conditions, including sleep disorders, cancer, depression, metabolic syndrome and inflammation. In particular, diseases with circadian rhythm disturbance are closely related to mental activities, e.g., Schizophrenia, Senile dementia, Bipolar disorder and so on, indicating that controlling circadian rhythms is very important for human health. Some of herbal plants for traditional folklore have been used for diseases of CNS (Central Nerve System) disorder and insomnia etc., suggesting that constituents of herbs are a candidate of a circadian modulator. After analyzed the circadian transcription of a critical clock gene, *Bmal1*, we established an assay system based on NIH 3T3 cells combined with the *Bmal1* promoter-driven luciferase gene to screen circadian modulators. Using this assay system, we have succeeded to find components as a circadian modulator from herbal plants including Ashwagandha. These results suggest the new insight for medical care, which remind people “developing new ideas based on study of the past and learning from the past”.

IL9

"The impact of biomass burning and urban emissions on the air quality in India and other Asian countries"

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Tropospheric ozone and particle matters (PM) have been recognized as harmful pollutants for decades, and Asia is a region in which anthropogenic emissions are considered to be rapidly increasing and are predicted to increase further. Thus, it is quite important to predict the concentration of pollutants over Asia for the prediction of air quality over a downstream region such as Japan. Especially in Asia, it is well known that anthropogenic emissions from megacities and biomass burning emissions from crop residue and open burning are quite important for the source of pollutants. To estimate the impact of such emissions, we have conducted regional model simulations over India from October to November 2016. Two-level model domains have been considered to treat urban pollution and regional pollution at the same time. The outer domain covers whole India with the grid interval of 27 km, and the inner domain covers around Delhi with the grid interval of 9 km. Our results showed that a plume of biomass burning had been transported from Panjab to Delhi, and visibility was also decreased from 20km to 5km during the same period.

IL10

Stimuli-responsive Molecular Glues for Modulation of Biomolecular Functions

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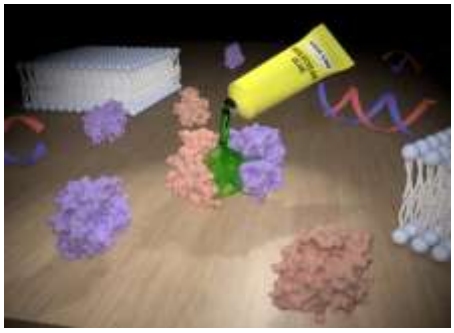
Biological processes are precisely regulated by association/dissociation of biomolecules. Therefore, molecules that reinforce or suppress these biomolecular interactions can serve as molecular tools to elucidate or control of biological phenomena. We have developed "molecular glues" bearing multiple guanidinium ion pendants, which tightly adhere to the surface of biomolecules through a multivalent salt-bridge formation with oxyanions located on the target surface.[1] Through the adhesion of molecular glues, many types of biomolecular interactions can be modulated.[2] However, due to the non-specificity of the adhesion, application of molecular glues to *in cellulo* or *in vivo* systems, where many non-target biomolecules coexist, is a still big challenge.



To overcome this difficulty, we have designed several types of "stimuli-responsive" molecular glues that increase or decrease their adhesivity toward biomolecules in response to external stimuli.[3] Light is one of the favorable stimuli to manipulate the molecular glues because of the high spatiotemporal resolution of light. Biomolecules that are overexpressed in specific cells or tissue, can be a stimulus for *in situ* manipulation of molecular glues. In this presentation, the design strategies and applications of "photoresponsive" molecular glues[4] and "ATP-responsive" molecular glues[5] for the modulation of biomolecular functions will be discussed.

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Special Talk

Introduction of Sakura Exchange Program for Indian youth

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SSP (Sakura Science Plan) is a short-term invitational program to Japan. SSP aims at strengthening exchanges and friendly relations by inviting outstanding young people from Asian countries and regions to Japan and giving the young aspiring people chances to experience cutting-edge research in science and technologies. Under this program, 1,400 youths from India have been invited to Japan during 2015 to 2017.

YS 1 (Young scientist talk)

CARF Enrichment Promotes Epithelial-Mesenchymal Transition Through Activation of Wnt/β-Catenin Signaling: Clinical Relevance & Mechanism of Action

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CARF (Collaborator of ARF) was initially discovered as a novel ARF-binding protein[1]. It was characterized as an essential cell survival, p53-function and cell proliferation -regulatory protein[2-5]. In the present study, we analyzed relevance of CARF levels in clinical tumors and found its amplification (genomic and transcript levels) in a variety of invasive and metastatic malignancies. Consistent to these results, we found enrichment of CARF in cancer cells promoted epithelial-mesenchymal transition (EMT). Molecular analyses revealed that it activates Wnt/β-catenin signaling, as shown by enhanced nuclear localization and function of β-catenin. CARF-mediated activation of β-catenin resulted in increased level of SNAIL1, SNAIL2, ZEB1 and TWIST1 and its downstream genes. Moreover, CARF knockdown led to decrease in nuclear β-catenin function and its key downstream effectors, involved in EMT progression. CARF-targeting *in vivo* either by siRNA or CARF shRNA (adeno-oncolytic virus) approaches restricted tumor growth and lung metastasis. Conclusively, we analyzed the clinical and molecular relevance of CARF function in EMT and cancer invasiveness & metastasis, suggesting its potential as a therapeutic target of malignant disease.

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YS 2 (Young scientist talk)

Ab initio study of the oxidation resistance of Ti surfaces at elevated temperature

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Titanium (Ti) and its alloys are an important class of materials for jet engines because of their high specific strength, excellent corrosion resistance, and good biocompatibility. However, at elevated temperatures the oxidation of Ti is tremendously enhanced. This severely limits its applications at elevated temperature. Although several approaches *viz.* coating, interface with other metals *etc.* are widely used, the oxidation resistance of Ti and its alloys is still an issue to be solved in their applications at elevated temperatures. One cheap and effective method to enhance the oxidation resistance is by doping elements to Ti. In this work, we present our ab initio simulations of the oxidation clean and element segregated Ti surfaces. We vary the oxygen coverage and element concentration on the Ti surfaces to investigate the oxidation of Ti at 973 K. Our results show that it is possible to enhance the oxidation resistance of Ti surface by preparing surface alloy of Ti with suitable elements.

[1] Somesh Kr. Bhattacharya, Ryoji Sahara, Tomonori Kitashima, Kyosuke Ueda and Takayuki Narushima, Accepted in JJAP.

[2] Somesh Kr. Bhattacharya, Ryoji Sahara, Tomonori Kitashima, Kyosuke Ueda and Takayuki Narushima, Accepted in STAM.

YS 3 (Young scientist talk)

Ionome screening of EMS-mutagenized rice

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Ionome is defined as "the mineral nutrient and trace element composition of an organism, and represents the inorganic component of cellular and organismal systems" (Salt et al., 2008). Ionomic analysis is a powerful approach to capture the nutritional status of plants and also applicable for the understanding of element transport mechanisms in plant in combination with genetics. For example, in *Arabidopsis thaliana*, Lahner et al. (2003) firstly performed ionomic screening of mutagenized Arabidopsis and isolated ionomic mutants. Through the analysis of the mutants, several genes regulating element uptake and distribution in plants have been identified. For example, ESB1 and MYB36, which is required for the formation of Casparian strip, have been identified (Hosmani et al. 2013; Kamiya et al. 2015).

We performed ionome screening in rice in two purpose. First is to understand the element transport pathway in rice. Second is to isolated useful mutants for human, such as low toxici elements (Cd, As) or high nutrients (Fe, Zn) in grain, a edible portion.

For the screening, we used ethyl methane sulfonate (EMS)-mutagenized rice (*Oryza sative* c.v. Hitomebore). EMS causes random mutations in DNA. In the first screening, we determined the 22 elements (Li, B, Na, Mg, P, S, K, Ca, Mn, Fe, Co, Ni, Cu, Zn, Ge, As, Se, Rb, Sr, Mo, Cd, Cs) concentration of around 3000 lines by inductively coupled plasma mass spectrometry (ICP-MS) (Agilent 7800, Agilent technologies). After the first screening screening, we selected 139 lines with altered element concentrations in grain and grown in a paddy field in 2013. We also determined the elements concentration of shoot samples grown in soil or Kimura B hydroponic culture supplemented with 0.1 μM Li, Co, Ni, Ge, As, Se, Rb, Sr, Cd, and Cs for three weeks. Finally, based on 2013 data, we selected 71 lines, which had significantly altered ionome ($|\text{robust z score}| \geq 2$) in either brown rice or shoot, and grew them in the same paddy field in 2016. These lines were also grown in soil and hydroponic condition to harvest shoots. After the two years screening, we have isolated several mutants with altered ionome. These mutants would be useful to understand element transport in rice. In addition, these mutants could contribute to establish lines with enhanced nutrients or low toxic elements. Now we are identifying the causal genes responsible for the ionome phenotype.

Poster abstracts

(in the order listed on page 9)

P 1

Photocontrol of Motor Protein Function

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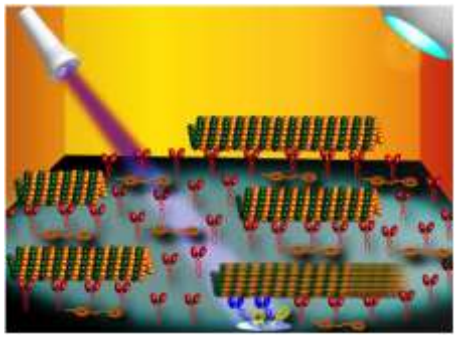
Motor proteins such as kinesin, dynein and myosin perform various mechanical functions of the cell by utilizing chemical energy from adenosine triphosphate (ATP) hydrolysis. Kinesin operate in association with microtubule – a protein filamentous polymer, to transport cell cargos (*e.g.*, vesicles, chromosomes and organelles) to specific sites. The indigenous transport behavior of these bio-machines has high competence to artificial manmade motors when compared to the size, performance and fuel efficiency. The precise spatiotemporal control over their motility function provides a platform to utilize them in lab-on-a-chip applications (*e.g.,* specific cargo loading, transportation and delivery). Previously, our group demonstrated the reversible regulation of the kinesin driven microtubule motility using azobenzene based energy molecules (AzoTP)[1]. With the development of photoresponsive inhibitors of kinesin (Azopeptide), we succeeded to achieve the complete ON/OFF switching of the motility by UV/vis light irradiation[2,3]. Further, exploiting the exquisite properties of the above systems we demonstrated the local concentration/dispersion of the microtubules at any desired position and time. In addition, various regulations of single microtubules (*e.g.*, driving, bending and breaking) under the influence of light became possible while almost arresting ambient microtubules – all without the need for any surface patterning[4].



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P 2

Effect of Mo Segregation on Mechanical Properties of TiMo Alloy Studied by Nanoindentation

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The Mo segregation in β-phase Ti-12 mass% Mo alloy was investigated using room temperature nanoindentation. The ingots of Ti-12Mo alloy were obtained by cold crucible levitation melting technique, and by changing its process parameters different microstructures were obtained, with and without Mo segregation. All samples were solution treated in the single β phase region (1073 K / 1 h), and isothermally aged (523 K / 1 h). Microstructural characterization was performed after nanoindentation test using the X-ray diffraction (XRD), atomic force microscopy (AFM), scanning electron microscopy (SEM) equipped with energy dispersive spectroscopy (EDS) and electron backscatter diffraction (EBSD). The β and isothermal ω phases were identified at observed XRD patterns of all samples, and presence of texture was noticed in the sample without Mo segregation. Nanoindentation results of the sample without Mo segregation confirmed the homogeneity of its microstructure with values of hardness and elastic modulus having low deviations. On the other hand, Mo segregation in heterogeneous microstructure showed great influence on hardness and elastic modulus values. The Mo segregation was confirmed by SEM-EDS examination which revealed the presence of bright and dark stripes in the heterogeneous microstructure corresponded to the Mo-rich and Mo-lean regions, respectively. Regions with lower Mo content showed higher values of hardness and elastic modulus as a consequence of higher content of ω-phase.

Keywords: Ti-beta alloy, segregation, nanoindentation, hardness, elastic modulus

P3

Black Cumin Seed Oil-in-Water Nanoemulsions - Preparation by High pressure homogenization & Evaluation of Stability

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Synthetic medicines indicated to act against any disease are often accompanied with severe adverse effects, and warrant investigation into new natural and economic molecules. Natural compounds, which are affordable and efficient are increasingly gaining popularity and are justified using *in vitro* systems. Thymoquinone is one of the natural bioactives derived from *Nigella sativa* sp. and is been brought forward for its activity against diseases such as cancer. However, its undesirable pharmacodynamics and pharmacokinetics result into poor bio-functionality and solubility in aqueous solvents, hence *in vivo*. They may be improved by emulsification and encapsulation of the molecules. Emulsification systems are a delicate field of study, related to various physical and chemical instabilities. In this study, we encapsulated the thymoquinone containing black cumin seed oil in various formulations of 1% emulsifier concentration using conventional methods and evaluated its stability. We identified certain emulsifying agents for the delivery system for thymoquinone, which could significantly improve its efficiency and stability, without any change in the structure or function of the compound, and validated with parameters such interfacial tension, Sauter mean droplet diameter, and zeta potential at varying pH, centrifugation and ionic strength. Effect of different storage temperatures was also carried out at 5°C, 25°, and 40° along with the determination of the most effective emulsifier for freeze thaw cycles. We believe that the identified novel formulations have tremendous role in improving therapeutics involving natural compounds, and will contribute in designing new functional products.

Keywords. *Nigella sativa sp., thymoquinone, anticancer, nanoemulsification, stability*

P 4

Creation of smarter aptameric reagents for the global antigenic diversity of influenza viruses

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Biopolymers such as DNA are a kind of molecular machine that are engineered by Nature at the atomic level. In this research, we introduce 'SELCO' (systematic evolution of ligands by competitive enrichment) as an effective strategy to mimic the essence of Nature and create smarter molecular machines to deal emerging global diversity of Influenza virus that are not known to exist in Nature. Influenza viruses have already been affected millions of individuals and become a worldwide concern for the health care and research community. Antigenic shift-based disease proliferation produces diverse destructive subtypes of the Influenza virus for which the previously selected antibody become non-functional.

The molecular biology exploration for evolving new aptameric reagents involved in recognition of diseased molecule with high affinity and specificity outsmart the antibodies and provide a superior platform for identification of the diseased molecules. However, this research has been limited to laboratories for quite a long time now because of cross reactivity between biomolecules of similar structural configuration. Henceforth, in this research we explore the possibilities to isolate diagnostic reagents, DNA aptamers for the life-threatening subtypes of Influenza A virus, H1N1 and H3N2 in parallel, providing reliability and clear identification of the infective subtypes. The competitive selection force, enhances the selectivity besides the affinity of the probe molecules for the distinct subtype. For further confirmation of the specificity of the selected probe by SELCO, we use DEPSOR (disposable electrode printed sensor) [1, 2] to evaluate the cross reactivity of the selected probe molecules for each subtype (Figure 1).

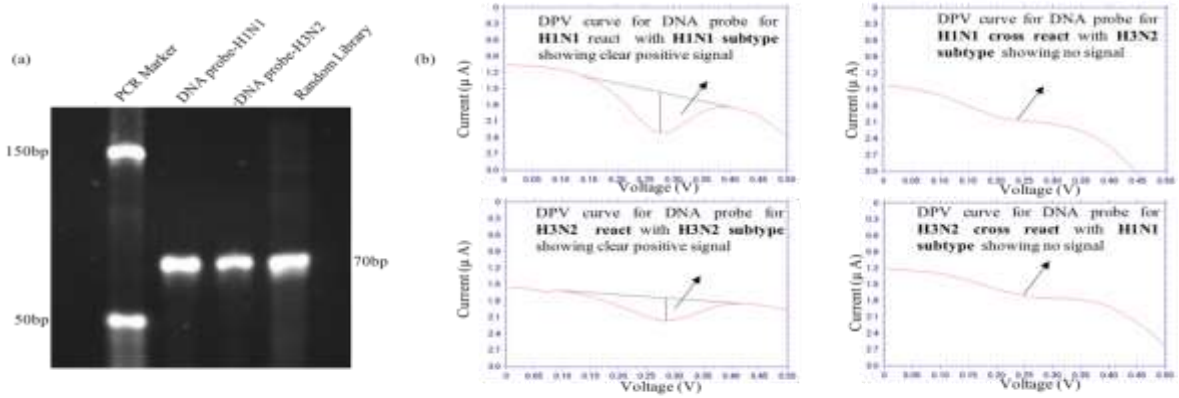

Figure 1: (a) Electrophoretic analysis results for the selected candidate probe molecule followed by counter selection after positive selection for both targets in parallel (b) Electrochemical curves plot for current (μ A) on X-axis and potential (V) on Y-axis generated using electro analysis system following the cross reactivity check using disposable electrode printed chip (The above experiment was repeated three times for confirmation).

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P 5

High efficiency silicon hybrid solar cells via energy management by employing nanocrystalline Si quantum dots and Si nanoholes

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Light harvesting via nanostructures or microstructures has been widely used in photovoltaics (PVs) to enhance the absorption of the active layer [1]. Many researchers have focused on the fabrication of optically active nanostructure arrays on the surface of solar cells such as silicon nanowires (SiNWs), silicon nanoholes (SiNHs), and silicon nanocones (SiNCs). More recently, light harvesting via excitonic energy transfer has inspired significant research efforts aiming to realize and design energy transfer-based light-harvesting systems for solar energy conversion, optoelectronic devices, and other biomedical applications [2]. By employing nanocrystalline Si quantum dots (nc-Si QDs) and modified silicon nanoholes (m-SiNH), we have achieved 13.73% efficiency in Si/PEDDOT:PSS hybrid solar cells. The efficiency enhancement is based on the energy transfer phenomenon of nc-Si QDs to make an effective exciton collection efficiency in the m-SiNH/PEDOT:PSS region for excellent carrier separation. Such Si/PEDOT:PSS hybrid solar cells exhibit high Jsc of 37.85 mA/cm^2, Voc of 0.595V, FF of 60%, and thus power conversion efficiency (PCE) of 13.73%. The main reason is due to the energy transfer effect of nc-Si QDs, which absorb UV light and convert non-radiative energy transfer (NRET) and radiative energy transfer (RET). The organic-inorganic hybrid solar cells obtained here holds the promise for developing energy transfer managing, low cost and high efficiency photovoltaic cells in the future.

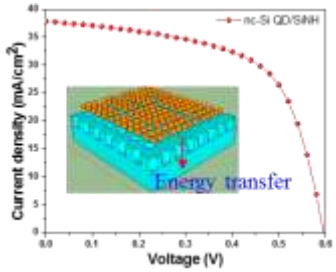

Figure. Schematic diagram and IV curve of hybrid solar cells

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P 6

Topological Defect-Mediated Kinetic Growth of Crystalline MOFs with Anomalous Morphological Complexity

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General requisite for designing high-performance materials is a high structural integrity up to meso-/macroscopic length scale. Current stage of supramolecular chemistry enables a facile strategy to assembly molecular building blocks into varies of novel nanostructures with high symmetry. However, it is still a big challenge to achieve high structural anisotropy from nanoscopic to meso-/macroscopic length scale due to numerous kinetic traps in the field of supramolecular chemistry. Inspired by those delicate biological assemblies in the nature that they ubiquitously make use of physical perturbations to realize structural anisotropy in a meso-/macroscopic length scale,1 herein, we report topological defect-mediated kinetic growth of crystalline microstructure with anomalous morphological complexity (Figure 1). The topological defect located at the center of the square peripheral crystal plays a pivotal role in mediating the nucleation and growth of a new crystalline phase with different composition based on in-situ observations. The obtained heterogeneous-structured crystalline microstructure exhibits unique photoluminescence properties (Figure 1). And more importantly, when a steady mercury light irradiation (450-490 nm) is applied to the isolated cubic crystal, we observed a reversible change in fluorescence emission because of subtle structural fluctuations induced by trans/cis isomerization.

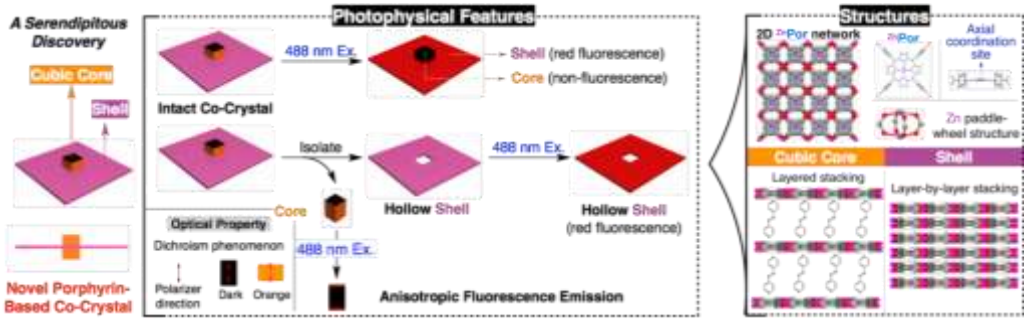

Figure 1. The illustrations of the morphology, photophysical properties and structure of heterogeneous-structured crystalline microstructure

P 7

Land-use urban morphology identification using digital surface model over Indian cities

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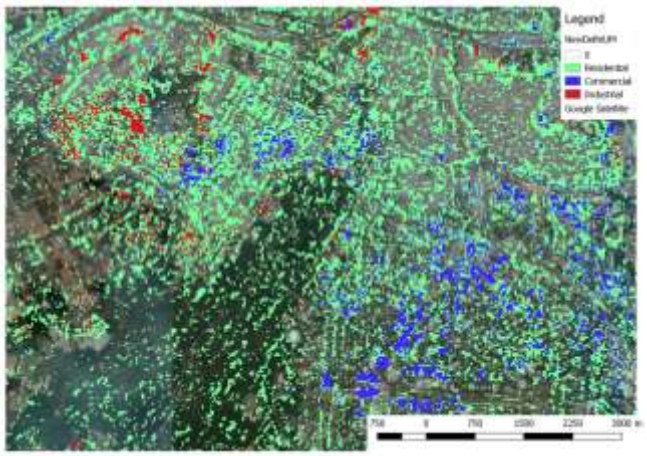
Urban air pollution is rising in many South/South-East Asian countries. E.g. half of the world's 25 most polluted cities lie in India (WHO, 2016). Reasons for growth of anthropogenic pollutants like PM2.5 are unclear due to lack of historical observations. Top-down approaches like satellite remote sensing can fill this gap by providing spatially and temporally continuous indication of fine mode anthropogenic aerosol (Misra and Takeuchi, 2017). Yet it is still challenging to relate them with bottom-up approaches so that contribution of different sources (e.g. factories, residential biomass burning, diesel genset, roads dust, etc.) can be evaluated. Previous researches have used bottom-up inventory datasets prepared by statistical information or extensive field surveys. However in a developing country like India, such approaches usually suffer from lack of updated data or other limitations. In this research we proposed a technique of identifying land-use urban morphologies which can be used for preparing emission inventories. We considered residential, commercial and industrial areas as they have different contributors of PM2.5. Our hypothesis is identification of such structures by remote sensing datasets owing to their different height structures and night time lights as seen from space. We didn't consider tall residential apartments due to their prevalence mainly in Tier-1 cities. We utilized digital surface models (30m resolution ASTER and AW3D30) and nightlight radiance (450m resolution VIIRS DayNightBand' in 20 cities India. Our results indicate high precision (0.83 to 0.95) and recall (0.69 to 0.98). Tier 1 cities present complicated urban land-use morphologies, resulting in low precision and recall values. Due to open data this approach is applicable for wider use.



P 8

Numerical Study on Seismic Structural Performance of Hollow Steel-Encased Concrete Piles

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This study examines the bending behavior of precast steel-encased concrete (SC) piles up to the ultimate damage state. Tests were carried out on SC piles under different loading conditions previously. Using data from these experiments, an analytic tool is presented to simulate the structural behavior of such piles by using fiber-based modelling approach in OpenSees. The flexural behavior is studied by focusing on moment vs. curvature relationships. A set of 6 piles under combination of cyclic lateral and high, constant axial loads is analyzed to improve the estimation of yielding and load carrying capacities. A comparison between test and numerical results is presented in terms of the moment-curvature relationship. It is seen that the analysis efficiently captures the pile behavior and accuracy increases with employment of linear tension softening in concrete model and isotropic strain hardening in the steel model.

P 9

Tuning of Multicolored Emission and Slow Magnetic Relaxation in Trimetallic $Eu_xTb_{1-x}[Co(CN)_6]$ Coordination Polymers

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Polycyanidometallate-based heterometallic materials arouse a considerable interest due to their diverse magnetic, optical and magneto-optical properties.[1] Among others, the d-f cyanido-bridged coordination polymers can serve as a source of bifunctional magneto-luminescent materials. In this context, we present a series of trimetallic $\{[Eu^{III}_xTb^{III}_{1-x}(3\text{-}OHpy)_2(H_2O)_4][Co^{III}(CN)_6]\}\cdot H_2O$ (x = 1, 0.8, 0.5, 0.4, 0.3, 0.2, 0.1, 0) chains.[2] Single crystal X-ray diffraction analysis revealed that all the compounds are composed of zig-zag chains of $[Co^{III}(CN)_6]^{3-}$ and $[Eu^{III}(\mu\text{-}NC)_2(3\text{-}OHpy)_2(H_2O)_4]^{+}$ ions bridged by cyanide ligands. These complexes show tunable photoluminescence ranging from green, through yellow and orange, to red color depending on the composition of the material, and the excitation wavelength in the UV range (Figure 1). Furthermore, the Tb-rich members of this family show a field-induced slow relaxation of magnetization because of magnetic anisotropy of Tb^{III}. The $Eu_{0.8}Tb_{0.2}Co$ compounds reveals nearly one relaxation process with an energy barrier of $\Delta E/k_B$ of 35.8(6) K and τ_0 = 1.1(2)·10^{-8} s at H_{dc} = 1500 Oe, that indicates a single-molecule magnet behavior.

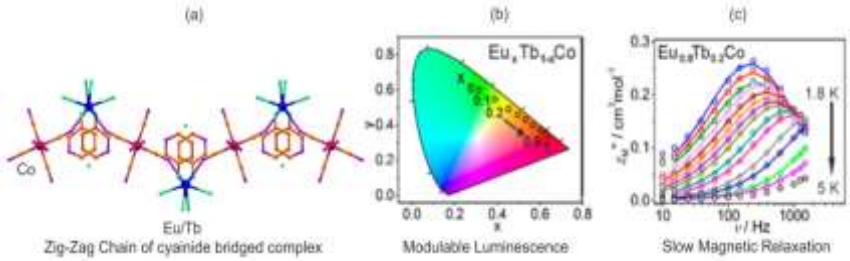

Figure 1. The crystal structure (a), the composition dependent multicolored photoluminescence (b), and the slow magnetic relaxation (c) of the trimetallic $\{[Eu^{III}_xTb^{III}_{1-x}(3\text{-}OHpy)_2(H_2O)_4][Co^{III}(CN)_6]\}\cdot H_2O$ chains.

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P 10

Behaviour of Clay Brick Masonry with Soft Brick under Uniaxial Compression

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The compressive behaviour of brick masonry made of soft bricks is investigated. Uniaxial compression tests are performed on masonry specimens made using mortars of different strengths. The influence of head joints is evaluated using specimens with three different aspect ratios. The failure in the masonry is studied in relation to the relative arrangement of the head joints. The ultimate strength in masonry with head joints is lower than the strength obtained from masonry tested in stack bonded configuration. Damage is associated with cracking in the mortar due to lateral tension produced by the confined expansion of brick. Failure is produced by vertical splitting and the number of cracks depend upon the tensile strength of the mortar relative to the brick and the number of head joints. Head joints act as stress risers, leading to high tensile stress.

Keywords: Bricks; Mortar; Brick masonry; Compressive strength; Aspect ratio.

P 11

Development of post-translational acyl transfer reaction toward *in vitro* synthesis of peptides with carbon-backbone

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Bioactive peptides are often composed of not only proteinogenic α-amino acids but also amino acids with carbon-backbones like β-amino acids, γ-amino acids, and their derivatives. Since such carbon-backbones enable peptides to increase the hydrophobicity and moderate flexibility of the global conformation, they are considered as attractive building blocks for bioactive peptides[1]. Although the peptides with carbon-backbone structures are elegantly biosynthesized by non-ribosomal peptide synthetases (NRPSs) in nature, NRPSs are evolved to produce specific natural products and are difficult to be applied for the synthesis of artificial molecules.

On the other hand, translation reaction is a versatile biosynthetic pathway that can produce various polypeptides according to mRNA templates and the genetic code. Although the translation system only produces peptides composed of 20 kinds of natural proteinogenic α-amino acids in general, our group previously developed an engineered translation system named FIT (Flexible *In-vitro* Translation) system, in which polypeptides containing artificial residues can be synthesized[2]. In the FIT system, arbitrarily chosen native aminoacyl-tRNAs are substituted with artificial acyl-tRNAs, so that the designated artificial residues can be used in a reprogrammed genetic code[3]. Indeed, the FIT system has demonstrated translational synthesis of peptides containing β-amino acid[4]. However, amino acids with longer carbon-backbone, like γ-amino acids, are still incompatible with translation, since the ribosome cannot accept them as substrates.

This research aimed a new method to express peptides containing long carbon-backbones *in vitro* followed by post-translational acyl transfer reactions. In this presentation, we will discuss design of artificial amino acid residues for this method and demonstration of the post-translational acyl-transfer reaction to yield peptides containing carbon-backbones.

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P 12

Content Analysis of EIA reports in India

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EIA stands for Environmental Impact Assessment. Overall EIA offers a systematic process of examination, analysis, assessment of planned activities with a view to ensuring environmentally sound and sustainable development (Glasson et al, 1999). In India, EIA started in administration with River Valley Projects 1978-1979 then industries, thermal power, mining scheme etc., are added. EIA statutorised by mandatory Environmental Protection Act 1986 and by EIA Notification 1994 & its amendments for 29 development activities (screening mainly based on investment). Then came EIA Notification 2006 and its amendments-presently in use (based mainly on capacity). While almost 23 years passed after EIA system has officially started, it is hard to find research papers related with EIA reports analysis in India. The purpose of this research, therefore, is to analyse EIA reports submitted by Project proponent.

There are 8 main activities which are divided into 39 sub-activities. These 39 sub-activities are divided into 2 groups- "A" and "B". "A" category projects are those where Environmental Clearance (EC) will be granted by Central Government whereas for "B" category EC will be granted by State Government. Category "A" and Category "B", division based on the spatial extent of potential impacts and potential impacts on human health and natural and man-made resources. Category "B" has two cases "B1" and "B2", in B1- forms and document submission, inspection, analysis is done as in Category "A" but in "B2" only Form1 is needed to be submitted.

The system has Single Window Clearance System (SWCS) for EC for both Category "A" and Category "B", for Category "A"-started from 3rd July'14 & for Category "B"-started from 2nd July'15. In SWCS, project proponent have to upload documents. From website of Ministry of Environment, Forest & Climate Change (MoEF & CC), 281 EC granted reports of Category "A" are collected and content of these reports will be statistically analysed. This will help in better management of EIA procedure, so, will help to make the system more uniform.

P 13

People Flow and Spatio-Temporal Density Representation in Maputo, the Capital of Mozambique

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KEY WORDS: people flow, urban mobility. GIS analysis.

Understanding human mobility has always been an interesting topic for many applications. Spatial and temporal aspects of people movement have been considered valuable for applications such as traffic management, Urban planning as well as disaster management. For years, travel surveys are conducted to understand travel behavior in metropolitan areas by collecting travel diary of participants as well as their socio-economic and demographic attributes.

In this research, we support person trip travel survey data (PT) in Maputo, the capital of Mozambique with available open source geospatial datasets to create a high-resolution Spatio-Temporal trajectory for all survey participants. The sampling methodology of the survey ensures it's representation to the population. We use Moderate Resolution Imaging Spectroradiometer land cover dataset (MODIS) to geo-smooth the origin and the destination of each trip from aggregated zone level to node level by probabilistically allocating weights to each land cover class. In order to estimate the most probable route for each trip, we prepared a road infrastructure network from available openstreetmap road links using open source pgRouting library. The geo-smoothed origin and destination points of each trip are used as an input to Dijkstra algorithm to calculate the shortest route along the road network. Using departure and arrival time of each trip, we applied 1 minute interval interpolation to estimate the spatio-temporal position of each user during the day. The output of this research enable to understand the dynamic flow of people and observe the spatial distribution of human density in the capital throughout the day. Such understanding can provide more value to public sectors such as urban planning, transportation or disaster management. It can also be used for intelligent geo-marketing and outdoor advertisement.

P 14

Development of Solid Base Catalyzed Stereoselective 1,4-Addition Reactions in the Batch and Flow System

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β-substituted derivatives of glutamic acid are essential nutrients for mammals including humans. They are not only one of the key structural components of peptides and proteins but also a vital ingredient in numerous biochemical pathways.[1] The catalytic stereoselective 1,4-addition of glycine derivatives to α,β-unsaturated carbonyl compounds or other Michael acceptors is one of the effective synthetic routes for the synthesis of these molecules. However, such synthetic methodologies are still not adequate due to the low stereoselectivity at the β-position and the unwanted formation of pyrrolidines derivations via [3+2] cycloaddition.[1] Herein, we have developed an efficient methodology for the synthesis of β-substituted glutamic acid derivatives via stereoselective 1,4-addition of glycine derivatives to α,β-unsaturated ester using $CsF•Al_2O_3$ as a highly efficient, environmentally friendly and recyclable solid base catalyst. $CsF•Al_2O_3$ showed great selectivity towards 1,4-addtion reaction by suppressing [3+2] cycloaddition for several β-substituted α,β-unsaturated esters, including most challenging β-alkyl substituted α,β-unsaturated esters with high yield and excellent anti-diastereoselectivity.[2] The characterization of the best catalyst done by the various techniques such as XRD, FT-IR, ^{19}F MAS-NMR, XPS and CO_2-TPD recognized the crystalline phase of Cs_3AlF_6 as the most probable active basic site responsible for the selective 1,4-addition reaction. Continuous flow synthesis of the 3-methyl glutamic acid derivative was successfully demonstrated by using the novel solid base-catalyzed methodology.

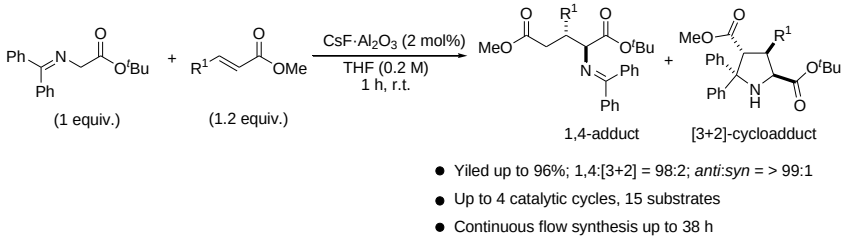

Figure 1: Catalytic 1,4-addition reaction using $CsF•Al_2O_3$ as solid base.

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P 15

Enhanced figure of merit in low thermal conductivity distrontium silicide (Sr_2Si) by spark plasma sintering technique

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MgSrSi-type (anti-$PbCl_2$ type) structure is an orthorhombic structure of space group *Pnma*. These compounds are calculated to be narrow-gap semiconductors when the number of valence electrons are 8 [1]. However, experimental evaluation of thermoelectric properties of these compounds are lacking, possibly because of the difficulty in synthesis and the high reactivity of the product. Although Ca_2Si has been already studied by Wen *et al.*, the reported *ZT* was 2×10^{-5} at 373 K [2]. Among such compounds, we selected Sr_2Si as a new candidate thermoelectric material, due to relatively wide calculated band gap ~0.5 eV and relatively large atomic mass.

In this study, we successfully synthesized Sr_2Si by annealing Sr (99.9%) and $SrSi_2$ (99.9%) in Ti container at 977ºC for 48 hours. A dense bulk with 98% of theoretical density was obtained by spark plasma sintering. Presence of excess Sr reduced the formation of Sr_5Si_3 impurity, resulting in single-phase Sr_2Si except for small amount of Sr_3SiO impurities. Without adding any extrinsic dopant elements, the Sr_2Si bulk exhibited good thermoelectric properties: Seebeck coefficient +157μV/K, electrical resistivity 425 μΩm, power factor 219 μW/mK^2, thermal conductivity 1.02 W m^{-1}K^{-1}, and *ZT* ~0.14 at 773 K. This was the highest *ZT* reported for MgSrSi-type compounds. Further improvement in *ZT* is expected, as there are many possible dopant elements that compose MgSrSi-type structure.

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P 16

Elucidation of relative drought responsiveness in pearl millet using RNA-Sequencing approach

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Pearl millet is a cereal crop known for its high tolerance to drought, heat, salinity stresses and for its nutritional quality. The molecular mechanism of drought tolerance in pearl millet is unknown. Here we attempted to unravel the molecular basis of drought tolerance in two pearl millet inbred lines, ICMB 843 and ICMB 863. Under greenhouse condition, ICMB 843 was found to be more tolerant to drought than ICMB 863. We sequenced the root transcriptome of both lines under drought and control conditions using an Illumina Hi-Seq platform, generating 139.1 million reads. Mapping and annotation of transcripts against the foxtail millet genome led to the identification of drought responsive genes. Total of 6799 and 1253 differentially expressed genes were found to be involved in drought tolerance in ICMB 843 and ICMB 863, respectively. Pathway and gene function analyses revealed that the drought response in pearl millet is mainly regulated by carbohydrate, amino acid and lipid metabolisms and involves pathways related to photosynthesis, hormone signaling and mitogen-activated protein kinase. A KEGG analysis indicated that respiration is affected by drought stress. The changes in transcript abundance determined by RNA sequencing were confirmed by the expressions of 10 drought-induced genes measured by quantitative reverse-transcription PCR.

These results are a first step to understand the molecular mechanisms of drought tolerance in pearl millet and lay a foundation for its genetic improvement

Keywords: Transcriptome, Drought, Pearl millet, Photosynthesis, RNA sequencing

P 17

Investigation of Slow-mode shocks in Earth's Magnetopause with Magnetospheric Mutiscale Mission

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The main driving process behind events like solar flares[1], magnetospheric storms[2] and astrophysical plasma jets[3] is magnetic reconnection. During this process, magnetic field lines break and reconnect, releasing large amount of energy explosively, accelerating and transporting particles from one region to another[4]. One of theories of magnetic reconnection is Petschek's reconnection theory[5]. In this theory, we have X-line geometry with two pairs of slow-mode shocks. Many studies have reported the presence of these slow-mode shocks in the anti-sunward region of Earth's magnetosphere called the magnetotail[6,7,8] but a few have reported existence of slow-shocks in sunward region of Earth's magnetosphere called the magnetopause[9,10]. Thus, the underlying physics of the slow-shocks in the magnetopause is not well understood and an exhaustive study with many events is needed. One of the reasons of the small number of the slow-shock events reported for the magnetopause is the lack of the high time resolution data to separate multiple discontinuities before the NASA's Magnetospheric Mutiscale (MMS) mission. Here we present a statistical study of slow-mode shocks in the dayside magnetopause crossings observed by MMS.

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P 18

Artificial photosynthesis catalyzed by earth-abundant metalloporphyrins

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Artificial photosynthesis is recognized as one of the most probable candidates to provide a realistic system from the viewpoint of renewable energy along with a well-balanced circulation of elements on the earth. Recent intensive studies on photoredox reactions and catalytic reactions that can be coupled with water oxidation processes strongly suggest that more a general concept should be defined for artificial photosynthesis from the viewpoints of renewable energy. Artificial photosynthesis thus should be scientifically defined as a fundamental science and technology that 1) can induce an uphill reaction that leads to energy accumulation as a result of a particular reaction, 2) uses water as the electron donor and the source material, and 3) uses sunlight irradiation. In view of the points described above, the conversion of solar energy into chemicals to generate fuels should be the most promising candidate for solving the energy crisis in the long term.[1] The solar cell, which directly generates electricity, is currently another candidate proceeding ahead of artificial photosynthesis. Visible light induced production of oxygen via four-electron process from water is one of the real bottle-neck in the field of artificial photosynthesis. Photochemistry of metalloporphyrins with earth abundant elements like Si, Al, and Sn as central ion which attracted much interest for the development of cost-effective water oxidation terminals has been studied by our group and molecular mechanism of electrochemical oxidation of water in to hydrogen peroxide was revealed on aluminum porphyrins.[2] The one-electron initiated two electron water oxidation pathway could overcome the bottle-neck in the four electron oxidation of water catalyzed by molecular catalysts.

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P 19

Molecular Mechanism of Anti-Cancer Properties in Fucoxanthin

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Fucoxanthin is a carotenoid abundantly found in the chloroplast of brown algae. It has been proposed to possess several health and therapeutic benefits including anti-cancer, anti-obesity, anti-inflammatory and anti-diabetes. However, mechanism(s) of action for these activities have not been supported by laboratory studies. With exponentially increasing incidence of cancer worldwide, it has been predicted that by 2030, 1 in 3 persons will have some kind of cancer. With this alert, and expected burden on health care and economy, search for natural compounds with cancer prevention and therapeutic value has been prioritized. In light of this, we initiated study to investigate the value and mechanism of anticancer activity in fucoxanthin using human cultured cells. Cell viability assay using a vital dye (MTT) showed that fucoxanthin is cytotoxic to a variety of cancer cells. Of note, we found that at low doses, it caused viability of a variety of cancer cells and was relatively safe for normal cells. We performed biochemical and imaging analyses that revealed that fucoxanthin is an anti-mortalin molecule and caused transcriptional activation of p53 resulting in growth arrest or apoptosis of cancer cells. Activation of wild type p53 in cancer cells was confirmed by p53-dependent reporter assays. Long term colony forming assays confirmed reduction in colonigenicity. Furthermore, we found that nontoxic low doses of fucoxanthin inhibited the migration of cancer cells in Wound-Scratch assays suggesting that it might be recruited for treatment of metastatic cancers. Molecular mechanisms of cytotoxic and anti-migration activities of Fucoxanthin for cancer cells with variable p53 status is under investigation.

P 20

Bioassays for Activities in The Grape Seed Extract: A Preliminary Study

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Gapes are known for high content of simple phenols, phenolic acids, cinnamic acids, anthocyanins, flavinoids, resveratrol and carotenoids. Dietary consumption of grapes has been recommended for healthy lifestyle, good cardiac and brain functions, lipid lowering activity, anti-oxidative, anti-inflammatory and anti-hyperglycemic effects. It has been shown to lower incidence of degenerative diseases such as cardiovascular disease and certain types of cancers. Most of these ailments have high cost of treatment, low rate of success and yield high economic burden. Furthermore, large proportion of the world population does not have access to the sophisticated treatment regimes. In view of these, the natural compounds have attracted attention due to their economic and safety aspects. In the current study, we prepared extracts by 95% ethanol extraction of the grounded grape seeds. The crude extract was freeze-dried and dissolved to obtain appropriate concentrations in DMSO. Human melanoma (G361) and normal (TIG-3) cells were treated with the extracts to determine their cytotoxicity by cell viability assays. We demonstrate that the extract was nontoxic to cancer as well as normal cells (in the range of 0.01-1.0%) in short-term viability and long-term colonigenic assays, and serial passaging. Molecular studies revealed no variation on the expression tumor suppressor proteins. Further with the help of oxidative stress models; hydrogen peroxide (H2O2), ultraviolet radiation (UV) and diacylglycerol 1-oleoyl-2-acetyl-sn-glycerol (OAG), we found that whereas the extracts did not offer any protection to stress caused by H2O2 and UV in cultured cells, OAG induced melanogenesis was significantly compromised in extract-treated cells as compared to the control (Figure 1). This data warrant further investigations to resolve (i) the active components and (ii) their mechanism of action to develop natural compounds/extracts for manipulation of melanogenesis. Such reagents will be useful for functional cosmetics on one hand and pigment related disease on the other.

P 21

Demethylation Drug 5'-Aza-2'-deoxycytidine Works Through Multi-pathway: Bioinformatics and Experimental Evidence

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Aberrant DNA methylation is a hall-mark of cancers. 5'-Aza-2'-deoxycytidine (5-Aza-dC) is a FDA approved DNA methyl-transferase inhibitor that causes DNA demethylation and activation of several tumor suppressor genes selectively in cancer cells. It is used in cancer therapy either alone or in combination of other drugs. Molecular mechanisms of its action, besides demethylation, have been predicted, but not completely understood. In this study, we performed an analysis for new functions of 5-Aza-dC by applying the bio-chemo-informatics approach. PASS online and Molinspiration was used to analyse the potential of 5-Aza-dC bioactivity. The Protein Networks and Biological Processes were analysed by Biological Networks using Gene Ontology tool, BINGO, based on BIOGRID database. Bioinformatics analyses predicted that 5-Aza-dC may function as a p53 inducer, radio-sensitizer, and inhibitor of some proteins, including HDM2, POLA1, POLB, and CXCR4 that are involved in induction of DNA damage response and p53-p21 signalling. By cell-based assays, we validated HDM2 as a target of 5AZA-dC. In an independent study, we performed loss-of-function miRNA screening in order to investigate its targets. We found it induces miRNA-335 that targeted CARF and several cell cycle regulatory proteins leading to growth suppression in cancer cells. Such growth arrest resulted in resistance of cells to drugs that work for dividing cells. Taken together, we demonstrate that 5-Aza-dC-induced growth arrest is a multi-module phenotype regulated not only by demethylation of DNA and protein expression, but also by noncoding miRNAs. Further studies are warranted to dissect these mechanisms and establish 5-Aza-dC as an effective multi-module anticancer reagent.

P 22

Honey Propolis for Cancer Treatment: Bioinformatics and Experimental Evidence to Mechanism of Action of Active Components, CAPE and Artepillin C

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Propolis is a resinous substance that honeybees make by mixing their saliva with plant sources including tree bark and leaves they live on. It has a complex chemical nature and is known to possess a variety of bioactivities. The two popular kinds of propolis, although known to possess anticancer potential, have been shown to differ in their active constituents. New Zealand propolis possesses CAPE (Caffeic Acid Phenethyl Ester) and Brazillian green propolis contains Artepillin-C (ARC). We have reported that anticancer activity of CAPE involves activation of p53-GADD45 signaling mediated by targeting of mortalin-p53 interactions. Furthermore, we reported that whereas CAPE was unstable in the culture medium (as it gets degraded into caffeic acid by secreted esterases), its complex with gamma cyclodextrin (γCD) showed high efficacy in anti-tumor and anti-metastasis assays *in vitro* and *in vivo*. In the current study, we report that similar to CAPE, ARC docks into and abrogates mortalin-p53 complexes causing activation of p53 function. The supercritical extract of green propolis (GPSE) and its conjugate with γCD showed stronger anticancer activity than the purified ARC in *in vitro* and *in vivo* assays. GPSE-γCD is proposed as NEW (Natural Efficient and Welfare) anticancer amalgam.

P 23

Establishment of CARF As a Stress Response Protein

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CARF, Collaborator of ARF (Alternate Reading Frame) is an ARF-interacting protein that activates ARF-p53 pathway. Overexpression of CARF causes growth arrest in cancer cells[2]; while, its excessively enriched levels shown to facilitate aggressive growth and malignant transformation of cancer cells[3]. Knockdown of CARF further was shown to trigger apoptosis[4], suggesting that it is an essential protein for cell survival. Molecular analyses of CARF functions revealed that it is upregulated during normal ageing process and is induced in response to a variety of drugs that cause premature aging[6]. Senescence induced by oncogenic RAS and deprotection of telomeres also showed upregulation of CARF at the transcriptional as well as translational levels[6]. Consistent to the characterization of CARF as a stress response protein, we aim to recruit it in a sensitive marker for stress prediction. Utility of such stress-diagnostics by quantitative and real-time CARF expression levels was tested for a variety of environmental stress models.

P 24

Anti-Stress Potentials of Tamarind Seeds: A Preliminary Study

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Tamarind is a sweet and sour fruit, a common component of Asian food and has a long history of medicinal use. It is known for easing stomach discomfort, fever, sore throat, inflammation, rheumatism, digestion and sunstroke. It has been shown to improve heart and nerve functions, improve circulation, manage body weight and diabetes, and boost immune response. Natural compounds have recently attracted attention as preventive and therapeutic medicine due to their safety and economic aspects. We have earlier identified anticancer, anti-stress and antiaging activities in *Withania somnifera, Helicteres augustifolia* and honey bee propolis using human cultured normal and cancer cells. Here we obtained tamarind seed extracts by 95% ethanol and water extraction. In cell based assays, we found that the extracts were safe for both cancer and normal cells (in the range of 0.01-1.0%, for at least 4 weeks). Consistently, molecular studies revealed no effect on the expression/activity of tumor suppressor proteins. We recruited oxidative stress models; hydrogen peroxide (H_2O_2), ultraviolet radiation (UV) and diacylglycerol 1-oleoyl-2-acetyl-sn-glycerol (OAG) and investigated the anti-stress potential of the extracts and found that whereas the extracts did not offer any protection to stress caused by H_2O_2 or UV, they significantly compromised OAG induced melanogenesis. The preliminary data warrant further investigations on the active components and mechanism of action to develop useful natural compounds/extracts for manipulation of melanogenesis that plays important role in response of cells to UV and its consequences including DNA damage, oxidative stress and related diseases.

P 25

Skin Pigmentation is a Stress Response

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Skin coloration from fair to dark is a well-recognized genetic phenotype. It is determined by amount and type of melanin pigment produced by specialized skin cells (melanocytes) in the basal layer of epidermis by a process called melanogenesis. Besides determining the skin coloration, melanin plays important role in tolerance of skin to stress and environmental conditions, including supra-optimal temperature, UV and oxidative stress. Several strategies including traditional home medicine and modern drugs have been in use to orchestrate stress tolerance of skin and to increase its outlook for safety and cosmetics. On the other hand, agents that induce depigmentation are valuable for treatment of moles, dark spots that appear on aging skin. Molecular mechanisms of melanogenesis and its manipulation by natural and synthetic drugs has not been completely resolved.

We previously established shRNA-mediated loss-of-function screening in conjunction with induction of melanogenesis by OAG (diacylglycerol 1 -oleoyl-2-acetyl-sn-glycerol) in human melanoma G361 cells. Cells were transfected with shRNA library and assayed for induction of melanogenesis by multidimensional approach, involving quantitative biochemical and visual determination of the melanin content and tyrosinase activity. Gene targets of the shRNAs that led to the loss of OAG-induced melanogenesis were considered as candidate cellular factors crucial for melanogenesis. We identified 40 gene targets. Bioinformatics and pathway analyses revealed that these gene targets are involved in the regulation of cell proliferation, apoptosis, stress response and mitochondrial functions. Based on these data, the role of mitochondrial stress chaperone, mortalin in melanogenesis was discovered. We demonstrate (i) its use as a molecular target for manipulation of melanogenesis and (ii) whitening effect of some natural and synthetic compounds in OAG-induced melanogenesis in cell culture models.

P 26

A Withaferin-A Derivative with Non-toxic and Anti-Stress Potentials: Molecular Evidence and Significance

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2,3-Dihydro-3β-methoxy withaferin-A (3βmWi-A) is a natural withanolide and shares structural similarities with withaferin-A (Wi-A). Wi-A is cytotoxic to human cancer cells and thus established as a candidate anticancer natural compound[1,2,3]; whereas 3βmWi-A lacked such activities[4]. Here, using cell-based biochemical, molecular, and imaging assays, we investigated and revealed that Wi-A and 3βmWi-A possess contrasting activities. Wi-A found to elicit oxidative stress in normal cells, while 3βmWi-A was well tolerated at even 10-fold higher concentrations. Contrary to induce stress, 3βmWi-A promoted survival and protected normal cells against oxidative, ionizing radiation, and chemical/therapeutic stresses. Analysis of its molecular activity revealed that 3βmWi-A induces anti-stress and pro-survival signaling through activation of the pAkt/MAPK pathway. Conclusively, we demonstrated that 3βmWi-A, contrary to Wi-A, is safe and possesses stress-relieving activity. It may be recruited to protect normal cells and hence enhance the therapeutic efficacy of chemotherapeutic drugs.

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P 27

Concurrent solid-state amorphization and structural rejuvenation in Zr-Cu-Al alloy by high-pressure torsion

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Amorphous alloys have been studied extensively due to their unique properties such as high strength and large elastic limit. Conventionally, amorphous alloys can be fabricated by melt-quenching without incurring crystallization. On the other hand, severe plastic deformation (SPD) can also induce solid-state amorphization (SSA) by the accumulation of structural defects. Since the mechanisms of the amorphous formation during melt-quenching and SPD are quite different such that there is no liquid-to-glass transition in SPD processes, the difference of the properties of the resulting amorphous alloys is worth investigating.

In this study, high-pressure torsion (HPT) was utilized to induce amorphization in a multi-phased Zr-40%atCu-10at%Al crystalline alloy, and we compared the mechanical and thermal properties of the solid-state amorphized sample to that of the metallic glass prepared by melt-quenching. Compared to the metallic glass, the SSA sample showed lower Vickers microhardness and homogenous plastic flow without shear bands under nanoindentation. Furthermore, the SSA sample exhibited a lower onset temperature of structural relaxation and larger relaxation enthalpy as measured by differential scanning calorimetry. These differences in mechanical and thermal properties can be attributed to the structural rejuvenation occurred concurrently with SSA.

P 28

Thermally bisignate supramolecular polymerization

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One of the enticing characteristics of supramolecular polymers is their thermodynamic reversibility, which is attractive, in particular, for stimuli-responsive applications[1]. These polymers usually disassemble upon heating, but here we report a supramolecular polymerization that occurs upon heating as well as cooling[2]. This behaviour arises from the use of a metalloporphyrin-based tailored monomer bearing eight amide-containing side chains, which assembles into a highly thermostable one-dimensional polymer through π-stacking and multivalent hydrogen-bonding interactions, and a scavenger, 1-hexanol, in a dodecane-based solvent. At around 50 °C, the scavenger locks the monomer into a nonpolymerizable form through competing hydrogen bonding. On cooling, the scavenger preferentially self-aggregates, unlocking the monomer for polymerization. Heating also results in unlocking the monomer for polymerization, by disrupting the dipole and hydrogen-bonding interactions with the scavenger. Analogous to 'upper and lower critical solution temperature phenomena' for covalently bonded polymers, such a thermally bisignate feature may lead to supramolecular polymers with tailored complex thermoresponsive properties.

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P 29

Deformation induced interfacial segregation of zinc in Mg–Zn–Y alloy

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We show here segregation of Zn atoms to different interfaces formed in a Mg-3Zn-0.5Y (at%) magnesium alloy by severe plastic deformation (SPD) by high pressure torsion (HPT) at room temperature (RT). Where as, only a small fraction of grain boundaries are segregated with zinc when same composition alloy extruded at 573 K (300 °C). The effects of strain rate and temperature on the diffusion behavior and segregation of zinc in these magnesium alloys have been studied. The segregation mechanism is explained through calculation of excess vacancy concentration and critical dislocation velocity as a function of strain rate. It is estimated that Zn atoms are transported by SPD induced vacancy flux in case of HPT at RT, whereas the Zn atoms are dragged by equilibrium vacancies and dislocations on extrusion at 573 K (300 °C). The amount of segregation to the different boundaries with different interfacial energies have been calculated by thermodynamic parameters and found to be in the range of 1–8 at% of Zn for the case of HPT process and 0.7–1.6 at% of Zn for extrusion processed specimens. These composition estimates well match with solute concentrations determined experimentally.

P 30

Allenamides as Orthogonal Hondles for Selective Modification of Cysteine

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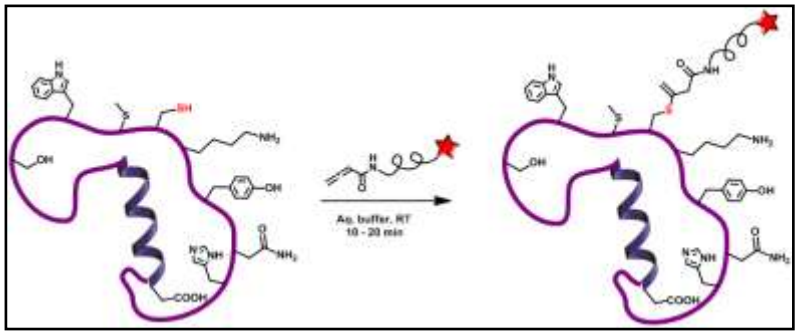
In this study, a remarkably simple and direct strategy has been successfully developed to selectively label target cysteine residue in fully unprotected peptides and proteins. The strategy is based on the reaction between allenamide and cysteine thiol which proceeds swiftly in aqueous medium with excellent selectivity and quantitative conversion forming a stable and irreversible conjugate. No metal catalyst or heating is required and no interference from any side chain of the unprotected peptide and protein is observed. The combined simplicity and mildness of the process project allenamide as robust and versatile handle to target cysteine with its potential use in the living system. Further fluorescent labeling studies demonstrated that the installation of C-terminal allenamide moiety onto various molecules of interest may supply a new methodology towards the site-specific labeling of cysteine containing proteins. Such new labeling strategy may thus open a window in for its wide application the field of life science in future.

Schematic diagram showing selective targeting of cysteine by allenamide in presence of other reactive side chains of various amino acids.



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P 31

CO_2 flux estimation from Indian Sundarban: Technology and advancement

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Due to the role of increasing atmospheric CO_2 concentration in climate change and global warming, characterising the source / sink nature of different natural ecosystems became the 'need of the hour'. The carbon sequestered in the vegetated coastal areas and marine living organisms is termed as 'blue carbon'. Amongst this blue carbon repository, mangroves, seagrasses and salt marshes are considered as the most important ecosystems.

World's largest stretch of mangrove forest named Sundarban of 10,000 km^2 areal extent is shared by India (~40%) and Bangladesh (~60%). Several endeavours have been taken to estimate the CO_2 flux from the Indian part of Sundarban till date. These flux estimations are based on CO_2 exchange between different compartments of the mangrove ecosystems namely, air-water, air-soil and air-vegetation.

The objective of the present work is to provide a broad overview on the technology and advancement of the measurement of CO_2 flux between different compartments of the Sundarban mangrove ecosystem (Indian part) from the review of our own works and other published works.

For estimation of air-water CO_2 flux, bulk formula method has been applied from the inner to outer estuarine zone. Air-water CO_2 flux varied depending on spatiality and seasonality with a mean flux of 0.28 g CO_2 m^{-2} day^{-1}. It was found that the organic matter rich waters leading to re-mineralization of CO_2 was abundant in inner estuarine stations, whereas, in the outer estuarine stations, lower partial pressure of CO_2 (water) was observed because of dilution of mangrove exported water mass by seawater lean in organic matter content. Incidentally the air-water CO_2 fluxes observed in the Sundarban waterways were fairly low compared to the results obtained in other mangrove waters of the world.

Static closed chamber method has been implemented for estimation of soil CO_2 efflux. The observations varied between 0.6 to 8.9 g CO_2 m^{-2} day^{-1}. The soil CO_2 effluxes mainly varied with the varying soil temperature along with a mild effect of soil moisture was found to play a regulating role seasonally.

The atmosphere-biosphere CO_2 flux has been estimated using flux gradient method, as well as the most advanced eddy covariance method. Estimated value of annual influx by mangrove forest using eddy covariance method was -2.5 ± 0.2 g CO_2 m^{-2} day^{-1} which is in parity with the fluxes estimated by other technique. Various factors were identified which regulated these fluxes.

P 32

Pt- free Catalysts for Next Generation Proton Exchange Membrane Fuel Cells

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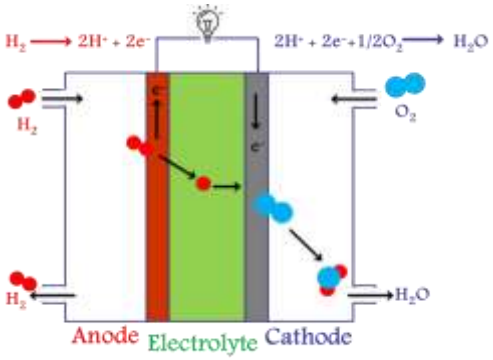
Research on renewable energy tehnologies have attracted much interest in recent years due limited availablity and enviournmental issues of fossil fuels. In this context, Proton exchange membrane fuel cells (PEMFC) have been getting much attention due to its properties like high power density, high energy efficiency and wide range of applications in different fields. Genarally PEMFC uses a water-based, acidic polymer membrane (eg. : Nafion) as its electrolyte which operates at temperatures below 100 ºC. This is the current leading technology for light duty vehicles and other applications. However the major shortcoming in the low temperature PEMFC which limit the application into the main stream are high system cost, low CO tolerence of Pt- based catalyst and low durablity. And fuel cells operate at high temperature up to 200 ºC are promising in terms of easy heat and water management, high CO tolerence ofcatalyst and fast electrode reaction kinetics. The development of nonprecious catalysts having better durability and excellent electrochemical activity continues to receive significant attraction for several years. Carbon nanomaterials especially hetero atom (N, P, S etc) doped graphene, carbon nanotube (CNT) and carbon nanofibers are widely using as electro-catalyst in different energy devices because of their excellent properties like high surface area, excellent thermal stability and high catalytic activity. In the present research we are developing efficient Pt- free catalysts for high temperature fuel cell applications.



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P 33

Magnetic properties and structure of high coercivity Sm-Co magnets

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[Introduction] Sm-Co magnets are expected as an alternative material for the Ne-Fe-B magnets in a high temperature environment. Sm-Co magnets have high Curie temperature and high anisotropic magnetic field[1]: Sm-Co magnets are ferromagnetic up to 900 °C although Nd-Fe-B magnets lose their permanent magnetic properties at 400 °C. Recently, we have succeeded in fabricating a high coercivity Sm-Co hard magnet with a coercivity exceeding 50 kOe. In this study, we have aimed to clarify the structure and magnetic properties Sm-Co magnets by changing the ratio of Sm and Co.

[Materials and Methods] Alloys with nominal composition Sm_xCo_{100-x} (x=18 - 20) were prepared by arc melting. Arc-melted Sm-Co alloys were then melt-quenched. Melt-spun ribbons were sintered using a spark plasma sintering (SPS) method. The alloys were annealed at various temperatures under an Ar atmosphere. To characterize the phase constitution, X-ray diffraction (XRD) measurements were performed. The magnetic properties were measured using a vibrating sample magnetometer (VSM) up to a maximum field of 90 kOe. Microstructural analyses were carried out using a scanning electron microscope (SEM) with energy dispersive X-ray spectroscopy (EDS) and X-ray fluorescence spectrometer (XRF).

[Results and Discussion] Fig.1 shows the SEM images of Sm-Co magnets sintered at 900°C for 3 min. The composition analysis by SEM-EDX revealed that the brighter area corresponds to the Sm_5Co_{19} phase and the dark area the $SmCo_5$ phase. Details of the magnetic measurements will be presented on the poster.

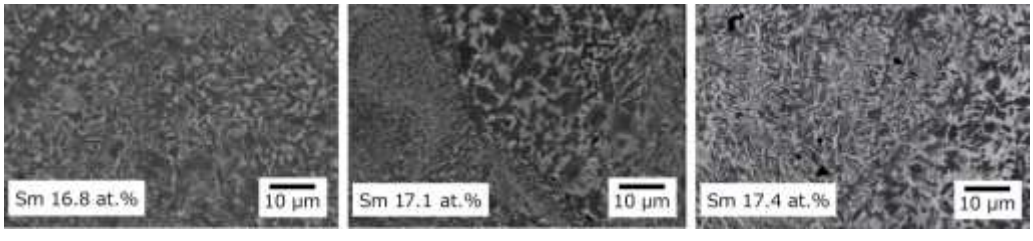

Fig.1 SEM images of sintered Sm-Co magnets with different Sm concentrations

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P 34

Magnetic properties of melt-spun Sm-(Co,Fe) ribbons

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$SmCo_5$ hard magnets have been commercialized because of their high Curie temperature and high anisotropy field. In particular, $SmCo_5$ having a very high coercivity, more than 50 kOe, has been reported[1]. The melt-spinning method has been employed to realized the high coercivity,. On the other hand, the saturation magnetization of $SmCo_5$ is 1.07 T[2], and improvement of magnetization is necessary for applications in high temperature environments. The partial replacement of Co with Fe is considered to be effective for improvement of the saturation magnetization $SmCo_5$. In this study, we have investigated the magnetic properties of $Sm(Co,Fe)_5$ ribbons prepared by melt-spinning. $Sm(Co_{0.8}Fe_{0.2})_5$ alloys were prepared by arc-melting high purity(> 99.9 wt%)Sm, Co, Fe. The alloys were subsequently melt-spun under an Ar atmosphere using single-roll melt-spinning technique with wheel surface speeds of 5, 20, 35, 48, 60 m/s. Phase identification of the ribbons was performed by X-ray diffraction (XRD) using Cu *K*α radiation. Microstructural analysis of the as-spun ribbons were carried out using scanning electron microscopy equipped with energy dispersive X-ray analysis (SEM-EDX). The magnetic properties of the ribbons were measured using a vibrating sample magnetometer (VSM) with an applied field up to 20 kOe. XRD patterns of the ribbons prepared at different wheel surface speeds of 5, 20, 35, 48, 60 m/s are shown in Fig.1. The patterns show that the $SmCo_5$ phase and a secondary phase exist in the melt-spun samples. The peaks of the ribbons prepared with high wheel surface speeds are found to be broadened, and the formation of the secondary phase is suppressed. Details of the magnetic properties will be presented in the poster.

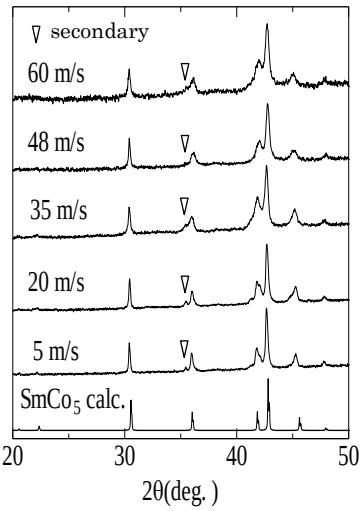

Fig.1 XRD patterns of the melt-spun $Sm(Co_{0.8}Fe_{0.2})_5$

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P 35

Moving Beyond the Nature with Metamaterials

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Metamaterials are artificial media created by subwavelength structuring, are useful for engineering electromagnetic space and controlling light propagation. Such materials exhibit many unusual properties that are rarely or never observed in nature. They can be employed to realize useful functionalities in emerging metadevices based on light. Using new metamaterials we can go beyond what nature has given us. Their properties are engineered by manipulating their structure rather than their chemical composition. The possibilities these materials open up are limited only by our imagination, and not by the number of elements in the periodic table. As a result, metamaterials research has exploded during the past decade. It has given us optical properties we once thought were impossible, including negative refraction never found in nature, and novel devices such as invisibility cloaks.

Among the varieties of metamaterials proposed and fabricated the hyperbolic metamaterials (HMMs) have rapidly gained a central role in nanophotonics, thanks to their unprecedented ability to access and manipulate the near-field of a light emitter or a light scatterer. They display hyperbolic (or indefinite) dispersion, which originates from one of the principal components of their electric or magnetic effective tensor having the opposite sign to the other two principal components. Such anisotropic structured materials exhibit distinctive properties, including strong enhancement of spontaneous emission, diverging density of states, negative refraction and enhanced superlensing effects. Already proven concepts such as the hyperlens require further extensive studies, to conclusively assess – and overcome – their practical limitations.

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Nucleotide Coordination With 14 Lanthanides Studied By Isothermal Titration Calorimetry

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With their hydrolytic, optical and magnetic properties, lanthanide ions (Ln^{3+}) are versatile probes for nucleic acids. In addition, nucleotide-coordinated Ln^{3+} ions form useful nanoparticles. However, the thermodynamic basis of their interaction is still lacking. In this work, isothermal titration calorimetry (ITC) is used to study Ln^{3+} binding to nucleotides and nucleosides for the whole lanthanide series, revealing important thermodynamic trends and insights into their coordination. Ln^{3+} interacts mainly with the phosphate of cytidine and thymidine monophosphate (CMP and TMP), while the nucleobases of adenosine and guanosine monophosphate (AMP and GMP) are also involved. Phosphate binding achieves inner sphere coordination with Ln^{3+}, with a release of bound water molecules. With increasing atomic number of Ln^{3+}, the binding with GMP goes from exothermic to endothermic. The entropy contribution starts to increase from Gd^{3+}, explaining the 'gadolinium break' observed in many Ln^{3+}-mediated RNA cleavage reactions. This study provides fundamental insights into Ln^{3+}-nucleotide interactions, and it is useful for understanding related biosensors, nanomaterials, and catalysts.

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Future of AI and Cyborgs

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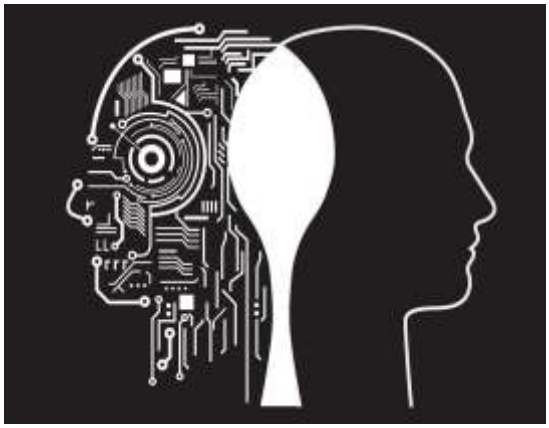
Writing algorithm to solve problem is great but those algorithms can't learn by themselves. That's where AI comes in. AI tries to replicates our brain in simulation. An AI model of an organism is a very-well-specified hypotheses about how that organism thinks and behaves. The predictions of a model are its behaviour, which we simply record after running simulations. Its assumptions are its components; for example, the computations it makes, the information it has access to, the things it perceives and remembers. We can use standard statistical tests to see how close we come to modelling behaviour in order to argue the validity of our assumptions.

AI is improving exponentially and if we are to continue to be the dominant species on this planet , we need to upgrade our intelligence . AI has access to much more computing power and data than our biological brains do[1] . We need a device which would act as brain computer interface that would allow the interaction between our Biological and Digital brain.It should give us read and write access to our own brain[2].This would allow us to have advantages of both Artificial Intelligence and Natural Intelligence.A lot of research is going in the field of Brain- Computer Interfaces. There are both Invasive and nonInvasive Brain-Computer Interfaces. Both have their own plus and minus Points . On the whole, if we will solve problems with AI taking human jobs, symbiosis of humans and machines seems very beneficial.



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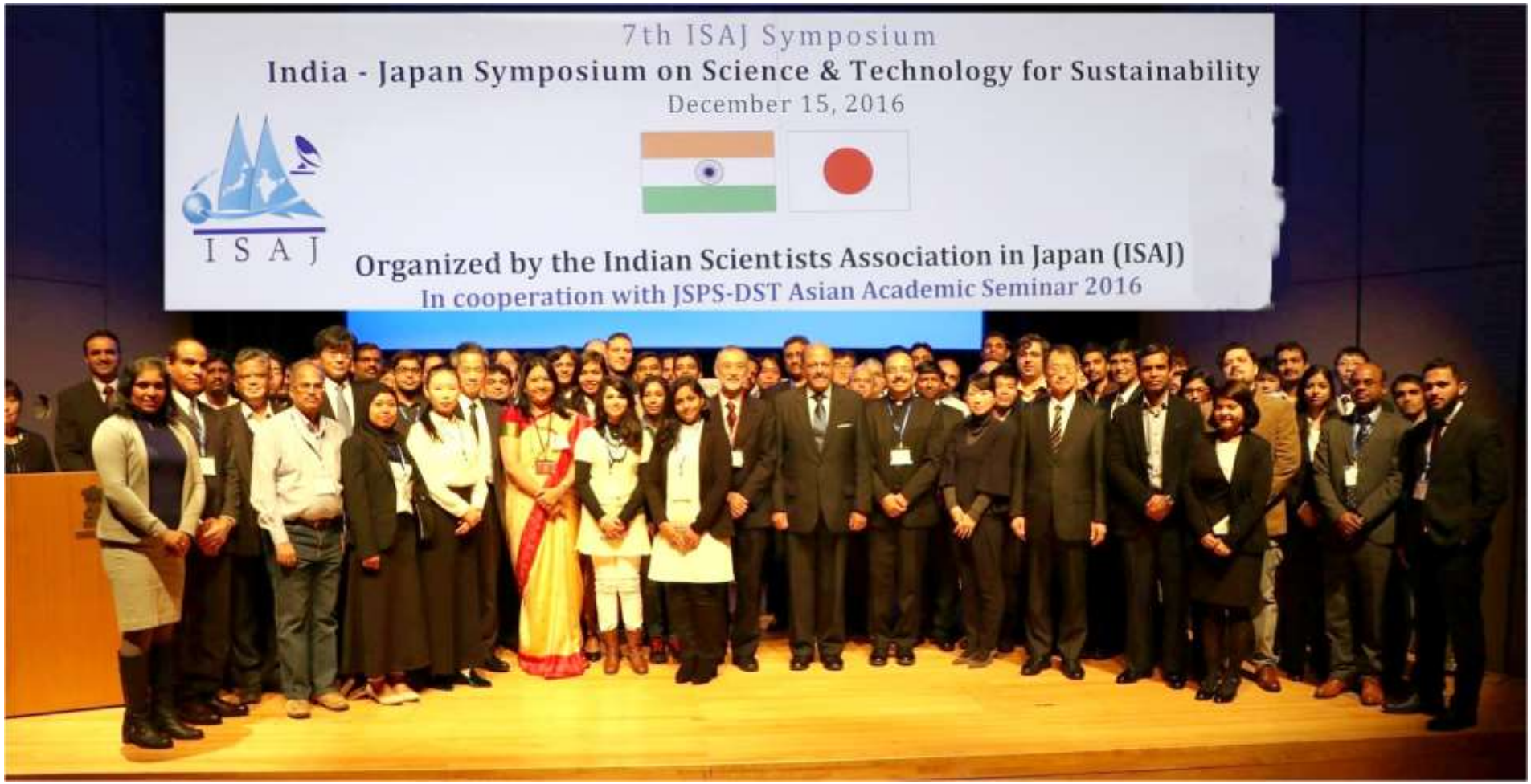
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