9th Annual Symposium of

INDIAN SCIENTISTS ASSOCIATION IN JAPAN

Interdisciplinary Science and Technology for Safety and Quality of Life

December 7, 2018

ISAJ

PROGRAM AND ABSTRACTS

AIST, Auditorium, Tsukuba, Japan

Dr. Sunil Kaul, Convener
Dr. Priyanka Jood, Co-convener
Dr. Manjiri Kulkarni, 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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Nov 15, 2018

Message

It gives me great pleasure to know that the Indian Scientists Association in Japan is organizing the 9th ISAJ Symposium on December 7, 2018 and that the theme for this year is **"Interdisciplinary Science and Technology for Safety and Quality of Life**". I remember with great pleasure having inaugurated the ISAJ in 2009 and meeting the very bright community of scientists forming the ISAJ. I congratulate the ISAJ executive team and all the members of the supporting and organizing committees for having kept this Association active and vibrant. I am also very happy that the venue of the meeting is at AIST, Tsukuba. AIST continues to have a strong collaboration with India. I understand that it has not only been the host for a large number of Indian researchers/students through the International Laboratory-DAILAB, formed in collaboration with DBT-India at IIT Delhi, but also, in the form of DAICENTER, has connected with several laboratories in India for integrating their complementary skills for mutual research benefit.

I am happy to see that the symposium will address the most frontier and multidisciplinary topics in science and technology and focus on Quality of Life. From the program that ranges from biotechnology to materials and space sciences to Yoga, I am sure that it will be very interactive and informative and enable the scientists to discuss their recent work, beyond theme boundaries.

I congratulate ISAJ for its constant efforts to increase the scientific cooperation between India and Japan, which India views as very valuable, and wish the Symposium all success

With kind regards
R. Chidambaram, DAE-Homi Bhabha Professor, BARC

के. विजयराघवन
भारत सरकार के प्रमुख वैज्ञानिक सलाहकार
K. VijayRaghavan
Principal Scientific Adviser to the Govt. of India

सत्यमेव जयते

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Message

It is my pleasure to write this message as an address to the delegates of 9th Symposium of Indian Scientists Association in Japan (ISAJ) held at the National Institute of Advanced Industrial Science & Technology (AIST), Tsukuba on Dec 7, 2018. I personally know both of these organizations for a long time and have interacted with them with a pleasant feeling and pride for the performance of our researchers. Japan is a special place and close to my heart. I am not only impressed by Japanese people as world-leaders in technologies, infrastructure and innovation but also by their politeness, patience, perfection and professionalism. In these premises, I believe that they offer us a great platform to polish our skills and take them to a higher level of success. During my visits to Japan at various occasions, I have witnessed their excellence in biotechnologies and am very glad that many of our scientists are there learning and performing in that environment. The world is changing rapidly in terms of its population demographics. Whereas Japan is facing problems of aging society, India is on the luckier side and has large population in their twenties. I believe that there is a great opportunity for young Indian population to learn from the experience and expertise of Japanese in a very mutually beneficial way. Culturally, we are very close to Japanese and relate well to their family and social values. I trust that this aspect is of big advantage for our people trying to make Japan their home, although there are challenges in learning language. Japan-India political ties have strengthened in last several years. India and Japan have regular annual Prime Ministerial level summits providing impetus to collaborations in various sectors. Several MoU in the field of Science, Engineering and Artificial Intelligence have been signed. I have been a part of many of these, and well aware of constant efforts of our Indian researchers who have not only implemented these MoU, but also took them to next phases successfully. DBT-AIST International Laboratory for Advanced Biomedicine (DAILAB) is one example that has become our pride.

I am glad that ISAJ is playing a key role in bringing all the Indian Scientists in Japan to one platform and networking internationally. The theme "Interdisciplinary Science and Technology for Safety and Quality of Life" of this year's symposium covers wide subjects selected very carefully in a most interdisciplinary and timely way providing an excellent opportunity for researchers to think beyond their boundaries and will be innovative in all aspects. I believe that an ultimate essence of these interactions is to improve the quality of human life and environment through multiplatform teachings, trainings and technology advancements. I truly believe that this symposium is covering all these aspects and congratulate the organizers for putting together this excellent program, and also enrolling their personal excellence and motivation to perform even beyond their expertise and barriers. I congratulate ISAJ and wish you all a grand success.

K. VijayRaghavan

(K. VijayRaghavan)
6th December, 2018

ISAJ
INDIAN SCIENTISTS ASSOCIATION IN JAPAN

Message from the Organizers

We the organizers, on behalf of Indian Scientists Association in Japan (ISAJ), would like to take this opportunity to sincerely welcome all the participants and guests to the 9th Annual Symposium of ISAJ on Interdisciplinary Science and Technology for Safety and Quality of Life. ISAJ is a nine-year old Non-Profit Organization (NPO). Orchestrated at the end of 2008 by coming together of many Indian scientists working in Japan and formally inaugurated by Prof. R. Chidambaram, the then Principal Scientific Adviser to the Government of India in January 2009, in the presence of His Excellency the then Ambassador of India, it has grown into a full-fledged organization. ISAJ has its functional chapters at Hokkaido, Sendai, Tsukuba, Tokyo, Kyoto and Kobe that have been promoting regular seminars, free discussions and networking at all levels. ISAJ has been focusing on networking among Indian scientists in Japan and serve as a strong bridge for India-Japan for Science & Technology exchange.

After seven successful annual symposia held at the Main Auditorium, Embassy of India, Tokyo, and one in University of Tokyo campus, we are very happy to welcome you to the ninth-one today at AIST-Tsukuba. In past eight symposia, we have always tried our best to make this event interdisciplinary, allowing wide participation and exchange of ideas and experiences beyond any thematic boundaries. Likewise, this year we have selected the theme entitled "Interdisciplinary Science and Technology for Safety and Quality of Life," which encompasses all disciplines of science and technology, such as physical, biological, chemical and mathematical sciences and engineering. We truly believe that this is a unique opportunity to interact with each other and learn beyond our specialized domains and to innovate our thoughts and research outcomes to the benefit of science and the society. We heartily welcome you, and are looking forward to intense interactions over the poster presentations. Young researcher's session has been the highlight of all our earlier symposia. This year too, we are looking forward to hearing from many young researchers on their work and pathway to success in Japan.

We are grateful to our guests, members and participants for their efforts in organization and participation in this event. We sincerely hope that we all will enjoy the symposium that will inspire India-Japan collaborations and friendships along with developing stronger ties in Science & Technology.

With best regards,

Sunil Kaul,
Chairman & Convener

Priyanka Jood,
Co-convener

Manjiri R Kulkarni,
Co-convener

Interdisciplinary Science and Technology for Safety and Quality of Life

9th Annual ISAJ Symposium

December 7th, 2018 (Friday)

Time	PROGRAM	
8:00-9:00	**Registration of participants**	
9:00-9:45	**Inaugural Session**	
9:00	Welcome Address	Sunil Kaul, Chairman, ISAJ
9:10	Inaugural Address	Dr. Katsunori Matsuoka AIST Vice-President Director General, Department of Life Science & Biotechnology
9:20	Special Address	Mr. Raj Kumar Srivastava Chargé d'affaires a.i. Embassy of India, Tokyo
9:35	Vote of Thanks	Alok Singh, Vice Chairman, ISAJ
9:45-10:15	**PHOTO SESSION & COFFEE BREAK**	
10:15-11:55	**Session – I** **Chair: Dr. Renu Wadhwa, AIST**	
10:15	Nobutaka Mitsuda National Institute of Advanced Industrial Science & Technology, Japan	Plant transcription factors --- Tool for crop improvement and beyond
10:35	Manish Biyani Japan Advanced Institute of Science & Technology, Japan	DEPSOR based biosensors and analytical platform for the SDGs
10:55	Kazuhiro Kimura National Institute for Materials Science, Japan	Activity of NIMS creep data sheet project
11:15	Santosh K. Gothwal Kyoto University, Japan	Regulation of class switch recombination by bromodomain protein Brd2
11:35	Shinichi Hasako Taiho Pharmaceuticals Co., Ltd., Japan	Drug development for lung cancer
11:55-13:00	**LUNCH & POSTER SESSION** **Chairs: Dr. Yoshiaki Onishi, AIST; Dr. Manish Biyani, JAIST;** **Dr. Nazmul Ahsan, University of Tokyo**	
13:00-14:10	**Session – II, Students Session** **Chairs: Dr. Caroline T. Cheung, AIST** **Ms. Vidhi Malik, Indian Institute of Technology (IIT) Delhi**	
13:00	Shreya Thusoo Tokyo Institute of Technology, Japan	Numerical study on steel-encased concrete section of earthquake resistant piles
13:10	Alok Kumar Kyoto University, Japan	Mechanistic analysis of unresponsiveness to the PD-1 blockade therapy
13:20	Priyanka National Brain Research Centre, India	HIV-mediated neurotoxicity in human astrocytes is modulated by stress chaperone mortalin/mthsp70
13:30	Nehpreet Kaur Walia University of Tokyo, Japan	Slow-mode shock observations in the Earth's dayside magnetopause

13:40	Yusuke Hashimoto Japan Advanced Institute of Science & Technology, Japan	Simple detection of amyloid-beta oligomers using peptide aptamer and DEPSOR based hybrid biosensor for Alzheimer's disease
13:50	Sneha University of Tokyo, Japan	Understanding multiplicity of urban governance and planning regulations for a metropolitan region with focus on land and private development – case study NCR – Delhi, India
14:00	Vidhi Malik Indian Institute of Technology (IIT) Delhi, India	Bioinformatics and experimental insights into the anti-metastatic activity of withaferin-A and its derivative 2,3-dihydro-3β-methoxy withaferin-A
14:10-15:50	**Session – III Chair: Dr. Alok Singh, NIMS**	
14:10	Parmanand Sharma Tohoku University, Japan	Creation of rare earth free meteoritic magnet
14:30	Ryouji Kurita National Institute of Advanced Industrial Science & Technology, Japan	Microfluidic disease marker determination by surface plasmon resonance technique
14:50	Steven Phillips National Institute of Advanced Industrial Science & Technology, Japan	Category theory for cognition
15:10	Ayako Yachie SBX Corporation, Japan	Towards predictive biology and beyond
15:30	Subramani Thiyagu National Institute for Materials Science, Japan	Effect of silicon nanocrystalline quantum dot on its energy transfer effect and applications for hybrid solar cells
15:50 - 16:00	**COFFEE BREAK**	
16:00-18:00	**Session – IV Chair: Dr. Mahesh Kaushik, University of Tsukuba**	
16:00	Nazmul Ahsan University of Tokyo, Japan	Next generation solar cell technology
16:20	Motomichi Doi National Institute of Advanced Industrial Science & Technology, Japan	Bioimaging-based screening for the factors concerning neuronal functions and diseases
16:40	Mahesh K. Kaushik University of Tsukuba, Japan	Sleep need and its relation to neurological disorders
17:00	Santosh Gaonkar Manipal Academy of Higher Education, India	One pot green synthesis of angiotensin II receptor antagonist drug losartan
17:20	Daisuke Kageyama National Agriculture and Food Research Organization (NARO), Japan	Selfish microbes that manipulate reproductive system of insects: basic and applied research on *Wolbachia*
17:40	Mahendra Kumar Pal National Research Institute for Earth Science and Disaster Resilience (NIED), Japan	E-Simulator: A high-performance simulation tool for seismic analysis and resilience assessment
18:00-18:30	**CLOSING SESSION AND POSTER AWARDS**	

List of poster presentations

No.	Name of presenter	University/Institute	Presentation Title
P1	Sajal Afzal	University of Tsukuba, Japan	Cucurbitacin B & Withanone (CucWi-N) for cancer treatment – merits and mechanism
P2	Lokesh Agrawal	University of Tsukuba, Japan	Role of serotonin 5-HT4 receptor in dendrite and axon formation of mice hippocampus neurons *in vitro*
P3	Zubin Atre	AtréYoga Studio, India	The biomechanics of yoga and its application to sports science
P4	Dudekula Althaf Basha	National Institute for Materials Science, Japan	*In-situ* straining studies of crack propagation behavior in pure Mg and Mg-0.3 at.%Y alloy in transmission electron microscope
P5	Rahul Bhardwaj	Japan Advanced Institute of Science & Technology, Japan	Single cell transcriptomics analysis with positional information using silicon chip
P6	Priyanshu Bhargava	National Institute of Advanced Industrial Science & Technology, Japan	A small molecule modulator of hypoxia: identification and therapeutic potency
P7	Gopakumar Changarathil	University of Tsukuba, Japan	Wild-type and SAMP8 mice show age-dependent changes in distinct stem cell compartments of the interfollicular epidermis
P8	Caroline TY Cheung	National Institute of Advanced Industrial Science & Technology, Japan	Differential expression and activities of microRNA-708 in human cancer cells with and without telomerase
P9	Nusaiba Madappura m Cheruthu	University of Tokyo, Japan	Development of ratiometric carbohydrate sensor based on boron dipyrromethene (BODIPY) scaffold
P10	Ashu Choudhary	National Institute for Materials Science, Japan	Revisiting grignard reagent based electrolytes in magnesium-ion battery: a first-principles study
P11	Paulino Cristovao	National Institute of Advanced Industrial Science & Technology, Japan	Designing loss-of-function that generates latent space for image in-betweening “interpolation”
P12	Nancy David	National Institute for Materials Science, Japan	Double layer surface modification of magnesium AZ31 alloy using ceramic oxide composite for orthopedic application
P13	Behnam Derakhshani	University of Zanjan, Iran	Comparative transcriptome analysis of two contrasting genotypes of barley reveals the gene networks involved in signal transduction
P14	Ambika Dudhate	University of Tokyo, Japan	P14: Comparative metabolite profiling of pearl millet for drought and salinity stress response
P15	Ahmed Elwakeel	University of Tsukuba, Japan	Cytotoxicity of fucoxanthin for a variety of cancer cells - molecular insights
P16	Kenta Goto	National Institute for Materials Science, Japan	Inverse estimation of stress-strain curve from load-displacment curve and indentation mark of single indentaion
P17	He Huifu	University of Tsukuba, Japan	Quantitative and qualitative cell viability (QCV) assay for evaluation of the short and long-term cytotoxicity of drugs
P18	Xin JI	National Institute for Materials Science, Japan	Twinning behavior of orthorhombic-α"

			martensite in a Ti-7.5Mo alloy
P19	Rajkumar S. Kalra	National Institute of Advanced Industrial Science & Technology, Japan	Clinical relevance of CARF in malignant and metastatic cancers: impact of beta Catenin activity
P20	Dai Kato	National Institute of Advanced Industrial Science & Technology, Japan	Design of nanocarbon film-based electrodes for biomolecular detection
P21	Ashish Kaul	University of Tsukuba, Japan	Molecular insights to the anticancer potential of honey bee propolis (green) extract
P22	Manpreet Kaur	National Institute for Materials Science, Japan	All-ceramic solar-driven water purifier based on anodized aluminum oxide and plasmonic titanium nitride
P23	Naoshi Kojima	National Institute of Advanced Industrial Science & Technology, Japan	Immobilization of genomic DNA with bifunctional linker molecules for 5-methylcytosine immunoassay
P24	Ling Li	National Institute of Advanced Industrial Science & Technology, Japan	Ashwagandha leaf extract Possesses anti-survivin activities
P25	Subrata Maji	National Institute for Materials Science, Japan	Macaroni fullerene crystals: novel nanocarbon materials for energy storage application
P26	Madhu Malini	Kyoto University, Japan	Combination immunotherapy using synthetic genetic switches
P27	Vaibhav P. Mehta	Yokohama National University, Japan	Estimating the dynamic stiffness and flexibility of laterally loaded pile foundation of seismically isolated cable-stayed bridge
P28	Murugan Muralidharan	National Institute for Materials Science, Japan	Iron sulphide nanoclusters biomineralized by the sulphate reducing bacteria enhanced synergetic anodic current generation with the Iron reducing bacteria
P29	S. Pavan Kumar Naik	National Institute of Advanced Industrial Science & Technology, Japan	Infiltration growth processing of bulk $YBa_2Cu_3O_{7-x}$/$REBa_2Cu_3O_{7-x}$ superconductors: Nano metal oxides and rare earth elements effects on crystal growth and physical properties
P30	Divya Naradasu	University of Tokyo, Japan	Low pH induced extracellular electron transfer by an oral pathogen
P31	Jingmin Nie	University of Tsukuba, Japan	Effects of N_2-nanosoluble water on anaerobic co-digestion of waste activated sludge & lignin
P32	Lalhaba Oinam	University of Tsukuba, Japan	Differential surface protein modifications during epidermal stem cell aging
P33	Amr Omar	National Institute of Advanced Industrial Science & Technology, Japan	Anticancer activity of soyasapogenol – potency and molecular mechanism
P34	Himankshi Rathore	Japan Advanced Institute of Science & Technology, Japan	Bio sensing of Leishmaniosis using FTA card as direct sampling tool for recombinase polymerase amplification
P35	Pathik Sahoo	National Institute for Materials Science, Japan	A time crystal aspect on slow release of sex pheromone from supramolecular container to control the pest in green way
P36	Ryuichi Saito	National Institute of Advanced Industrial Science & Technology, Japan	The novel F-box protein regulates a

			quick avoidance behavior to a pathogenic bacterium *P. aeruginosa* in *C. elegans*
P37	Anissa Nofita Sari	University of Tsukuba, Japan	Withaferin A and CAPE are potential inhibitors of PARP-1 and DNA repair
P38	Mengjiao Tan	University of Tsukuba, Japan	Short chain fatty acids production from blast furnace gas under anaerobic conditions: Effect of additional H_2, pH and inoculum pretreatment
P39	Shunsuke Tomita	National Institute of Advanced Industrial Science & Technology, Japan	Optical fingerprint-based sensing of proteins using an environmentally-responsive fluorescent polymer
P40	Tatsunosuke Tomita	National Institute of Advanced Industrial Science & Technology, Japan	Cell-based real-time reporter gene assay for circadian rhythm monitoring and its application
P41	Jia Wang	University of Tsukuba, Japan	Folic acid receptor-targeting of alcoholic extract of Ashwagandha leaves enhances its cancer cell selectivity
P42	Liu Xuan	National Institute for Materials Science, Japan	*In situ* heating TEM observations on the carbide formation in twinned martensite
P43	Sushma Yadav	National Institute for Materials Science, Japan	All-atom first-principles molecular dynamics study for ion selectivity across biological ion channel
P44	Hao K. Shen	University of Tokyo, Japan	1D Coassembly of chaperonin GroEL and streptavidin: potential application on drug delivery and biosensor

Plenary Lectures

Next generation solar cell technology

Nazmul Ahsan[1], Sivaperuman Kalainathan[2], Yoshitaka Okada[1]

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The field of renewable energy (i.e. solar energy) requires utmost attention to bring the climatic change and earth resource depletion under control. We would discuss on the theory and application of emerging semiconductors for solar energy conversion in high efficiency solar cells, for example, multi-junction tandem solar cells (MJSC) that can break the single junction solar cell efficiency limit. Special emphasis is given on intermediate band solar cells (IBSCs) who theoretical limit is around 63%. The experimental solar cell performance is further discussed, which has been recently demonstrated. IBSCs having widely different structures and materials. In our review paper[1], a detailed discussion including the current review are given on the thermodynamics of solar energy conversion in IBSCs, the device physics, and the carrier dynamics processes with a particular emphasis on the two-step inter-sub band absorption/recombination processes[2]. These processes are of paramount importance in a successful implementation high-efficiency IBSC.

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1. Y. Okada, N. J. Ekins-Daukes, T. Kita, R. Tamaki, M. Yoshida, A. Pusch, O. Hess, C. C. Phillips, D. J. Farrell, K. Yoshida, N. Ahsan, Y. Shoji, T. Sogabe and J.-F. Guillemoles, Applied Physics Reviews 2 (2), 021302 (2015).
2. N. Ahsan, N. Miyashita, M. M. Islam, K. M. Yu, W. Walukiewicz and Y. Okada, Appl. Phys. Lett. 100, 172111 (2012).

Activity of NIMS creep data sheet project

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Creep Data Sheet project started in 1966 at National Research Institute for Metals which was a former organization of National Institute for Materials Science, in order to evaluates long-term creep strength of 100,000 hours and longer for creep resistant steels and alloys produced in Japan. A large number of long-term creep data obtained by Creep Data Sheet project with a history of 50 years was published as a series of NRIM/NIMS Creep Data Sheet. Very long-term creep strength is controlled by the Inherent Creep Strength of the materials and those of ferritic creep resistant steels are almost the same level. Region Splitting Analysis method has been proposed as a reliable and accurate life prediction method for creep strength enhanced ferritic (CSEF) steels, and it has been employed for review of not only allowable stresses of CSEF steels, but also allowable stress intensity values up to 500,000 hours of Grade 91 steel. Degradation mechanism of the materials have been widely investigated based on accumulated creep data, and a new high strength creep resistant ferritic steel strengthened by intermetallic compounds has been proposed.

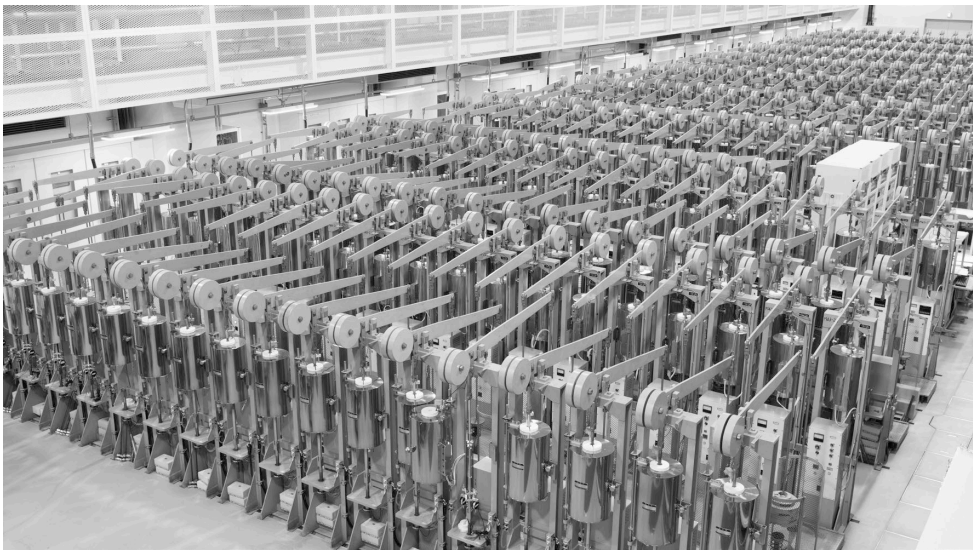

Figure 1. Creep laboratory in NIMS.

Plant transcription factors --- Tool for crop improvement and beyond

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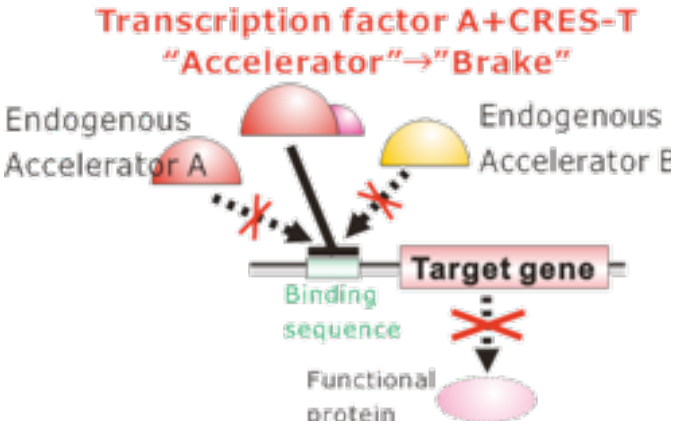
Transcription factor (TF) is a fascinating target of genetic manipulation to improve crop traits because TF regulates expression of many genes at once. This unit of TF and regulated genes is called "regulon". Most TFs work as activators to activate gene expression like an accelerator of automobile. The model plant Arabidopsis thaliana has ca. 2,000 TFs, which regulate the expression of whole ca. 27,000 genes in the genome ("regulonome"). For functional analyses and industrial applications of plant TFs, we developed a gene-silencing technology CRES-T, the method to express repression-domain-fused TF in plant. This method changes most TFs to repressor (chimeric repressor) like a brake of automobile (Figure). We applied this method to almost all TFs in Arabidopsis and half of rice TFs and observed numerous intriguing phenotypes. We also prepared the pool of T2 seeds of CRES-T lines to find a particular phenotype of interest and have isolated many kinds of TFs which can confer stress tolerances. In addition to the model plants, we also applied CRES-T to various horticultural plants to modify their flower traits. Furthermore, we prepared Gateway entry clones of almost all Arabidopsis TFs and more than 1,000 rice TFs and developed TF-only yeast-one/two-hybrid library. This library enabled us to isolate TF that interacts with specific DNA/protein efficiently. Using these tools, we are trying to establish the "regulon biotechnology" to create "tailor-made" plant which could meet various demands of farmers, companies, and consumers. Recently, we further advance this idea and try to create artificial "new plant" by using TFs like building blocks. I would like to introduce some examples in the field of wood engineering in this presentation.



Creation of rare earth free meteoritic magnet

Parmanand Sharma, Akihiro Makino

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Demand for permanent magnet is increasing due to their applications in automobile industry and renewable energy generation. Rare-earth elements (such as Nd, Dy etc.) are currently used to produce high-grade permanent magnets. Their material cost and supply risks are high. Thus, magnets free of rare-earth elements must be developed. This is important not only for catalyzing the field of materials science, but one-step closer for realizing a safe and sustainable society in the 21st century. Researchers are trying very hard to develop an alternative material to rare-earth magnets. Unfortunately, none of the manmade low-cost magnets are able to compete with rare-earth magnets.

A guest from outer space "Fe-based meteorite" showed promising potential, because chemically ordered $L1_0$ FeNi phase present in it has high saturation magnetization (M_s~1270 emu cm^{-3}) and a large uniaxial magneto-crystalline anisotropy (K_u~1.3 x 10^7 erg cm^{-3}). These properties ensure hard magnetic performance comparable to rare-earth magnets developed in recent years. Unfortunately, artificial production of $L1_0$ FeNi phase is not only difficult, but a dream for researchers. A major problem in realization is low order-disorder transition temperature (~320 ^{0}C) at which atomic diffusivities of Fe and Ni are negligible. This makes ordering of Fe and Ni possible in billions of years. Additionally, detection and characterization of $L1_0$ FeNi phase is tough due to similar atomic scattering factors. Recently, we have demonstrated the possibility of development of highly ordered $L1_0$ FeNi phase[1-4]. Various structural and magnetic measurements confirmed artificial formation of $L1_0$ FeNi phase without any doubt. In my talk, I will explain how we succeed in the development of meteoritic magnet, and its potential as a rare earth free hard magnet.

1. P Sharma, S Okamoto, H Tajiri, K Sato, Y Zhang, O Kitakami and A Makino, IEEE Transactions on Magnetics, **54**(11), 20101705 (2018).
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3. K Sato, P Sharma, Y Zhang, K Takenaka, and A Makino, AIP Advances, **6**, 055218 (2016).
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Towards Predictive Biology and Beyond

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Systems biology has emerged as a conceptual approach to understand the life as an evolvable and robust system (1,2). Mathematical modeling and simulation of the biological systems have been playing the central role in the context of systems-level understanding and predictability for the living organisms. Well-trained mechanistic simulation models where essential components in the system are assembled can predict the systems response towards given perturbations. The hypothesis derived from such simulation is then become valuable for experimental validations. For example, recent study has revealed that specific combination of signaling inputs yields nontrivial cell fate in embryonic stem cells through novel simulation framework of molecular regulatory networks (3).

Towards scalable prediction of biology, whole computational workflow including data collection, machine-learning, modeling, simulation, model analysis and model validation has to be executed to complete the systems biology roadmap. Given the accumulation of high-dimensional data and its diversity, a key challenge is on connectivity of different resources, discoverability of the right tools for a specific analysis, reproducibility and navigability through inter-operable analytics. Garuda (www.garuda-alliance.org) is a platform to provide a framework to connect and navigate through different 'gadgets' including analytic software, data, visualization and physical devices (4). The platform and its concept is now being applied to provide the connectivity of key elements in healthcare including various types of personalized data, analytics and humans. To this end, mechanistic model-based predictions are required as platforms to integrate the input properties and the systems condition. All these bottom-up and top-town efforts for predictive biology have opened up opportunities for the systems-level understanding of living systems, healthcare and beyond.

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2. Kitano, H, Nature, 420: 206-210 (2002)
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4. Ghosh, S et al., Nature Review Genetics 12, 821–832 (2011)

Invited Lectures

DEPSOR based biosensors and analytical platform for the SDGs

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Abstract: Technological innovation is key to the implementation of Sustainable Development Goals (SDGs) set by United Nations. We describe a robust and handheld device, called DEPSOR (Disposable Electrochemical Printed Sensor), for the rapid and affordable electrochemical sensing of analytes. The unique combination of hardware (i.e., disposable electrode printed chip and a palm-sized potentiostat), software (i.e., smartphone-supported programming to perform on-site voltammetry analysis) and wetware (i.e., evolutionary molecular engineered bio-probes) elements of high-performance DEPSOR, which are easy to integrate into diverse applications, make this system extremely portable and affordable with application-ready signal outputs in resource-limited settings. In this talk, I will describe a variety of DEPSOR platform including DEPSOR-M (for rapid and simultaneous testing of heavy metals); DEPSOR-V (for on-site enumeration of total viable bacterial count); and DEPSOR-H (for aptamer-based sensing of early disease information) [1-3]. With these diverse applications, DEPSOR successfully launched two new startups in India and Japan and thus are highly expected to bring a rapid transformation of electrochemical sensing technologies for mass application and so thus solutions for sustainable development challenges.

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Bioimaging-based screening for the factors concerning neuronal functions and diseases

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Visualization of protein dynamics in living cells or in animals is a quite helpful strategy for direct understanding of in-vivo protein function. In addition, visualization of target-protein dynamics should be important to characterize the effects of candidate molecules in drug discovery. In several neurodegenerative diseases, such as Alzheimer's and Parkinson's diseases, protein oligomerization and/or aggregation have been considered to be a main cause of disease onset. However, several features of these causal proteins have prevented us to directly visualize protein dynamics in living cells. Recently we have developed novel visualization methods to monitor protein dynamics of Amyloid-beta in vivo, which is considered as a primary factor of Alzheimer diseases.

The Amyloid-beta protein is well known to be catalyzed from its precursor protein APP and to form large aggregations called senile plaque in the brain. Many recent studies, however, suggest that intracellular small oligomers of Amyloid-beta are more toxic than extracellular large plaques for the onset of Alzheimer diseases. So, by arranging the linker sequence between Amyloid-beta and fluorescent proteins, we developed two fusion proteins which enable us to visualize and to monitor the aggregation states of Amyloid-beta both in living cells and in living animals. We have characterized these proteins in detail and found that the short linker fusion protein loses its fluorescence dependent on its aggregation state. On the other hand, the long linker protein can express fluorescence independent on their aggregation. We also show that these proteins can be used to isolate suppressive factors for Amyloid-beta aggregation by directly observing its fluorescent level in the cells and in animals. We are now trying to isolate effective natural compounds against Alzheimer diseases from Indian natural resources.

In this presentation, we will show other novel visualization methods to analyze protein functions in vivo and a unique model system to analyze human diseases using our excellent model organism *C. elegans*.

One pot green synthesis of angiotensin II receptor antagonist drug losartan

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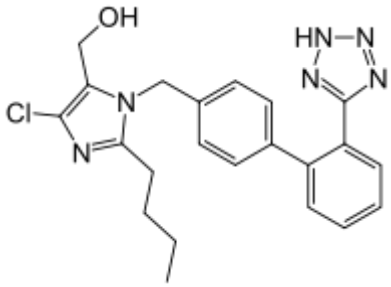
2-butyl-4-chloro-5-hydroxymethyl1-[(2′-(1H-tetrazole-5-yl)biphenyl-4-yl)methyl]-imidazole, commonly known as Losartan[1] is a well-known angiotensin II receptor antagonist drug used mainly in the treatment of hypertension and the first non-peptide AT1 antagonist approved by the U.S. Food and Drug Administration for clinical use. It was the first angiotensin II antagonist to be marketed. Losartan is also used in the treatment of diabetic nephropathy, renal insufficiency and in post-myocardial infraction. It is a billion dollar business worldwide and the global demand for losartan is increasing rapidly.



Losartan

There are number of patents and papers which describe the synthesis of losartan. Most of the synthetic routes use toxic tin reagents for the construction of tetrazole ring. In continuation to our work on the development of active pharmaceutical ingredients[2], here we present an efficient one pot green synthesis of Losartan without the use of toxic tin reagent[3].

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Regulation of class switch recombination by bromodomain protein Brd2

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Class Switch Recombination (CSR) is required for Isotype-specificity of antibody molecules, essential for fighting against pathogens and various toxins. Although key enzyme, which initiates the CSR i.e. Activation-induced cytidine deaminase (AID), has been identified but the detailed molecular mechanism of the downstream regulation of CSR is still elusive. CSR physically takes place on immunoglobulin locus (IgH) and is influenced by several epigenetic factors such as histone H3K4-mehylation and histone H4K-acetylation. These epigenetic marks in the IgH locus are required to support CSR specific DNA breaks and their repair, respectively, by a yet unknown mechanism. In order to explore the DNA repair phase of chromatin regulation in CSR, I studied the role of H4K-acetyl reader protein BRD2 in a mouse B cell line. Depletion of BRD2 in this cell line not only impaired Ig-isotype switching but also the aberrant recombination between IgH and cMyc loci. Analysis of the recombination junctions in BRD2-depelted cells suggests a defect in the non-homologous end joining (NHEJ) mediated DNA repair pathway. Mechanistic study revealed that the CSR induced H4Kac-BRD2 formation in the IgH locus promoted recruitment of the essential NHEJ factors. We propose, BRD2 plays an essential regulatory role in the resolution of AID induced DNA break in CSR and associated genomic instability.

Drug development for lung cancer

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Malignant cancers develop in various organs, and deaths from lung cancer are the most common among cancer-related deaths in the world. Lung cancer, which is derived from the bronchus or an alveolus, is classified as two major types by its histology. One is non-small lung cancer (NSCLC) and another is small cell lung cancer, and approximately 80% to 85% of lung cancers are classified as NSCLC. Although several therapeutic options including surgical treatment, radiation therapy, and chemotherapy have been established for patients with NSCLC, systemic chemotherapy is the most major therapy because of difficulty in early detection of the cancer. As for NSCLC, precision medicine with genetic testing is moving ahead of that in other cancer types due to discovery of key genomic changes which drives tumorigenesis and tumor growth. These genetic abnormalities are called “oncogenic drivers”, and somatic mutations of EGFR are one of the most common drivers and are present in approximately 30-50% and 10-20% of NSCLC in Asian and in American and Western European populations, respectively.

EGFR is a transmembrane receptor tyrosine kinase, and most of mutations are concentrated in the kinase domain of the EGFR gene. Activating mutations result in ligand-independent activation and subsequent phosphorylation of downstream molecules, leading to cancer cell growth, survival, and metastasis. Given its important role in cancer, EGFR-tyrosine kinase inhibitors (TKIs) (e.g., gefitinib, afatinib) exert a drastic clinical activity in patients with NSCLC harboring mutations such as exon 19 deletion mutations and L858R substitution mutation in exon 21. However, clinical and preclinical studies revealed that the response to EGFR-TKI therapy differs depending on each mutation, especially in-frame insertion mutations in exon 20 behave as intrinsic resistant mutations. Patients with NSCLC harboring these mutations exhibit poor clinical responses to the existing EGFR-TKI therapy, because plasma concentrations of these drugs in clinical settings are kept low by dose-limiting toxicities such as skin rash and diarrhea, caused by wild-type (WT) EGFR inhibition. Therefore, it is reasonable to hypothesize that the agents, which are able to inhibit exon 20 insertion mutant EGFR while sparing WT EGFR, might achieve target inhibition in tumors rather than normal tissues, leading to improvement of the clinical issue on therapy for these patients.

In this talk, I’d like to show the process of drug discovery and development of mutant EGFR selective inhibitor, referring TAS6417 which is a novel EGFR-TKI targeting exon 20 insertion mutations.

Selfish microbes that manipulate reproductive system of insects: basic and applied research on *Wolbachia*

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Heritable microbes are common among insects. For strictly vertically transmitted intracellular symbionts, host cells are indispensable for their survival. On the other hand, symbionts can either be obligate or facultative for their hosts. *Wolbachia pipientis* (often referred to as *Wolbachia*) is a bacterium that tactfully manipulates reproductive system of their arthropod hosts by various ways for their own benefit. It is considered that the host manipulation allows *Wolbachia* to spread rapidly among host populations and it is empirically documented in several cases. Because of its ubiquity among arthropods (present in > 40% of insect species), *Wolbachia* is considered as one of the most successful symbionts on this planet. In this symposium, I will talk about the worldwide projects that utilize *Wolbachia* to control populations of harmful insects and insect-borne human diseases. I will also talk about the diversity of *Wolbachia*-induced host manipulations, which have potential to contribute to pure science of general interest (i.e., development, ecology and evolution of biological organisms).

Sleep need and its relation to neurological disorders

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Sleep is universal, a quite familiar and common phenomenon. It is conserved throughout the evolution independent of the organization of the nervous system, and unlike ancient beliefs, it is tightly regulated. However, underlying mechanisms of sleep are unknown and even simple questions, what exactly the sleep is, why we need to sleep, are unanswered. Thus, sleep is one of the greatest mysteries in today's neuroscience. The necessity of the sleep can be understood by the fact that loss of sleep, fragmented sleep, and/or poor quality sleep results in the decline in attention, affect learning and memory consolidation, and alters mood. Moreover, most neurological disorders, such as epilepsy, narcolepsy, Parkinson's disease, Alzheimer's disease, stress, and anxiety are intimately associated with sleep deprivation or poor quality of sleep. Although it is still debatable whether sleep loss causes these neurological disorders or sleep disturbances occur due to the neurological disorders, studies suggest sleep loss is a trigger to the onset of brain disorders.

The discovery of orexin was a real breakthrough towards understanding the sleep/wake regulation, but it still remains a challenge for the scientists. Orexin regulates sleep/wake along with many other vital functions. Narcolepsy, a neurological disorder of sudden sleep attacks with loss of muscle tone that results in falling, occurs due to loss of orexin signalling in the brain. Unfortunately, only symptomatic treatment with an array of side effects based on the benefit-to-risk ratio is available to date. One of my research goals is to develop the therapy for neurological disorders resulting due to poor sleep quality. Orexin replacement therapy is an option to treat narcolepsy, however, it is unavailable to human narcoleptic patients due to its non-permeability to the blood-brain barrier. I recently developed a mechanistic therapy to inhibit narcolepsy in mouse models. This technique works by delivering orexin directly to the central nervous system via a chronically implanted catheter in the spinal cord at the lumbar level to execute its action on deep-seated brain structures. The flow of orexin to the brain can be controlled with a programmable and implantable pump. We believe this approach could be an alternative therapy to human narcoleptic patients where conventional therapy fails.

Microfluidic disease marker determination by surface plasmon resonance technique

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Various new microfluidic devices have been proposed to measure a trace level of biomolecules quickly for a usage in the medical and biochemical research fields. I have focused on a surface plasmon resonance (SPR) techniques as a platform for the microfluidics development. One important feature of the SPR-based sensor is a surface analysis at a solid-liquid interface. SPR angle is affected in the evanescent field (approx. 100 nm on a metal surface). This feature is suitable to utilize high surface-to-volume ratio characterizing the microfluidic analysis, and advantageous for a quick measurement with high sensitivity.

I will talk about our new methods, materials and microfluidics to improve the analytical performance, especially an immunochemical determination of disease markers and DNA methylation by the SPR-based technique. It is well known that thiols form a self-assembled monolayer on a metal surface, and this has been widely used to modify metal surfaces. I employed this characteristic for a highly sensitive immunoassay of B-type Natriuretic peptide, which is a cardiac marker, by obtaining a surface pre-concentration of thiol molecules formed by the enzymatic reaction of labeled antibody. I also show the discrimination of the cytosine methylation status in DNA with anti methylcytosine antibody. This was realized by employing an affinity measurement involving a target methylcytosine in a bulge region and anti methylcytosine antibody, following hybridization with a bulge-inducing DNA to ensure that the only the target methylcytosine is located in the bulge.

E-Simulator: A high-performance simulation tool for seismic analysis and resilience assessment

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Recent advancement in High Performance Computing (HPC) has enabled researchers to perform the high-fidelity Finite Element (FE) analysis using solid elements. On the same line thoughts, E-Simulator is being developed at-and-by E-Defense of NIED, which aims to reproduce the damage mechanism of civil structures exposed to the any sort of strong ground motions. E-Simulator is parallel FE analysis tool, which uses a general-purpose parallel FE software: ADVENTURECluster, as a platform to accomplish the large-scale simulations. Schemes such as hierarchical domain decomposition method for domain decomposition in linear algebraic solver, coarse grid conjugate gradient (CGCG) method; an iterative solver and Hilbert-Hughes-Taylor time integration scheme aka α-method are incorporated. Sophisticated constitutive models and failure criterions for various materials such as concrete, steel and rubber, with the appropriate mathematical framework are included in the tool. It is noteworthy to mention that every crucial stage involved in the large-scale simulation is verified and validated with experimental data.

In this talk, I would like to briefly introduce the capabilities of E-Simulator by demonstrating the few simulations of namely composite beam i.e. steel beam with concrete slab) -to-column T-joint, soil-underground structure specimen and furniture's set-ups tested at E-Defense, accomplished using this tool.

Category theory for cognition

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Category theory was invented as a formal language for comparing mathematical structures (Mac Lane, 1998). Beyond mathematics, category theory has had a significant impact on computer science and the study of computation. Computational modeling is the backbone of many areas of science, including cognition. Yet, category theory is obscure to many researchers. Over the last decade, we have been using category theory as a formal approach to cognitive science (Phillips et al 2009, 2012, 2016; Phillips & Wilson 2010, 2016, Phillips, 2018). This talk will provide a basic introduction to category theory, and an overview of our work on applying category theory for an understanding of human cognition.

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Effect of silicon nanocrystalline quantum dot on its energy transfer effect and applications for hybrid solar cells

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Very recently, light harvesting through excitonic energy transfer has inspired significant research efforts to realize and design energy transfer based light-harvesting systems for solar energy conversion, optoelectronic devices, and biomedical applications [1]. The new device structure combines energy transfer layers (e.g., using quantum dots) with high-mobility semiconducting channels. In particular, there is growing interest in the development of Si-based PV devices using simpler and cheaper processing techniques [2-3].

Combining nanocrystalline Si quantum dots (nc-Si QDs) to organic/Si nanostructure hybrid solar cells, we have achieved 13.73%efficiency in Si/PEDOT: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 Si nanostructure/PEDOT:PSS region for excellent carrier separation. The main reason is due to the energy transfer effect of nc-Si QDs, which absorb UV light and convert it to NRET (Nonradiative energy transfer) and RET (Radiative energy transfer).The NRET and RET from nc-Si QDs generate excess electron-hole pairs in the Si nanostructure layers. Additionally, we enhanced the NRET effect by changing the ligand passivation length of nc-Si QDs. Finally, we showed that shorter ligand length gives high energy transfer efficiency and increases the power conversion efficiency to 14.06%. The organic-inorganic hybrid solar cells obtained here holds the promise for developing energy transfer managing, low cost and high-efficiency hybrid photovoltaic cells in the future.

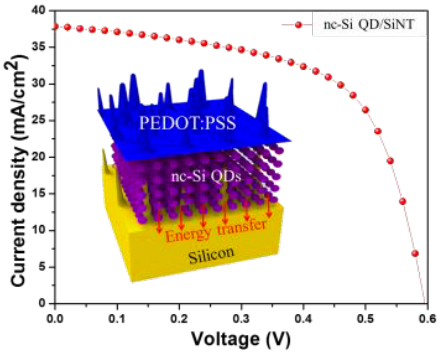

Fig. 1. Schematic diagram and J-V curve of hybrid solar cells incorporation with nc-SiQDs.

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Students Session

Simple detection of amyloid-beta oligomers using peptide aptamer and DEPSOR based hybrid biosensor for Alzheimer's disease

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Introduction: Realization of the UN sustainable development goal 3 (Good health and well-being) relies on smart biosensing technologies for the early and accessible diagnosis of diseases. In this work, we introduce peptide aptamer-based biosensor for making undetectable sensing possible for routine and fast-tracking molecular diagnostics. Small peptide chains, which can arrange themselves into tridimensional functional structures, exhibit a smaller binding footprint allowing for a more thorough and precise interrogation of the target molecule. We engineered these peptide chains by an iterative process of test-tube evolution and applied to recognize Amyloid beta oligomers, biomarker for Alzheimer's disease, with high affinity and specificity. The applicability of these peptide aptamer to fabricate the new age of integrated electrochemical biosensors using DEPSOR (disposable electrochemical printed sensor) technology, to detect Amyloid beta (Ab42) in nM range is addressed in this presentation. Experimental Method: Firstly, we attached streptavidin on the surface of screen-printed electrode of DEPSOR by physical adsorption. The unbounded surface was then blocked by BSA. Next, we immobilized the biotinylated Amyloid beta oligomers on the surface by utilizing streptavidin-biotin binding. Finally, *poly(ethylene glycol)2000 was used to keep the surface functional for assay [3]*. A one-step competitive assay was used to detect Ab42 in the unknown sample. Result and Discussion: Figure 1 shows the DPV (differential pulse voltammetry) measurement for Ab42 in a competitive assay. Our results clearly revealed: (i) nonspecific signals could be suppressed by using BSA (samples (1) vs (2)); (ii) functional peptide aptamer successfully captured Ab42□(samples (2) vs (3)); the addition of PEG drastically increases the signals (samples (3) vs (4)). Finally, we successfully measured Ab42□as low as 4 nM using our newly fabricated hybrid peptide aptamer-based biosensor.

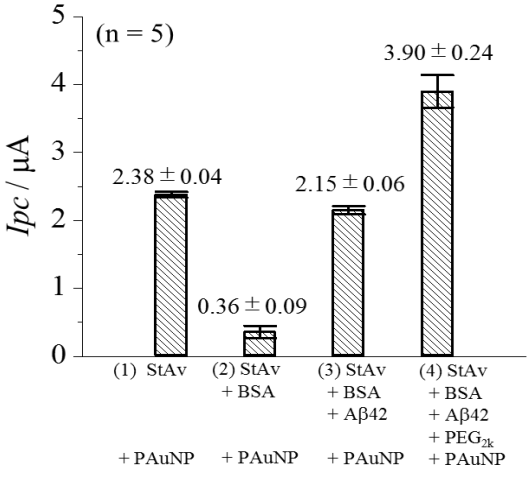

***Fig.1** Electrochemical measurement of A□□□*

Mechanistic analysis of unresponsiveness to the PD-1 blockade therapy

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Cancer figures among the leading causes of morbidity and mortality worldwide. Programmed cell death protein 1 (PD-1), an immune-inhibitory receptor expressed on activated T cells, regulates tolerance and auto-immunity. Up-regulation of PD-L1 on cancer cells renders them to evade immune response. Immunotherapy mediated by PD-1 blockade has revolutionized the cancer treatments through its long-lasting effect and high efficacy against a wide variety of cancers with limited side-effects. The major issues for the PD-1 blockade therapy are (i) around 40-60% of patients remain unresponsive or less responsive and (ii) lack of a biomarker that predict the responsiveness to the PD-1 blockade therapy. To improve the efficacy further, it is imperative to understand the mechanism of unresponsiveness considering the different immune response against responsive and unresponsive tumors. In our preliminary studies, we observed that the tumor reactive cytotoxic T lymphocytes (TRCTLs) from responsive tumor bearing mouse has higher mitochondrial activation status compared to TRCTLs of unresponsive tumor bearing host's. In order to investigate further why the immune responses are different for different tumors, we investigated MHC I expression on murine tumor cells and found that some unresponsive tumors do not express MHC I. Further, to test whether the unresponsive tumors are being recognized by the host immunity, we compared the rate of tumor growth between wild type and Rag2-/- host bearing unresponsive tumor. Faster aster tumor growth in Rag2-/- compared to wild type mice indicates that tumor has enough antigen to be recognized by the host immunity or less immunosuppression and vice-versa. Further, to test whether the unresponsive tumors suppress immune response, we used 'bilateral tumors in a host' experiment where we observed immunosuppressive effect of unresponsive tumors on host's anti-tumor immune response against responsive tumor on the opposite side. We found some unresponsive tumors do not suppress immune response while some inhibit immune response. To investigate further how the suppressive tumors inhibit immune responses, we found conditioned media from suppressive unresponsive tumors inhibit naïve CD8 proliferation and inhibit the mitochondrial functions as evidenced by low mitochondrial mass, potential, superoxide and oxygen consumption rate (OCR), a parameter for mitochondrial respiration. We found that the soluble factor is a novel, non-proteinaceous, and small molecule with size less than 3kDa. In conclusion, we found reasons for unresponsiveness to the PD-1 blockade therapy in a very broad way e.g. low antigenic load, no MHC I expression, systemic immune suppression that ultimately lead to low proliferation or proliferated but exhausted with low or no mitochondrial activation. In addition, we can also conclude that mitochondrial activation parameters could be a biomarker to the PD-1 therapy.

Bioinformatics and experimental insights into the anti-metastatic activity of withaferin-A and its derivative 2,3-dihydro-3β-methoxy withaferin-A

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Withaferin-A (Wi-A), one of the key secondary metabolites extracted from Ashwagandha (*Withania somnifera*) leaves, is known for its anti-cancer and anti-metastatic activity. On contrary to Wi-A, its methoxy derivative 2,3-dihydro-3β-methoxy Withaferin-A (3βmWi-A), is nontoxic and is well tolerated at higher doses. Increased expression of Vimentin and N-cadherin are the hallmarks of malignant cancers. Anti-metastatic activity of Wi-A has been explored in earlier studies by studying its effect on Vimentin; induction of Vimentin aggregation and altered Vimentin assembly was reported. We investigated the effect of Wi-A and 3βmWi-A on Vimentin protein: its assembly using bioinformatics. *In-silico* experiments were performed to check the binding affinity of Wi-A and 3βmWi-A around Cys328 residue that helps in polymerization and reorganization of Vimentin network in response to oxidants and interaction with metal ions. We found that both Wi-A and 3βmWi-A could interact with different forms of Vimentin (monomer, dimer and tetramer). However, Wi-A showed greater binding affinity for Vimentin dimer and tetramer and caused local disruption of helical structure at Vimentin tetramer binding site, while no such effect on structure was observed in case of 3βmWi-A. We also found that the binding orientation of Wi-A in Vimentin dimeric and tetrameric forms is such that its oxygen moieties are in close proximity to Cys328. Such configurations can affect interaction of Vimentin with metal ions like Zn, while forming Vimentin octamer or higher oligomers in Intermediate filament assembly. Experimental insight into the effect of Wi-A and 3βmWi-A on Vimentin and N-Cadherin expression showed that, Wi-A, but not 3βmWi-A caused reduction in the cytoskeleton proteins (Vimentin, N-Cadherin) and Vimentin aggregation that are essential for key processes in cancer cell metastasis, namely, EMT, cell migration and cell invasion. Hence, it was concluded that Wi-A, but not 3βmWi-A, targets Vimentin causing anti-migration and anti-metastatic effects.

HIV-mediated neurotoxicity in human astrocytes is modulated by stress chaperone Mortalin/mthsp70

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One of the viral proteins of human immune deficiency virus (HIV), the Transactivator of Transcription (Tat), is a well-known neurotoxicant that induces glia mediated and direct damage to neurons. Heat Shock Proteins (HSPs), play important roles ranging from maintenance to destruction of cells. Unlike other HSPs, Mortalin is different as this is a non-heat inducible protein. Interaction of mortalin to various other cellular as well as foreign molecules is one of the key processes that determine its role ranging from guardian to killer. Mortalin has also been found to be down-regulated in various neurodegenerative diseases, such as - Alzheimer's and Parkinson's disease. We used primary cell culture of human fetal brain derived neural progenitor cells, progenitor derived astrocytes and neurons for studying the role of mortalin in modulating HIV neuropathogenesis. We observed that human astrocytes express mortalin in cytoplasm, nucleus and mitochondria. Introduction of HIV-1 Tat protein to these cells caused significant down-regulation of mortalin at both mRNA and protein levels. We observed that over-expression of mortalin in HIV-1 Tat harbouring cells rescued them from Tat-induced cytotoxicity. Bio-informatics and molecular docking analyses demonstrated interaction between mortalin and Tat that might mediate rescue process.

Understanding multiplicity of urban governance and planning regulations for a metropolitan region with focus on land and private development – Case study NCR – Delhi, India

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Affordable Housing across various income groups in India is one of the pressing urban issues being faced by the governing authorities. The literature study for policies related to urban housing in India suggest that much focus has been given to the urban poor and slum rehabilitation and redevelopment. Private development has been dealt only in terms of urban real estate market demand – supply dynamics but fails to address the socio – economic costs of these developments.

This research addresses the phenomenon of what can be described as the "Housing Dilemma in India". On one hand the housing market faces housing shortage of 18.78 million units (census 2011, including the congested housing) and at the same time the housing supply in the market is flooded with unsold inventory of worth INR 820 billion (Business Standards, 2015) which will require another 46 months to be sold out at current pace of sales (Liases Foras research). Project delays, unlawful land acquisition, agitations against under valuation of land by land owners have become synonym with Real estate and private development in India. Even the projects being delivered by private developers and developing authorities also face issues in terms on non-sustainable residential environment, lack of basic amenities and fragmented neighbourhood. Through this research we like to bring forth the urban land use pattern and morphology created in absence of a comprehensive land and private development regulation within a metropolitan region. The aim for this study is to identify the actors/agents and their corresponding network within the governance framework of land and private development.

Numerical study on steel-encased concrete section of earthquake resistant piles

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The concept of earthquake resistant piles developed in Japan, is a fairly new concept in the world of civil engineering. Such piles consist of a combination of three steel-concrete sections, usually a ribbed section at bottom, prestressed reinforced concrete section in middle and a steel encased concrete (SC) section at the pile-pile cap joint. In concept, damages are allowed to occur only at the SC pile joint. The nature of these damages, performance of SC pile sections till ultimate damage conditions and finally, the best design practice for these joints are the major research queries of our group.

Current work deals with 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 here to predict the structural behavior of such piles by finite element analysis using OpenSees. Flexural behavior is studied by focusing on the moment vs. curvature relationships. A set of 6 piles under combination of cyclic lateral and high, constant axial loads is analyzed here to improve the estimation of yielding and load carrying capacities. A comparison between test and numerical results is presented by comparing various points of interest in 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.

Slow-mode shock observations in the earth's dayside magnetopause

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The plasma particles from the Sun can enter the Earth's magnetosphere by a process called magnetic reconnection. During magnetic reconnection, two oppositely directed magnetic field lines come in contact, they break and reconnect, releasing large amounts of energy and accelerating particles. The part of Earth's magnetic field facing the Sun (magnetopause) interacts with the Sun's magnetic field through this process. One theory of magnetic reconnection proposes the presence of a structure, called the slow-mode shock, which helps in the fast release of energy and acceleration of particles. The presence of slow-mode shocks has been well established in the night-side region of Earth's magnetic field, which is symmetric. However, the magnetopause is known to have asymmetric magnetic configuration and only a few observational studies have reported the presence of the slow-mode shock in the magnetopause. Based on observations by the Magnetospheric Multiscale spacecraft in the magnetopause, we found that 20% of the magnetopause crossings with reconnection jets had the slow-mode shock structure. The occurrence frequency is comparable to or a little higher than the symmetric reconnection cases. Their dependence on the number of particles is consistent with previous simulation studies. This study provides substantial evidence that the slow-mode shocks are as common in the asymmetric magnetic reconnection as in the symmetric cases.

Poster Presentations

P1: Cucurbitacin B & Withanone (CucWi-N) for cancer treatment – merits and mechanism

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Cancer is a syndrome of abnormally mutated proliferating cells, treatment of which with synthetic chemotherapeutic drugs is often associated with severe adverse effects. Development and application of NEW (Natural, Economic and Welfare) compounds is warranted to address the exponentially increasing global cancer incidence. Cucurbitacin B (Cuc) has been shown to possess cytotoxicity against a number of cancer cell lines *in vitro*. However, we previously found it to be toxic to the normal cells also. In order to make it selectively toxic to cancer cells, we made its cocktail with Withanone (Wi-N) and analyzed its effect and mechanism of action on human non-small-cell lung cancer cells. We demonstrate that CucWi-N (1:500 molar ratio combination of Cuc and Wi-N) is safe for normal cells and induces of stress and senescence in cancer cells. It caused inhibition of cancer cell migration. *In vivo* tumor progression assays using sub-cutaneous xenografts and tail vein metastasis models supported competent anti-tumor activity of CucWi-N. Furthermore, it inhibited cancer cell stemness and caused sensitization of cancer cells to conventional drugs. CucWi-N is proposed as a NEW anticancer natural drug.

P2: Role of serotonin 5-HT4 receptor in dendrite and axon formation of mice hippocampus neurons *in vitro*

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Recent studies have shown that serotonin (5-HT) is involved in various aspects of the development of hippocampal neurons. However, the specific role of 5-HT4 receptor (5-HT4R) is poorly understood. We investigated the role of 5-HT4R in the formation of dendrites and axons of the mouse hippocampal neurons in vitro using 5-HT4R agonists (RS67333, BIMU8) and antagonist (GR125487). Neurons from the mouse hippocampus at embryonic day 18 were dissociated and treated for 4 days with 1 nM, 10 nM, 100 nM of RS67333. The treatment increased the number of primary dendrites and the branching of dendrites and axons. Scanning electron microscopic (SEM) measurement showed the increase of axon diameter. We also investigated the role of 5-HT and BIMU8, and confirmed the effects of RS67333 in the development of axons and dendrites. Next, we found that treatment of GR125487 neutralized the effects of RS67333 on the primary dendrites and branching of dendrites and axons, which confirmed the specific effects through 5-HT4R.

Now we are investigating the involvement of collapsin response mediator protein 2 (CRMP2) in the role of 5-HT4R. CRMP2 is an important therapeutic target in various psychiatric and neurodegenerative diseases. CRMP2 is widely expressed in embryonic brain, and plays important roles in axon formation through the interactions with microtubules. Recent studies have shown that c-terminus of 5-HT4R also affects the CRMP2 expression via direct or indirect molecular pathways which are not well studied. We investigated the localization of CRMP2 in developing hippocampal neurons in vitro. We are now examining the effect of RS67333 on *crmp2* mRNA expression, and also the involvement of *crmp2* in RS67333-mediated formation of dendrites and axons.

P3: The biomechanics of yoga and its application to sports science

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The purpose of this project is to demonstrate how yoga has concrete applications in many domains, from sports to daily life, to space exploration. While training Abhinav Bindra for the 2016 Olympic Games, the author developed a method that integrates the traditional yogic approach to the training of ace athletes of 10-meter air rifle shooting. The goal of the research that stem from this experience is to extend the application of yoga to other domains (the author is currently working with athletes preparing for the 2020 Tokyo Olympics), through a systematic approach that works at the tripod level of body, breath and mind, combining bio-mechanics with proprioception and kinesthetic awareness.

With the application of the method to ace athletes, results have been found at three levels: body, breath and brain. An increased sensory development has been observed in terms of balance, with the stimulation and challenge of the visual, vestibular and somato-sensory systems; of flexibility, with the improvement the end range of motion; of stability, with the development of stabilizer muscles; of strength, with the canalizing of energy; and of coordination, with a focus on mindful movements to build up the muscle memory and develop new neuropath ways. By making the body experience challenging and unusual yoga postures, the brain gets exposed to unfamiliar stimuli as well. This process helps both the body and the brain learn how to cope with stressful events. The strengthening of the mind through the strengthening the body prepares the athlete to cope more easily with the stress of the real competitions and increase the level of awareness. The breath operates as connection between the body and the mind. By increasing one's capacity to control the breath, it is possible to increase concentration and decrease the respiratory rate, creating meditation patterns around the breath and enhancing the effects of the method on body and brain.

P4: In-situ straining studies of crack propagation behavior in pure Mg and Mg-0.3 at.%Y alloy in transmission electron microscope

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Magnesium(Mg) alloys are the most sought after light weight structural materials in aerospace and automotive industries to increase the fuel efficiency. However, Mg alloys with HCP structure exhibit low ductility and formability due to their highly anisotropic critical resolved shear stress(CRSS) values for activation of different slip mechanisms which limits its application as the structural materials. Recently, it has been reported that yttrium and rare earth (RE) elements additions to Mg can improve its room temperature ductility significantly by non-basal dislocation slip activities [1]. From safety point of view it is also important to study the fracture behavior of these alloys. Ex-situ Studies can not offer an opportunity to record dynamic process that ensues during deformation and crack nucleation. In contrast, in-situ straining is a deformation study inside a microscope to observe the fundamental deformation mechanisms. In-situ studies can provide access to observe sequence of events such as change in crystallography of microstructure, various defects nucleation, dislocation emission and their interaction with grain boundaries and twin boundaries during deformation process.

In the present work, In situ tensile experiments in a transmission electron microscope have been carried out to study crack nucleation and propagation behavior on thin foils of polycrystalline pure Mg and Mg-0.3at.%Y alloy. In case of pure Mg crack nucleation and propagation occurred along grain boundaries. Twin nucleation occurred at grain boundary from crack tip during crack propagation. However, crack avoided propagating along twin boundaries. In case of Mg-0.3at.%Y alloy, crack propagated along yttrium segregated grain boundaries and newly formed twin boundaries. These studies are important in understanding the effect of segregation on the crack propagation behavior [2].

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2. D.A. Basha, H. Somekawa, A. Singh, Crack propagation along grain boundaries and twins in Mg and Mg–0.3at.%Y alloy during in-situ straining in transmission electron microscope. Scripta Materialia 142 (2017) 50-54.

P5: Single cell transcriptomics analysis with positional information using silicon chip

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Introduction: Single cell transcriptomic analysis is tremendously useful to uncover cellular heterogeneity, cellular behavior, tumor progress at molecular level. Single cell transcripts provide the details of gene expression level of individual cell by sequencing the expressed mRNA using the advanced protocol like SMART-Seq, STRT Seq or Quartz-Seq. However, researchers are still suffering from the low number of detected genes, ~ 6000 genes/cell. In this work, a novel method for efficient mRNA capture using single bead and heat treatment will be demonstrated.

Experimental section: HEK293 cell was positioned over micro-hole cavity by applying the suction pressure (5kPa) through the micro-hole. Increasing the pressure (45 kPa) results in the cytoplasm extraction through micro-hole to a PDMS chamber placed beneath the silicon chip. Bead placed in PDMS chamber, immediately captures the free mRNAs in cytoplasm over 10 min incubation at 72 °C. After that, single bead was transferred to eppendorf tube for reverse transcription and amplification of mRNA into a library of cDNAs (Fig. 1). Later, the sample was sequenced with NGS sequencing for measurement of gene expression count.

Results and discussion: Bioanalyzer results (Fig. 2) shows that the sample from single cell with heat treatment obtained larger amount of cDNA compare to the control experiment without heat treatment. The heat treatment helps in the unfolding of mRNAs to linear structure, and in binding the mRNAs with the probes attached over bead surface. Use of bead and heat treatment results in the detection of more than 10000 genes/cell (from NGS data).

Acknowledgements: This work was supported by CREST, JST. We are thankful to prof. Shinichi Hashimoto and Sadahiro Iwabuchi from Kanazawa University to provide the beads and NGS analysis.

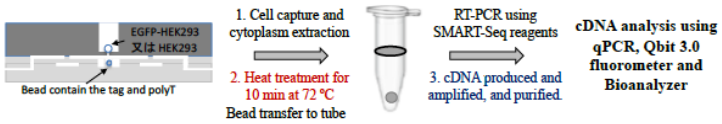

Figure 1. Schematic diagram of the experimental setup

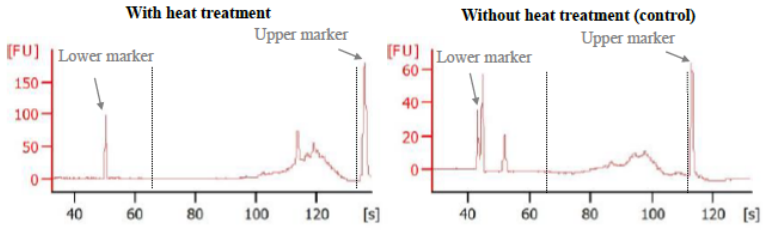

Figure 2. Agilent Bioanalyzer results from purified cDNA of single cells

P6: A small molecule modulator of hypoxia: identification and therapeutic potency

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Hypoxia (low O_2) is a pathophysiological condition in which O_2 imbalance occurs in between cellular consumption and vascular perfusion. Hypoxia-inducible factor (HIF) is a transcriptional factor and major player of cellular physiology during hypoxic condition. It is observed very frequently in solid tumors in which activation of HIF signaling results in tumor aggressiveness and metastasis. On the other hand, hypoxia condition in brain leads to severe patho-physiologies including stroke, memory loss, imbalance in motor skills, chronic pain, and premature aging. Modulation of HIF signaling has been predicted to yield useful outcomes in treatment of these diseases.

With an aim to identify new hypoxia modulating natural compounds, we engineered hypoxia responsive cell lines by stable integration of HIF-driven luciferase reporter. Screening of sixty compounds in three rounds resulted in identification of CL-D3 as a pro-hypoxia compounds. We demonstrate that CL-D3 induces HIF1 signaling and autophagy. It caused disruption of BCl2-Beclin1/ BCl-xL-Beclin1 interactions resulting in autophagy that was also supported by upregulation of LC3 and ATG family proteins. In view of the established role of hypoxia and autophagy in stress adaption and differentiation, we explored and found that CL-D3 could protect against heat, metal-induced protein aggregation and potentiated early differentiation in primary neuronal cells. CL-D3 is proposed to possess therapeutic potential for differentiation, reperfusion and protein-aggregation anomalies.

P7: Wild-type and SAMP8 mice show age-dependent changes in distinct stem cell compartments of the interfollicular epidermis

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Delayed wound healing and reduced barrier function with an increased risk of cancer are characteristics of aged skin and one possible mechanism is mis-regulation or dysfunction of epidermal stem cells during aging. Recent studies have identified heterogeneous stem cell populations within the mouse interfollicular epidermis that are defined by territorial distribution and cell division frequency; however, it is unknown whether the individual stem cell populations undergo distinct aging processes. Here we provide comprehensive characterization of age-related changes in the mouse epidermis within the specific territories of slow-cycling and fast-dividing stem cells using old wild-type, senescence-accelerated mouse prone 1 (SAMP1) and SAMP8 mice. During aging, the epidermis exhibits structural changes such as irregular undulations and overall thinning of the tissue. We also find that, in the old epidermis, proliferation is preferentially decreased in the region where fast-dividing stem cells reside whereas the lineage differentiation marker appears to be more affected in the slow-cycling stem cell region. Analyzing the proliferative history of the epidermal basal cells with H2B-GFP pulse chase system, we report that fast diving stem cells become over all slower cycling with age. Furthermore, SAMP8, but not SAMP1, exhibits precocious aging similar to that of aged wild-type mice, suggesting a potential use of this model for aging study of the epidermis and its stem cells. Taken together, our study reveals distinct aging processes governing the two epidermal stem cell populations and suggests a potential mechanism in differential responses of compartmentalized stem cells and their niche to aging.

P8: Differential expression and activities of microRNA-708 in human cancer cells with and without telomerase

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Telomere maintenance facilitates replicative immortality and is a major hallmark of tumor cells. It is attained by activation of either telomerase protein or ALT (Alternative mechanism of Lengthening of Telomeres), the latter of which accounts for approximately 10-15% of cancers. Although both telomere maintenance mechanisms prevent telomere shortening, more in-depth studies into the underlying mechanisms are required for their recruitment in cancer prognosis and therapeutics. Under this premise, we conducted a microarray analysis on isogenic telomerase-positive (TEP) and ALT cell lines for differences in expression of microRNA (miR) species, which are known to play major roles in regulation of tumorigenesis. Amongst 6 validated miR species with the highest expression difference between telomerase-positive (TEP) and ALT tumor cells, miR-708 was selected for further analysis since it was the only miR that was consistently highly expressed in a large panel of ALT cells. We characterized the role of miR-708 by its overexpression and knockdown in TEP and ALT cells, and found that miR-708 expression indeed was correlated with the formation of C-circles, a hallmark characteristic of ALT cells. Further, we found that miR708 overexpression promoted suppression of cell migration, invasion, and angiogenesis both in TEP and ALT cells. However, it inhibited cell proliferation only in TEP cells suggesting that ALT cells possess active mechanism(s) to escape the growth arrest caused by overexpression of miR-708. These findings show the first miR differentially regulated in TEP and ALT cells and have implications in cancer prognosis and therapy choice.

P9: Development of ratiometric carbohydrate sensor based on boron dipyrromethene (BODIPY) scaffold

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Boron dipyrromethene (BODIPY) is one of the useful platforms to design novel sensors because of its strong absorbance and fluorescence properties in the visible region, and chemical stabilities against chemical modifications. Utilizing the BODIPY, our laboratory developed a variety of fluorescence sensors that can manipulate or visualize biological phenomena in living cells as well as animal models. Here we present a novel sensor design consisting boronic acid (BA) substituted BODIPY, which can potentially detect carbohydrates in complex biological media. Of note, the boronic acids moiety is known to form reversible ester bond with diols of carbohydrate.

Interestingly, the carbohydrate sensing behavior strongly depends on the substituents at BODIPY and its absorbance or fluorescence wavelengths. The substituent BA is in equilibrium between the boronic acid [$B(OH)_2$] and boronate [$B(OH)_3^-$] forms, which have different fluorescence wavelengths in the visible region (figure 1). Reaction of the boronic acid moiety with *syn*-periplanar hydroxyl groups of carbohydrate affords a cyclic ester, and shifts the equilibrium in favor of the boronate ($B(OR)_3^-$) form, resulting in a carbohydrate-concentration-dependent change of the fluorescence ratio $FL_{490\ nm}/FL_{510\ nm}$ (figure 2). Thus, the sensor, BA-BODIPY, can ratiometrically detect carbohydrate at a pH near the pK_a of cyclic ester formation.

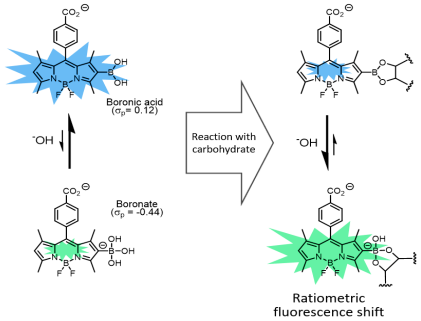

Figure 1: *Design principle for a ratiometric carbohydrate sensor based on reaction of carbohydrate diol moiety with monoboronic acid-substituted BODIPY.*

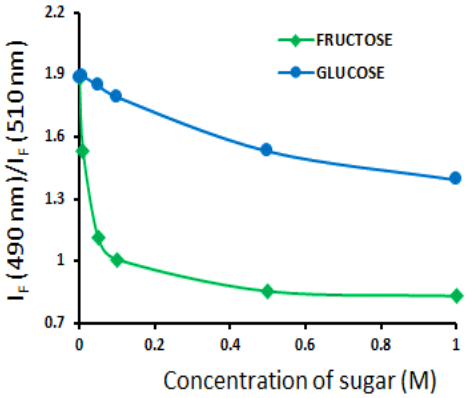

Figure2: *Titration curve showing the ratiometric response of 1 μM BA-BODIPY acid to various concentrations of fructose and glucose at pH 9.5 in 100 mM sodium phosphate buffer.*

P10: Revisiting grignard reagent based electrolytes in magnesium-ion battery: a first-principles study

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Magnesium-ion batteries (MIBs) have gained considerable attention as an alternative energy storage to Li-ion batteries in the past few decades [1]. Grignard reagent (R-Mg-X: X=halogen) with ether has been one of the most studied and efficient solutions for MIB. However, the microscopic behaviors in the electrolyte solution are still under debate. To gain insight of the solvation and dissolution/deposition on the atomic scale, we performed the first-principle molecular dynamics samplings of such MIB electrolytes using the CPMD code. We carried CPMD simulations of a single R-Mg-X (where R=Methyl, Ethyl and Phenyl) in different cubic boxes with 44 tetrahydrofuran(THF) molecules. We employed the dispersion corrected PBE-D2 functional. The compatibility of electrolyte for reversible dissolution/deposition of Mg^{2+} is a most important factor to determine Coulombic efficiency of the battery. Therefore, the solvation structure of RMg-X in THF is studied through radial distribution functions (RDFs) and vibrational shift in power spectra. The strong solvation of Mg^{2+} with THF is revealed through the RDFs well-structured peaks. The RDFs differences for different R groups in R-Mg-X (R=Methyl, Ethyl and Phenyl) shows that R=Phenyl, has most closely packed solvation shell and the order of such packing is Ph>Me>Et. However, the coordination number of THF's in RMgX solvation shell follow the order Ph<Et»Me. Power spectra of THF in the solvation shell of Mg^{2+} ion for the RMgX shows red shift for the -C-O- frequencies, compared to bulk THF, which also support the strong solvation of Mg^{2+} ion with THFs. Such spectral findings are also verified through experiments. These calculation results will provide useful insight of solvation and dissolution/deposition process in MIBs.

1. D. Aurbach, Z. Lu, A. Schechter, Y. Gofer, H. Gizbar, R. Turgeman, Y. Cohen, M. Moshkovich and E. Levi, Nature 407 (2000) 724-727.

P11: Designing loss-of-function that generates latent space for image in-betweening "interpolation"

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Learning interpretable latent representation of independent data is an important task of intelligence machines. We have designed a loss-of-function that generates a latent space and represents the spatial configuration of the object in the images. By interpolating the latent space of nearby frames, we generate the intermediate image that preserves the spatial location, contextual information of the moving objects. The resulting latent space could be used for image in-betweening or image prediction. We will show the details of our network architecture and results based on the variational autoencoder for image in-betweening.

P12: Double layer surface modification of magnesium AZ31 alloy using ceramic oxide composite for orthopedic application

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The main aim here to design a material that is supportive until bone regeneration and biologically utilized after bone healing. This materials intention is to avoid second surgery for patients who are very vulnerable. The ideal degradable metallic implant in BTE is magnesium based alloys. But the drawback of using it as bone replacement is its rapid degradation through corrosion and hydrogen evolution. Here suitable surface modification of the Mg AZ31 alloy using double layer coating which is bioresorbable yet highly corrosion resistance is desired. One such material that is well known for its biological activity is HAP and the material that is known to degrade very slowly in physiological condition is iron (Fe). This makes these two material favourable to synthesis a composite of Fe doped HAP (FeHAP). The toxic tolerable limit of 350 mg/day for magnesium (Mg) and 8-18 mg/day for Fe makes it biologically degradable. The FeHAP coating at 3 different voltages (10 V, 20 V and 30 V) deposited through electrophoretic deposition (EPD) techniques forms the outer layer and the inner layer is the Sr for its excellent biological advantageous functions. The crystalline and the bonding between the metal and the coating were confirmed through XRD and IR studies. The morphology and the elemental composition of the bare and coated sample were studied using SEM-EDAX. The electrochemical corrosion behavior of the as prepared and immersed sample for 28 days was investigated to study the corrosion behavior in physiological medium. The Dynamic Electrochemical Impedance Studies (DEIS) was carried out the extensively know the metal and coating corrosion at the surface. From which the 20 V FeHAP coated sample perform better. The hydrogen gas evolved was quantified and found to be 0.2 ml/day for 20 FeHAP coating. The scanning electrochemical microscopic robust experiment was carried out to elucidate the potential window for dissolution of ions from the bare and coated surface along with the potential at which hydrogen gas is evolved.

P13: Comparative transcriptome analysis of two contrasting genotypes of barley reveals the gene networks involved in signal transduction

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High toxicity and ready uptake of cadmium (Cd) by plants have become a major agricultural problem. The parents of Oregon Wolfe Barley (OWB) mapping population have shown distinct responses to salinity and *Puccinia persistence* rust fungi. In our study, using RNA-Seq data a total of 4,868 differentially expressed genes (DEGs) were detected in pairwise comparisons. The results of enriched Gene Ontology (GO) terms in different comparisons were approved by KEGG pathway enrichment analysis. Cd tolerant genotype Rec showed higher gene expression levels of proteins involved in signal transduction, transcription factors, chaperones, oxidative stress protection enzymes, cell wall metabolism, transporters and ion channels relative to cd susceptible genotype Dom. Furthermore, 157,179 moderate or high ranked single nucleotide polymorphisms (SNPs) were identified between genotypes using sufficient coverage with high quality sequence reads by sequence comparisons. The identified SNPs may influence gene expression and messenger RNA (mRNA) conformation (stability) between two genotypes. We found that several Cd-responsive genes have SNPs, suggesting that they may participate in tolerance. The identified DEGs and detected SNPs between genotypes will provide an insight into early response to Cd stress in barley.

P14: Comparative metabolite profiling of pearl millet for drought and salinity stress response

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Drought and salinity are two major environmental stresses which determines plant productivity and distribution. For this study pearl millet an important tropical, C4 small grained cereal crop was experimental material. Mainly it is grown in semi-arid and arid regions of India, sub-Saharan Africa and Southern America over area of 28 million hectare. The main objective of this study is to find out the altered metabolites in pearl millet treated with drought (stopping water for 5 days) and salinity (250mM NaCl). The Untargeted metabolite profiling was performed into High performance liquid chromatography (HPLC) apparatus (Agilent 1200 series), LTQ ORBITRAP XL (Thermofisher scientific). The raw spectra were processed with Mzmine2 tool. The univariate and multivariate PCA (Principle component analysis) and PLS-DA (partial least square discriminate analysis) were performed to study the difference in metabolomics profile within samples. All the analysis yields the detection of 102 metabolites in Leaf under drought condition; 123 metabolites in Root under drought condition; 141 metabolites in leaf under salinity condition; 117 metabolites in root under salinity condition. The list of significant metabolites was subjected to the MS peaks to pathways module of Metaboanalyst ver.4.0 to find out the most enriched pathways. The results show that 13 pathways were enriched from carbohydrate metabolism, 12 from amino acid metabolism, 7 from cofactor and vitamin metabolism and secondary metabolism, energy metabolism. Performing hierarchical clustering of these pathways forms a cluster of highly significant pathways mainly involved in carbohydrate and amino acid metabolism. However brief study is needed to validate the data.

P15: Cytotoxicity of fucoxanthin for a variety of cancer cells - molecular insights

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Cancer is on the rise; claiming millions of lives worldwide to the extent that it might will soon be called an epidemic. Presently available cancer remedies are expensive, and are associated with serious side effects and appearance of drug resistance forms of cancer cells. Exploring and applying natural compounds as a remedy to prevent or limit cancer propagation could be beneficial and empirical. With this objective, we screened a variety of natural compounds from our compound library using cultured human cells for their anticancer mechanisms, and kindled specific interest in fucoxanthin. It 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 pursuits have not been dissected actively. We found that it dose-dependently caused toxicity in a variety of cultured cancer cells, and was reasonably safe to the normal lung fibroblasts. We performed *in silico* analyses and found that fucoxanthin with a very high potential docked with the p53 binding site of mortalin. It inhibited the interaction of p53 and mortalin resulting into apoptosis specifically in the cancer cells. We performed biochemical and imaging analyses and found that it caused downregulation of mortalin resulting activation of p53 activity and compromised migration and invasion capacities of the colorectal and bone cancer cells. Molecular mechanisms of cytotoxic and anti-migration activities of fucoxanthin for cancer cells with variable p53 status is currently under investigation and validation.

P16: Inverse estimation of stress-strain curve from load-displacement curve and indentation mark of single indentation

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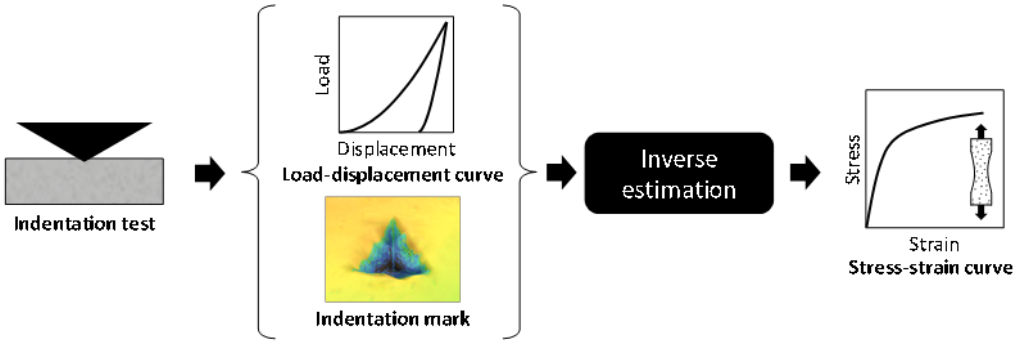
A stress-strain curve plays an important role in product design and evaluation. Many studies have been addressed to develop an inverse estimation technique of the stress-strain curves using instrumented indentation tests as an alternative to a tensile test since sample preparation of the indentation test is relatively easy and many tests can be performed with one sample. Most of the techniques require plural indents with different shapes of indenters due to the uniqueness problem of load-displacement curves. However, plural tests are time-consuming and do not give local properties on a specific point of interest.

Another information obtained from the indentation test is the three-dimensional shape of the indentation mark generated on the sample surface due to its plastic deformation. It also reflects the mechanical properties of the sample. The authors proposed an inverse estimation technique of the stress-strain curve using the indentation mark shape in addition to the load-displacement curve.

In this work, the authors investigated the dependency of indentation results on the parameters extracted from the stress-strain curve such as yield stress and strain hardening exponent using the finite element method. As a result, the load-displacement curve depends on both of the yield stress and strain hardening exponent, while the maximum height of indentation mark strongly on strain hardening exponent. It was confirmed that such different dependency of the indentation results on the elastoplastic properties makes it possible to estimate a stress-strain curve from a single indent.



P17: Quantitative and qualitative cell viability (QCV) assay for evaluation of the short and long-term cytotoxicity of drugs

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In view of the toxicity of conventional cancer chemotherapeutic drugs to normal body functions, identification of safe and natural anticancer drugs has been prioritized. Short-term cell viability assays often based on formation of a chromogen generated selectively in viable cells are conventionally used. The quantitative measures of the chromogen in control and treated cells in 96 well plates by a spectrophotometer are the conventional read-outs. These are often complicated by (i) some natural compounds have slow/gradual action and require long term assays, (ii) effect of drugs on single cells, layers and colonies vary (iii) natural extracts often possess intrinsic color that may interfere with quantitative readouts and (iv) the visual observations of cell morphology that hold significant hints to molecular signaling underlining the effect of drugs are difficult to be recorded. We report a simple cell viability assay protocol in 12 well culture plates using a viable cell specific stain (Crystal violet). It allows Quantitative and Qualitative Cell Viability (QCV) assays and overcomes above limitations.

P18: Twinning behavior of orthorhombic-α" martensite in a Ti-7.5Mo alloy

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Orthorhombic-α" martensite plays a key role in characteristic mechanical properties of β-Ti alloys, such as low Young's modulus, and shape memory effect. Ti-7.5Mo alloy with fully α" martensite has been recently developed as promising biomaterials. Therefore, the investigations of deformation mechanisms of α" martensite are suggested important for the enhancement of mechanical properties. In the present study, we have investigated the deformation mechanisms of orthorhombic-α" martensite in Ti-7.5Mo alloy. The microstructure characterization has been performed by means of transmission electron microscopy (TEM) and scanning electron microscopy (SEM) combined with electron backscattered diffraction (EBSD) in a tensile deformed sample. The as-quenched α" plates contain $\{111\}_{\alpha''}$-type I transformation twins generated to accommodate transformation strain from bcc-β to orthorhombic-α" martensite. Tensile deformation up to strain level of 5% induces $\{112\}_{\alpha''}$-type I deformation twins. The activation of $\{112\}_{\alpha''}$-type I deformation twinning mode is reported for the first time in α" martensite in β-Ti alloys. $\{112\}_{\alpha''}$-type I twinning mode was analyzed by the crystallographic twinning theory by Bilby and Crocker and the most possible mechanism of atomic displacements (shears and shuffles) controlling the newly reported $\{112\}_{\alpha''}$-type I twinning were proposed.

P19: Clinical relevance of CARF in malignant and metastatic cancers: impact of beta Catenin activity

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CARF (Collaborator of ARF) was initially discovered as a novel ARF-binding protein.[1] It was further 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.[6] At molecular level, we found enrichment of CARF in cancer cells promoted epithelial-mesenchymal transition (EMT), essentially by enhancing nuclear localization and function of β-catenin in cancer cells.[6] CARF-enriched cells showed increased level of expression of not only the β-catenin effectors including SNAIL1, SNAIL2, ZEB1 and TWIST1[6], but also the key regulators of cancer cell stemness including CD24, CD44,CD61, CD133, Oct4, SOX2, NANOG and ABCG2. Of note, CARF knockdown caused diminished nuclear β-catenin function, abrogated EMT as well as CSC phenotypes. Consistent with these findings, we found that CARF-suppression *in vivo* either by siRNA or CARF shRNA (adeno-oncolytic virus) caused significant delay in tumor growth and lung metastasis. Taken together, we report that CARF is a novel activator of Wnt/β-catenin signaling and promotes EMT and CSC properties in malignant and metastatic malignancies.

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P20: Design of nanocarbon film-based electrodes for biomolecular detection

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We have been studying nanocarbon film electrodes formed by some sputtering method.[1)] The film electrode has excellent properties including relatively high electrode activity for various analytes, a low background current, and little surface fouling, while maintaining. These characteristics allow the detection of various analytes, which are difficult to measure at the conventional carbon electrodes. For example, this film electrode can measure various biomolecules (including DNA base derivatives e.g., 5'-methylcytosine, lipopolysaccharide) quantitatively.[2)] Moreover, due to their good electrochemical stability and low background current, the nanocarbon film electrode is suitable for long-term analysis including as the electrode of an HPLC detector for detecting cerebral gliotransmitter from real samples.[3)] The nanocarbon film surface can be easily modified with other atoms/nanoparticle without losing its ultraflatness.[4)] For example, we previously developed electrochemically stable fluorinated nanocarbon (F-nanocarbon) film by CF_4 plasma treatment. We successfully applied for quantitative measurements of lipophilic antioxidants (α-tocopherol) with maintaining the suppression for the responses of hydrophilic antioxidants (ascorbic acid) in liquid food samples.[5)] This is highly advantageous in terms of constructing a simple assay of antioxidant because an extraction process is usually required prior to the conventional assay. Our sputtering method can also be applied to develop a platinum nanoparticle-embedded nanocarbon film electrodes for detecting geosmin, which is difficult to detect at the nanocarbon film itself. The most significant and implicative point of these works, is that the nanocarbon film-based electrodes can extend ability to detect analytes, which is previously unattainable for measurements (due to electrode problem such as narrow potential window, large background noise, and surface fauling).

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P21: Molecular insights to the anticancer potential of honey bee propolis (green) extract

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Propolis, a resinous substance that honeybees make by mixing their saliva with plant sources including tree bark and leaves etc. It has a complex chemical nature and is known to possess a variety of bioactivities. There are mainly 2 kinds of propolis known that differ in their constituents; New Zealand propolis possesses CAPE (Caffeic Acid Phenethyl Ester) and Brazilian green propolis possesses Artepillin-C (ARC) as their main anticancer components. We recently reported that anticancer activity of CAPE involves activation of p53-GADD45 signalling that resulted from targeting of mortalin-p53 interaction by CAPE. We found 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 yCD showed stronger anticancer activity than the purified ARC in *in vitro* and *in vivo* assays suggesting that GPSE-yCD could be NEW (Natural Efficient and Welfare) anticancer amalgam. We tested cytotoxicity of GPSE to cancer cells with varied status of p53 protein and found that it inhibits growth and migration of cancer cells irrespective of their p53 status suggesting that it may work through multiple mechanisms.

P22: All-ceramic solar-driven water purifier based on anodized aluminum oxide and plasmonic titanium nitride

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Titanium nitride (TiN) nanoparticles (NPs) act as excellent solar-heat nano-generators due to their broadband plasmonic resonances together with their chemical stability. So far, TiN NPs have been studied without loaded onto any host or support materials for solar water distillation system, which make them difficult to re-use in practical applications [1]. To overcome this drawback, our previous studies have demonstrated a floating composite structure composed of TiN NPs and transparent ceramic fibers with improved solar steam generation efficiency up to 80% [2]. In the current project with the motive to further enhance the solar steam generation efficiency, we develop cost-effective, reusable and efficient composite ceramic structures using porous alumina.

Here, we demonstrate an efficient method of water purification and desalination using anodized aluminum oxide (AAO) with titanium nitride (TiN). While the ceramic TiN converts the incident light energy into thermal energy and generates a hot region at the water-vapor interface, AAO provides the efficient transport of water to the forefront of water evaporation through its nanochannel. Our studies have shown that photo thermal performance of TiN-AAO can be optimized by adjusting the pore diameter and TiN thickness. Additionally, a thermal insulation by a facile technique was effective in improving the water evaporation speed. Low cost and concise design makes our structure portable material for the solar steam generation. It has 95% steam generation efficiency under solar irradiation of 100 mW cm^{-2}.

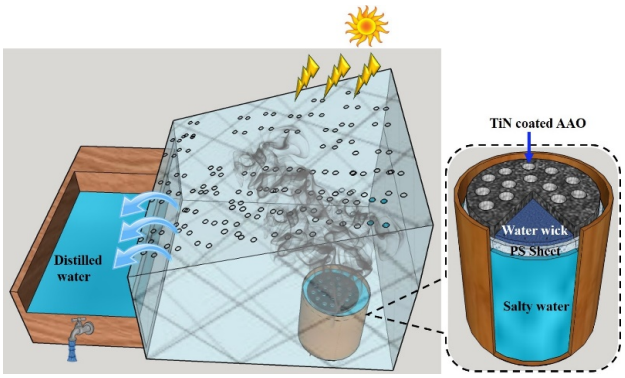

Figure: Schematic shows Titanium nitride (TiN) coated anodized aluminum oxide (AAO) converts the incident solar energy into thermal energy by the photothermal conversion and generate steam efficiently.

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P23: Immobilization of genomic DNA with bifunctional linker molecules for 5-methylcytosine immunoassay

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DNA methylation is an epigenetic modification, which is represented in mammals by the methylation of a carbon atom at position 5 of cytosine residues. It is now well recognized that 5-methylcytosine (5-mC) plays an important role in regulating many cellular processes including gene expression and embryonic development. Also, it was recently revealed that the changes in methylation level are related to many human diseases including cancers, neurodegenerative diseases such as Parkinson's and Alzheimer's diseases, and autoimmune diseases. Therefore, the detection and quantification of the DNA methylation level is important not only for understanding many biological processes but also for reaching diagnoses.

We developed novel hetero-bifunctional linker molecules which can anchor DNA samples on the surface of bio-sensing devises. The linker molecules are constituted of nitrogen mustard moiety and cyclic disulfide (L1) or biotin (L2) groups. The L1 linker can immobilize genomic DNA on the gold surface of SPR (surface plasmon resonance) sensor, while the L2 linker can be used for streptavidin coated 96-well microplate. Using these linker molecules, we succeeded in the immunochemical detection and quantification of 5-mC by the SPR assay, and by the conventional ELISA assay.

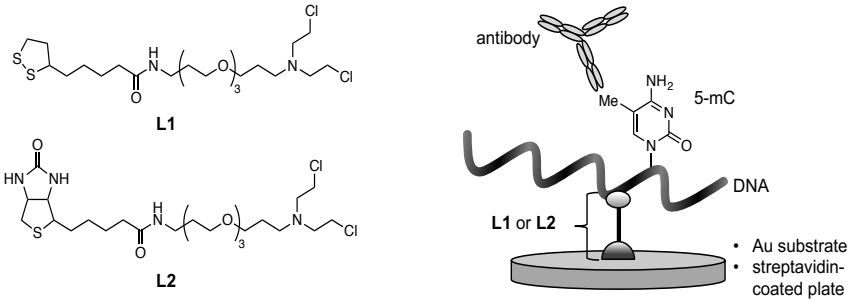

Fig. Structures of bifunctional linker molecules and schematic image of 5-mC detection

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P24: Ashwagandha leaf extract possesses anti-survivin activities

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Survivin is a member of the inhibitor of apoptosis protein family that inhibits caspases activation thereby blocks programed cell death. Survivin regulates cell cycle progression and is often overexpressed in cancer cells facilitating their aberrant progression. On the other hand, it is barely detectable in the terminally differentiated normal cells or tissues. Furthermore, expression of survivin in tumors correlates with not only inhibition of apoptosis and a decreased rate of cell death, but also resistance to chemotherapy and aggressiveness of tumors. It is a nodal protein in a number of cellular pathways. Activation of the Wnt signaling pathway in cancer cells leads to accumulation of β-catenin/TCF enhancer factor transcriptional machinery has been shown to upregulate survivin. Therefore, survivin is an important target for cancer vaccines and therapeutics. Currently a limited number of survivin inhibitor have been developed in recent years. In this study, we investigated effect of Ashwagandha extracts and some purified components on survivin using surviving enriched cancer cells. We found decrease in survivin in treated cells as compared to the control and of note, this decrease was comparable to the cells treated with specific synthetic inhibitors (PFK118-310, YM155 and AMPK Activator) of survivin. It is suggestive that Ashwagandha leaf extract may serve as a potent natural drug for survivin enriched cancers.

P25: Macaroni fullerene crystals: novel nanocarbon materials for energy storage application

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Fullerene nanocarbon materials display unique physical and chemical properties due to their extended conjugation through sp2 carbon atoms,1 which make them attractive for the fabrication of novel functional systems. Recently, self-assembled fullerene nanostructures have received considerable attention due to their potential application in various fields.2,3 Introduction of pores (micro-or meso or both) in fullerene crystals drastically increase the effective surface area leading to great utility in energy storage and sensing applications.4 Here, we present novel nanocarbon material "macaroni fullerene" (MF) crystals fabricated at liquid-liquid interface under mild conditions of temperature and pressure. MF crystals possess uniform 1D hollow structure (average length and diameter ca. 1.5 μm and 550 nm, respectively). These macaroni nanostructures could be directly transformed into mesoporous macaroni carbons by heat-treatment at 1000 °C under vacuum. This new family of mesoporous macaroni carbons having π-electron conjugation over the sp2-carbon with robust frameworks show excellent electrochemical super capacitive performance.

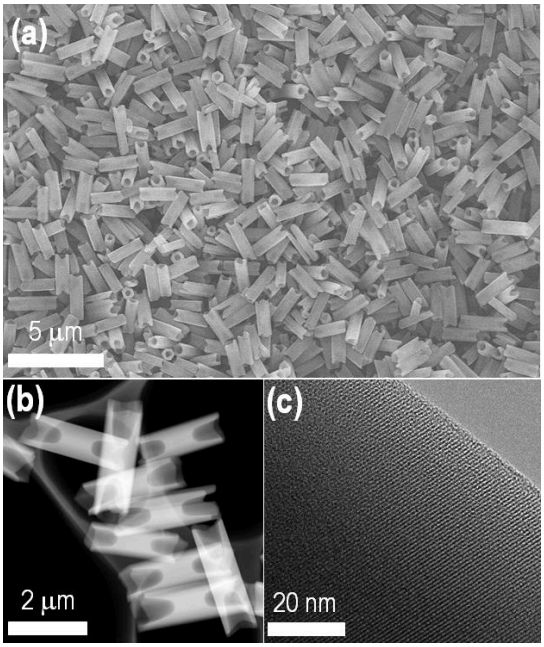

Fig.1 SEM (a), STEM (b) and HR-TEM (c) image of macaroni fullerene crystals.

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P26: Combination immunotherapy using synthetic genetic switches

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Cancer is the leading cause of mortality worldwide. Checkpoint blockade therapy (especially PD-1 blockade based) has revolutionized the cancer treatments by its long-lasting effect and being applicable to different tumors irrespective of their origin. Cancer cells evade the immune response by upregulating PD-L1 (ligand of PD-1) expression and ligating with PD-1 on T cells. The major issue with PD-1 blockade therapy is the high cost of anti-PD-1 or PD-L1 antibody that restricts its worldwide application to treat cancer. Consequently, there is a growing demand to develop a cost-effective strategy to enhance anti-tumor immunity. Recently, epigenetic strategies got proclaimed to cancer immunotherapies, however, the lack of sequence specificity is a major concern. *N*-methylpyrrole (P) and *N*-methylimidazole (I) are noncovalent hairpin polyamides which selectively recognize Watson–Crick base pairs of DNA sequences located within the minor groove that modulate endogenous gene expression. We have developed designer PIPs as a cost-effective combinatorial approach to Switch OFF and Switch ON the genes of interest that will enhance the efficacy of checkpoint blockade immunotherapy by two ways: **A)** Targeting cancer cells using genetic OFF Switches - Chb-PIP conjugate (Chb, chlorambucil, a DNA alkylating agent) is expected to 'Switch OFF' the PD-L1 expression in cancer or host immune cells (macrophage, dendritic cells, myeloid cells) at transcription level, which inturn could result in blockade of PD-1/PD-L1 axis and activate killer T cells **B)** Targeting CD8 effector T cells using genetic ON switches - designer PIPs conjugated with the epigenetic activator CTB to target and induce the specific transcription factors for mitochondrial activation and biogenesis i.e., Tfeb that will finally upregulate PGC-1α.

P27: Estimating the dynamic stiffness and flexibility of laterally loaded pile foundation of seismically isolated cable-stayed bridge

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The problem of the degradation of supporting soil due to large ground excitations have a great deal to do with the damage to structures during earthquake. In view of this, current study attempts to estimate the dynamic pile cap stiffness and pile cap flexibility of the pile foundation (pile and caissons (sheet pile)) of seismically isolated cable-stayed bridge under lateral loading, which are often neglected in control of structures. Thin-Layered Element Method (TLEM), a semi-analytical finite element method is used for the dynamic soil-pile group interaction analysis. In the present method, a numerical program TLEM-(Ver 1.2) has been used in which the piles are assumed to be upright Timoshenko or Bernoulli-Euler beams. The frequency dependent dynamic pile cap stiffness and pile cap flexibility are evaluated for the Shin-Nakagawa cable-stayed Bridge hereby refereed as targeted bridge which is in the Ibaraki prefecture of Japan. The targeted bridge is monitored with wireless MEMS sensors for long-term structure health monitoring (SHM). The numerical results show that the change in dynamic soil properties affects the pile cap stiffness and pile cap flexibility for sway, coupling and rocking motions. These stiffness parameters can be used as an input for assessing the soil-structure interaction (SSI) for the finite-element model of the targeted bridge in future.

P28: Iron sulphide nanoclusters biomineralized by the sulphate reducing bacteria enhanced synergetic anodic current generation with the Iron reducing bacteria

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Iron sulphide minerals, an important mineral involved in the global biogeochemical sulphur cycle, is a ubiquitously occurring mineral existing in various metastable phases (FeS_x). The tetragonal forms of iron monosulphides show metallic like conductivity that enable them to function as long-range electron conductors adjoining various redox environments. Iron sulphide nanoclusters biosynthesized by the action of dissimilatory sulphate reducing bacteria (SRB) has already been shown to improve the electron transfer rate to the electrodes. Recent studies with the electrogenic iron reducing bacterium (IRB) *Shewanella oneidensis MR-1* also reported that the presence of FeS facilitated anaerobic bacterial respiration which are coupled with electron transport process to external solids, the so-called extracellular electron transport (EET) and its presence drastically improved the anodic current production. However, it has been unclear how these metallic nanoparticles influence the current generation by these electrogenic microbes. In this work, we investigated the influence of FeS nanoclusters for the synergetic anodic current generation by SRB and IRB cocultures which function as FeS nanoclusters and current producers respectively. We performed electrochemical measurements to study the current generation with *Desulfovibrio vulgaris,* as SRB and *S. oneidensis MR-1* as IRB in a three-electrode electrochemical reactor with indium tin-doped oxide electrode as working electrode poised at 200 mV vs Ag/AgCl KCl sat. Our observation showed that the biomineralization of FeS nanoclusters promoted the synergetic enhancement of current generation. Electrochemical gating measurements with the interdigitated array electrodes showed a redox gradient driven long-range electron conduction in the system in the presence of FeS nanoclusters, suggesting the synergetic effect is related with the long-range electron conduction. We also examined how the concentration of electron donor, lactate, impact the synergetic current production to understand the interaction between SRB and IRB. We will discuss about the potential mechanism for synergetic current production in detail.

P29: Infiltration growth processing of bulk $YBa_2Cu_3O_{7-x}$/$REBa_2Cu_3O_{7-x}$ superconductors: nano metal oxides and rare earth elements effects on crystal growth and physical properties

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High critical temperature $REBa_2Cu_3O_{7-x}$ (REBCO/YBCO, RE = rare earth elements) superconductors are promising and are currently being utilized for various practical applications in science and technology due to their effective flux pinning abilities [1]. Controlling the growth and engineering the microstructure are the key parameters for producing high quality superconducting final products. This can be achieved employing various fabrication methods and modifying the chemistry. Currently evolving infiltration growth (IG) processing technique is superior to the melt growth process [2]. IG process offer near-net shaped final products with controlled microstructure which are highly in demand for practical use. This presentation will introduce various techniques employed for fabricating the high quality REBCO superconductors, summarize their influence on final microstructure and superconducting properties. The effect of introducing various rare earth elements in IG processed YBCO/GdBCO bulk superconductors, and the evolution of microstructures supported by thorough elemental analysis and their effect on superconducting properties will be discussed. More emphasis will be given for discussing the IG processing of single grain REBCO products and controlling their micro-structural properties at various stages. Scaling of the flux pinning force is very effective method to understand the involved pinning mechanisms in the superconductors. Therefore, we will imply the scaling of bulk volume flux pinning force method and discuss the effect of various parameters to understand the superconducting properties of the final products. We will also discuss the synthesis of recently developed high-T_c $Y_3Ba_5Cu_8O$ superconductor and YBCO nano rods fabricated through template growth method for various magnetic field sensor applications.

P30: Low pH induced extracellular electron transfer by an oral pathogen

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Streptococcus mutans, the major causative agent of human dental caries, lives almost exclusively as tenacious biofilms on the tooth surface and survive in various kinds of environmental stresses like nutrient availability, pH, temperature, oxygen tension, saliva, and shearing force. Primary fermenters in oral environment like *S. mutans* excretes acid end products like lactate, acetate, formate or gases like H_2, CO_2 which creates a redox environment with in oral community. Such redox ambiances inhibit energy maximization and prohibits them to maintain the redox balance with only fermentation. Hence, long-range electron transport would be highly energy conservative for the microbes in order to maintain the redox balance. Extracellular electron transport (EET) is a phenomenon, where microbes transfer their metabolically generated electrons to outside of cell body to reduce an external electron acceptor and gain energy. However, the EET capability was not explored in oral pathogens. In our study, we tested the EET capability in an enormously studied fermentative oral pathogen *Streptococcus mutans* UA159 by in-vivo electrochemistry for the first time. *S. mutans* has shown the EET capability on electrode surface and such EET capability is induced upon acid stress exposure during preculture and is insignificant in no pH stress cells (Figure1). Our analysis revealed the electrogenic activity of *S. mutans* on electrode surface is coupled with glucose oxidation directly through a membrane bound redox enzymes. Microscopic observation of heme stained *S. mutans* indicated that redox enzymes (Fig. 1) are highly expressed during the acid stress. Single cell activity by nanoSIMS revealed that EET has a role to activate the microbes that are less active in fermentation. Though immense research has been done on *S. mutans* aciduricity, from our analysis we proposed that EET has a role to harvest energy in stressful conditions like acid stress.

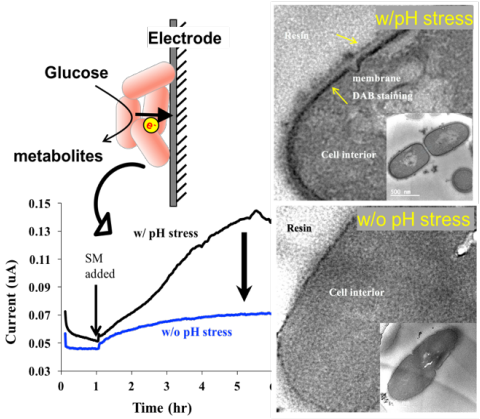

Figure1: pH stress induced EET via membrane bound redox enzymes

P31: Effects of N_2-nanobubble water on anaerobic co-digestion of waste activated sludge and lignin

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Introduction: Anaerobic digestion (AD) is considered as a suitable technique for converting waste activated sludge (WAS) and lignocellulosic biomass into biogas that can be used for heating and power generation. Among the main three organic components (cellulose, hemicellulose and lignin), lignin is regarded as the major barrier to the bioconversion of lignocellulosic materials during AD. It can resist the hydrolysis of lignocellulose, thus limiting the degradation of substrates for biogas production. In this study, nano-bubbles (NBs) (<200 nm in diameter) with specific characteristics (relatively high stability, rapid mass transfer rate and improved gas solubility in aqueous solution) were firstly generated in water which was then applied for enhanced methane production from WAS via AD process. Materials and methods: Nano-bubble water (NBW) was produced by the Micro-Nano Bubbles generator. N_2 was injected into the generator and recycled for 25 min, which was termed as N_2-NBW. Digested sludge sampled from the wastewater treatment plant (Ibaraki, Japan) was used as inoculum (stored at 4°C before use). In order to enrich lignin-WAS utilizing bacteria, both lignin and WAS were used as the substrate during the enrichment stage, at a ratio (VS basis) of 2:1 for the inoculum and WAS. AD of deionized water (DW) medium and dead inoculum were used as controls, respectively. Soluble total organic carbon (sTOC) removal, methane production and lignin degradation rate were investigated under different proportion (0%, 25%, 50% or 100%) of NBW addition and initial lignin concentrations (50, 100, 200 or 300 mg/L). Results: Results show that after N_2-NBW addition, higher methane production and lignin degradation rate were achieved, averagely 911.7 ml for per gram reduced volatile solids (VS) and 76%, about 17% and 11% increase compared to the control group with DW addition, respectively. When different proportion of N_2-NBW being added, the daily and accumulative methane production showed a dose dependent manner, further indicating the positive effect of NBW on methane production. The highest lignin degradation rate, about 80%, was obtained from the scenario of 200mg/L lignin concentration. NBW addition showed some positive effect on sTOC reduction, with the maximum about 6 % compared to the control. Results from the present work show that N_2-NBW did not have profound improvement on methane content and VS reduction.

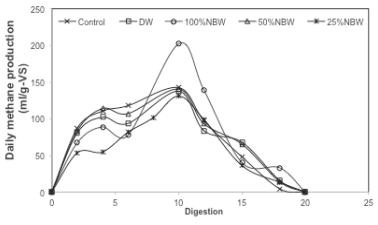
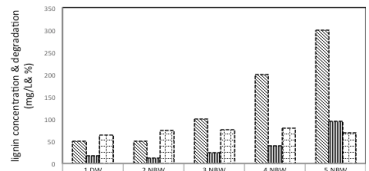


Fig. 1Daily methane production when adding different proportion of NBW



	1 DW	2 NBW	3 NBW	4 NBW	5 NBW
Inital(mg/L)	50	50	100	200	300
End(mg/L)	18.03	12.82	24.1	39.5	94.6
degradation%	63.94	74.36	75.90	80.25	68.47

Fig.2 lignin degradation when adding different inital concentration of lignin

P32: Differential surface protein modifications during epidermal stem cell aging

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Aging in the skin epidermis is marked by a gradual decline in barrier function, impaired wound healing and an increased risk of cancer. This could be due to an age-related change in the property of epidermal stem cells or defective interactions with its microenvironment and/or other cell types in the skin. There have been conflicting reports for aged epidermal stem cells as there are no definitive markers available for these cells. In this regard, we need a new tool to dissect age-related changes in epidermal stem cells. The cellular glycosylation is known to have a role in cell-cell communications, cell to matrix adhesion in various physiological and pathological conditions.

Herein, we explored the changes of glycans in epidermal stem cells during aging as a potential marker along with its functional implications. Using lectin array, a technique that utilizes lectins to recognize various glycan structures, we compared the cell surface proteins of epidermal stem cells isolated from young and old mice. We found several lectins were differentially identifying glycan structures in the young and old epidermal stem cells. The aged epidermal stem cells showed a significant decrease in mannose (Mana1-3Man, Mana1-6Man) and an increase in sialylation (α2-3 Sia) modifications. To further understand the molecular mechanism and biological significance of these glycan changes during aging, we are currently identifying the core protein(s) in which the glycan modifications take place by lectin pull-down assays followed by mass spectrometry. During physiological aging, we found that epidermal stem cells showed changes in their cellular glycosylation patterns. These glycan modifications detected by lectins will serve as a molecular marker for aging, and further functional studies will lead us to a better understanding of the process of skin aging. Modification of these glycans may possibly be used as a strategy to reverse the aging phenotype.

P33: Anticancer activity of soyasapogenol – potency and molecular mechanism

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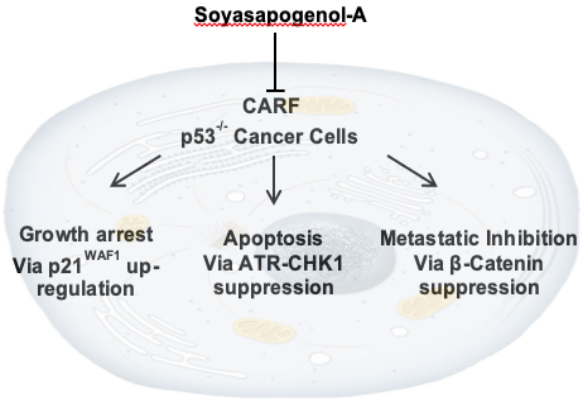
CARF (Collaborator of ARF) protein is a key regulator of ARF-HDM2-p53 tumor suppressor pathway and proliferation fate of cells. Whereas it's moderate upregulation results in increase in p53 and growth arrest, its super-high level leads to decrease in p53 and malignant transformation of cancer cells. Molecular analyses have revealed that CARF activates p53 function directly and indirectly through ARF and HDM2 proteins. At the same time, it causes transcriptional repression of p21WAF1 (a key executor of growth arrest) resulting in pro-proliferation, especially in p53-compromised cells. More recently, we found that enriched levels of CARF in cancer cells promote Epithelial Mesenchymal Transition (EMT) through activation of Wnt/β-catenin signaling. Based on these results, CARF was predicted to be a potential target for cancer therapeutics.

In the present report, we detected cytotoxicity of Soyasapogenol-A to a variety of cancer cells in cell culture assays; Soyasaponin-I was inert. We present molecular and biochemical evidence that Soyasapogenol-A targets CARF yielding growth arrest (through activation of $p21^{WAF1}$), decrease in migration (through inactivation of EMT and metastasis) of cancer cells with p53-null status, especially. Soyasapogenol-A may be a NEW (Natural Efficient and Welfare) drug for treatment of p53-null aggressive cancers.



P34: Bio sensing of Leishmaniosis using FTA card as direct sampling tool for recombinase polymerase amplification

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Leishmaniasis is a vector-borne disease that is transmitted by sandflies. DNA-based molecular typing methods such as Polymerase Chain Reaction (PCR) are highly reliable, sensitive and specific and can be used for the detection of asymptomatic infections and early stage infections of the disease. However, these methods are unsuited for implementation at primary or secondary health-care facilities due to the obvious requirements of highly sophisticated laboratory and trained personnel. Very interestingly, recombinase polymerase amplification (RPA)-based molecular tools are continuously being emerged as an elegant method of choice to perform amplification without the need of complex instrumentation[1]. Sampling methods such as liquid biopsy are a burden to both patients and physicians and the DNA extraction and purification steps involved for sampling in DNA-based methods render the diagnosis more time consuming. Recently the use of FTA cards for direct sampling of lesions was demonstrated for PCR and LAMP[2]. Direct sampling by FTA card reduces the risk of contamination and also facilitates transport and long-term storage of the sample at room temperature.

Therefore, in this research, we propose FTA card as a direct sampling method for detection of leishmaniasis using RPA. 2mm disk was punched from the FTA card and washed to readily capture DNA on the card and subjected the disk to RPA targeting a 360bp segment of 18S rRNA gene of *Leishmania major* genome. We obtained the expected band in the case of FTA card containing the sample (Fig. 1). We also developed a palm-sized electrophoretic device for rapid on-site gel electrophoretic analysis of RPA products to distinguish true positives from false-positive results arising due to the high chances of non-specific amplification in RPA. We show that FTA card can be used successfully without vigorous sample preparation steps for field applicable bio sensing of leishmaniosis using RPA.

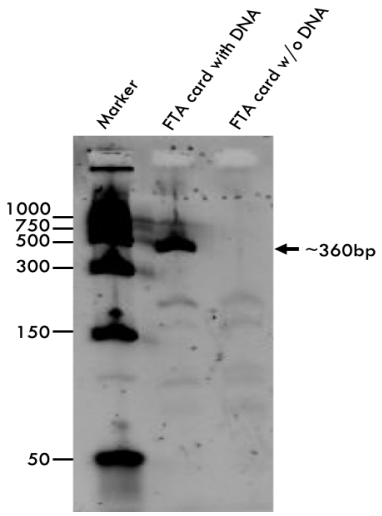

Fig. 1. *RPA using FTA card for direct sampling to detect leishmaniosis.*

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2. Kato, H. *et al. J. Clin. Microbiol.* 48, 3661–5 (2010).

P35: A time crystal aspect on slow release of sex pheromone from supramolecular container to control the pest in green way

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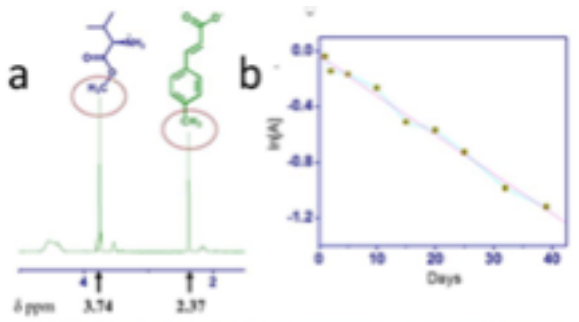
Slow release of sex pheromone from supramolecular container[1] has a great potential in controlling the pest in green way. Some major sex pheromones with primary amine functionality can be reacted with cinnamicacid analog to form a Primary Ammonium Monocarboxylate (PAM) synthon, which can be used as supramolecular container of sex pheromones for several Phyllophaga species. This study mainly conined with valinemethylester p-methylcinnamatesalt (Fig. 1a, ΔpKa =pKa(donor) – pKa(acceptor) = -3.39) to demonstrate the release of major sex pheromone of P. anexia and P. Georgiana to the environment. The borderline |ΔpKa| is large enough so as to allow efficient formation of the salt, yet small enough relative to |ΔpKa| value for p-methylcinnamic acid-water donor-acceptor system to allow controlled disintegration of the salt in nominal presence of moist air. The salt decomposes instantly into the reactants in presence of water and several other protic solvents. The salt lattice clearly does not exist in chloroform solution but charged molecular form does exist, being stabilized by charge-transfer H-bonds. The latter are known to have greater bond energy than ordinary H-bonds.

The moisture present in the air catalyze the pheromone release from the supramolecular container. Formation and the property of time crystal will be compared with catalytic cycle to demonstrate the implication of time crystal concept in Chemistry for the first time.



(a), NMR signal of the salt. (b) first order kinetics of pheromone release experiment.

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P36: The novel F-box protein regulates a quick avoidance behavior to a pathogenic bacterium *P. aeruginosa* in *C. elegans*

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For most animals including human, avoiding the intake of pathogenic bacteria is one of important strategies for their healthy conditions and long-lived life spans. *Caenorhabditis elegans* is known to show an avoidance behavior to *Pseudomonas aeruginosa* which is a common Gram-negative pathogenic bacterium and is known to affect health condition in many animals. Previous reports showed that *C. elegans* on the *P. aeruginosa* (PA14) lawn starts to avoid PA14 after eight hours, but in some cases, after 24 hours they fed PA14. However, it is not clear how worms change the behavior to avoidance from PA14 and why it takes such long periods to induce this behavior. Alternatively, is it possible for worms to recognize PA14 as a pathogen in a shorter period and to induce an avoidance behavior before eight hours? To answer these questions, we examined how quickly worms can respond to PA14 and what kind of molecules regulate this quick recognition and behavior.

By carefully observing behaviors on the PA14 lawn, we found that more than 50% of wild-type animals showed an avoidance behavior within 30 min. This implies that worms can recognize PA14 in such a short period and change their behavior state. To identify the molecules involved in this behavior, we performed a genetic screening and isolated a candidate mutant which shows a significantly weak quick avoidance behavior to PA14 (only 15% avoidance in 30 min). By cloning the responsible gene of this mutant, we found that the novel protein with a F-box domain, which mediates protein-protein interactions in ubiquitination, regulates the quick avoidance behavior. Further analyses will reveal the exact protein function in the quick worm response to pathogenic bacteria.

P37: Withaferin A and CAPE are potential inhibitors of PARP-1 and DNA repair

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Cervical cancer is the second most common cancer affecting the woman. It is caused by human papillomavirus (HPV). When HPV infects cells in the cervix for a long time, it causes abnormal cell growth and inflammation, often yielding to cancerous pathology. The most known treatments for cervical cancer, chemotherapy, surgery and radiotherapy are complicated by several side effects. Therefore, research on anticancer natural products has been prioritized as these would offer additional advantages such as, easily available and affordable.

We have earlier reported anticancer activity in Withaferin A (Wi-A), a withanolide derived from Ashwagandha (*Withania somnifera*) and CAPE, an active compound from New Zealand honey bee propolis. Both of these were shown to activate tumor suppressor protein p53 by targeting mortalin-p53 interaction in cancer cells. In the current study, we report that Wi-A and CAPE cause downregulation of mortalin and PARP-1, a key regulator of DNA repair and target protein for drugs (Olaparib and Rucaparib) used for treatment of ovarian cancers. We demonstrate that human cervical cancer cells treated with Wi-A and CAPE showed a significant inhibition of mortalin and PARP-1 resulting in induction apoptosis that was well marked by upregulation of pro-apoptotic proteins. We compared the docking behavior of Wi-A and CAPE to CAPE and found that, similar to Olaparib, both of these could bind to the catalytic domain of PARP-1. Taken together, the data suggests that Wi-A and CAPE have significant potential as natural PARP-1 inhibitors and could be considered as potential therapeutic drugs for treatment of cervical cancer treatment.

P38: Short chain fatty acids production from blast furnace gas under anaerobic conditions: fffect of additional H_2, pH and inoculum pretreatment

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Introduction: In recent years, biological fermentation of syngas is a promising emerging technology for biofuel production without the use of plant biomass as sugar-based feedstock, which also plays a vital role in achieving development of alternative and sustainable energy. The most promising bacterial groups for fermenting syngas are acetogens. These unique obligatory anaerobic bacteria are able to fix CO_2 or CO using H_2 as an electron donor or CO alone to produce organic acids. Blast furnace gas (BFG), a mixture of 22% CO, 22% CO_2, 4% H_2 and N_2, was used in this study. As the H_2 content of BFG is very low, adding H_2 is an efficient means to promote organic acids production from BFG. Medium pH has been shown to be a key factor affecting the acetate production. Due to the different results on pH obtained from previous studies, the optimization of medium pH for acetate production was also conducted on syngas fermentation in this study. Moreover, the inoculum was pretreated by adding bromoethanesulfonate (BES), which was compared with the inoculum with heating pretreatment as well. Materials and methods: The inoculum in this study was anaerobic granular sludge (AGS) sampled from a mesophilic Expanded Granular Sludge Blanket (EGSB) reactor treating brewery wastewater (Asahi, Ibaraki, Japan), which was stored in refrigerator at 4 ºC before use. Batch AD experiments were performed under different H_2 partial pressures (0.04, 0.44, 0.88, 1.32 atm) and different pH (4, 6, 7, 8, 10) conditions at the optimal H_2 partial pressure. In addition, the inoculum was pretreated with heating and BES addition under the optimal H_2 partial pressure and pH. VFAs were measured by using gas chromatograph (GC-8A) equipped with Unisole F200 30/60 column and flame ionization detector (FID). Biogas composition was analyzed by using gas chromatograph (GC-8A, Shimadzu, Japan) equipped with a thermal conductivity detector (80°C/170°C) and Porapak Q column (60°C/80°C) using N_2/He as carrier gas. Results and discussion: As shown in Fig. 1, the VFAs concentration was increased with the increase in H_2 partial pressure, and the highest VFAs concentration about 343mg C/L was achieved under H_2 partial pressure of 0.88 atm. This phenomenon indicates that additional H_2 might promote the consumption of CO and CO_2 in the BFG to produce short chain fatty acids (SCFAs) with the optimal H_2 partial pressure at 0.88 atm. After 173 hours' operation (Fig. 2), the highest VFAs concentration was achieved at pH8, about 370mg C/L under the optimal H_2 partial pressure (0.88 atm). The followed-up experiments are expected to find an economic and efficient way to pretreat the inoculum.

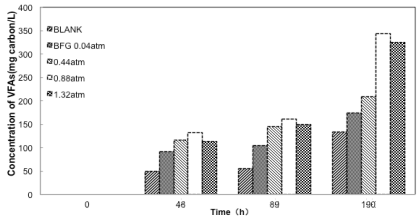

Fig. 1 Effect of H_2 partial pressure on BFG fermentation for VFAs production by AGS under 37°C

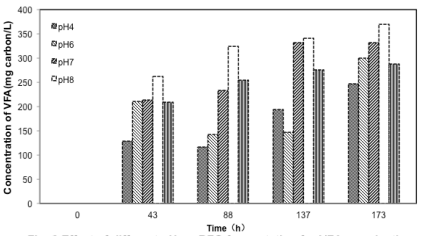

Fig. 2 Effect of different pH on BFG fermentation for VFAs production by AGS under 37°C

P39: Optical fingerprint-based sensing of proteins using an environmentally-responsive fluorescent polymer

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Conventional approaches to detect or quantify proteins in biological samples are based on well-designed specific recognition pairs, such as antigens and antibodies. As a prospective alternative to conventional methods, fingerprint-based sensing has recently been proposed, which exploits the pattern-recognition of unique optical fingerprints for individual proteins. Optical fingerprints are acquired using "cross-reactive" molecules that can interact in different ways with target proteins[2]. Herein we present a novel environment-responsive fluorescent polymer for fingerprint-based protein sensing[3].

Our strategy is based on a poly-L-lysine derivative that incorporates environment-responsive dansyl groups (PLL-Dnc), which are capable of generating a fluorescence signal in a turn-on manner upon binding to proteins. Protein solutions were mixed with PLL-Dnc (5.0 μg/mL) to a final protein concentration of 20 μg/mL in six different buffer solutions, i.e., 18 mM 2-(*N*-morpholino)ethanesulfonic acid (MES) at pH = 5.5, 18 mM 3-(*N*-morpholino)propanesulfonic acid (MOPS) at pH = 7.0, and 18 mM 3-[4-(2-hydroxyethyl)-1-piperazinyl]propanesulfonic acid (EPPS) at pH = 8.5 in the presence/absence of 25 mM NaCl on a 96-well plate. The fluorescence signals from each protein/sensor element combination were recorded as (I-I_0) at four different channels. The obtained fingerprints were statistically evaluated using linear discriminant analysis. The linear discriminant score plot revealed well-separated clusters corresponding to six mammalian albumins and those with post-translational modification (PTM)-like chemical modifications. Furthermore, we found that the PLL-Dnc system enabled to quantify the population of proteins with more realistic PTMs, including HSA glycation and phosphorylation of extracellular signal-regulated kinase (ERK1).

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3. S. Tomita et al., *ACS Appl. Mater. Interfaces*, 2017, 9, 22970

P40: Cell-based real-time reporter gene assay for circadian rhythm monitoring and its application

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We can find many physiological phenomena show clear oscillation patterns in one day. Many of these processes are controlled by the molecular circadian clock. The molecular circadian clock is mainly sustained by 4 genes, namely *clock*, *bmal1*, *per*s and *cry*s in mammalian. These components consist the transcriptional and translational negative feedback loops, and control expressions of many downstream genes as the transcription oscillator. These genes are expressed in each cellular level, ubiquitously observable from the central nervous system to peripheral organs.

For observing oscillation patterns of the molecular clock in cellular levels, we consider that real-time reporter gene assay is a powerful tool. We have already established some cell lines containing a promoter of clock genes and a luciferase reporter. We can observe the oscillation patterns of the clock gene expression for ~1 week, using these cells.

This cellular based assay system is useful especially for seeking a new compound with potential function for modulating circadian rhythm. This function will be attractive especially in our modernized and urbanized society, where our daily physiological rhythms tend to be disturbed. In this session, we show some natural compounds (including the compound from Ashwagandha) with rhythm modulating function, which are newly found by this system.

P41: Folic acid receptor-targeting of alcoholic extract of Ashwagandha leaves enhances its cancer cell selectivity

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Folate receptor alpha (FRA) is a glycosylphosphatidylinositol cell surface anchored glycoprotein that is overexpressed on the surface of a variety of cancer cells. It binds to folic acid, mediates its intracellular transport via receptor-mediated endocytosis and is essential for proliferation of these cancer cell types. FRA expression level has also been related to tumor stage and survival. On the other hand, normal cells and tissues have limited FRA expression restricted largely to the apical surfaces of the epithelial tissue, where it is inaccessible to the circulating drugs. Due to such limited expression in normal tissues, FRA has been considered as a target for cancer therapy.

We have earlier reported that alcoholic extract of Ashwagandha leaves (i-Extract) has selective cancer cell killing activity. We aimed to increase potency of the such activity by recruiting FRA. FRA-ligand, Folic acid (FA), was used as a carrier for i-Extract. FA-PEG-i-Extract (FAP-iEX) nanoparticles was generated by using 1,2-distearoyl-*sn*-glycero-3-phosphoethanolamine-N-[folate(polyethylene glycol)-2000] FA-DSPE-PEG. Cytotoxicity of FAP-iEX nanoparticles was evaluated by *in vitro* and *in vivo* assays using $FRA^{Plus(+)}$ and $FRA^{Minus(-)}$ cells. We found that FAP-iEX nanoparticles caused dose-dependent growth arrest that was much stronger for HeLa cells (FRA^{+}) as compared with MCF7 cells (FRA^{-}). Molecular analyses revealed stronger decrease in Cdk4 and anti-apoptotic protein Bcl2, and increase in $p21^{WAF1}$ and pro-apoptotic protein Pro-PARP-1 in FAP-iEX treated HeLa cells. *In vivo* subcutaneous xenograft assays in nude mice showed a significant suppression of KB (FRA^{+}) tumor growth as compared to HT-29 (FRA^{-}) in FAP-iEX fed groups. Of note, no toxicity to the animals was observed in FAP-iEX fed groups suggesting that Ashwagandha FAP-iEX nanoparticles could be an efficient and safe natural drug for cancer treatment.

P42: In situ heating TEM observations on the carbide formation in twinned martensite

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The characteristics of strength and hardness in quenched high carbon steel are mainly originated from the martensite structure, and then the mechanical properties of steel are regulated by tempering process[1]. In this process, the formation of carbides is indispensable. Carbon as initial atom is one of the most important components of carbon steel, though several theories were proposed in previous studies, the mechanism of carbide formation is still unclear. In present research, in situ heating TEM observation on carbides formation are carried out in twinned martensite after martensite transformation. During TEM observation on twinned martensite, the nanoclusters in both twin and matrix have also been observed[2] and the twin crystals merged into large grain as the temperature increase from room temperature to 220℃.

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2. X. Liu, D. H. Ping, H. P. Xiang, X. Lu, J. Shen. J. Appl. Phys. 123, 205111 (2018).

P43: All-atom first-principles molecular dynamics study for ion selectivity across biological ion channel

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The ion selectivity to pass through ion channel in the cellular membranes play a key role in many important biological processes. We have analyzed the complex system of gramicidin ion channel embedded in lipid bilayer with bulk water using force-field molecular dynamics. Some of these preliminary results, and previous estimates of binding affinities through literature found inconsistent from experiments due to available computational methods. And, encourage us to use all-atom first principles DFT calculations by Conquest software for such large system. The usual molecular dynamics is already possible by Conquest Code. We aim to provide more detailed information about the deviation in energy barrier from the experiments, which is currently limited by the accuracy of the force field. For that, we are heading to develop our code for biased molecular dynamics simulation for the estimation of free energy.

1. M. Todorovic, D. R. Bowler, M. J. Gillan, T. Miyazaki, Journal of The Royal Society Interface 10 [89] (2013) 20130547-20130547.
2. M. Arita, D. R. Bowler, T. Miyazaki, Journal of Chemical Theory and Computation 10 [12] (2014) 5419-5425.
3. T. Baştuğ, S. Kuyucak, Biophysical Journal 90 [11] (2006) 3941-3950.

P44: 1D Coassembly of chaperonin GroEL and streptavidin: potential spplication on drug delivery and biosensor

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Introduction: In biology, chaperone GroEL encapsulates denatured proteins into its hydrophobic cavities, refolds and releases them with the help of ATP. We have previously used GroEL as a scaffold for supramolecular polymerization and prepared nanotubes by chemically functionalizing its apical domain with merocyanine units, which coordinate with divalent metal ions [1]. Here, we present novel GroEL nanotubes achieved using biotin appended GroEL and genetically engineered divalent streptavidin linkers.

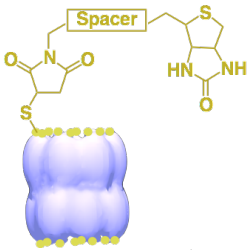

Figure1: GroEL^{biotin}

Results: GroEL was functionalized with biotin-maleimide at its cysteine-incorporated apical domain (GroELbiotin, Figure 1), followed by incubation with trans-divalent streptavidin (trans-Strep), which binds to two biotins at its trans position (Figure 2) [2]. The formation of polymeric structures was confirmed by size exclusion chromatography (SEC) and dynamic light scattering (DLS), while the tubular structure (Figure 3) (300–500 nm) was observed in transmission electron microscopy (TEM). Furthermore, the tube length can be tuned by adjusting the equivalence of trans-Strept to GroELbiotin. The unique property of GroEL, which encapsulates hydrophobic guests and releases them through the structural changes upon ATP, endows its assembly with various possible applications. These include carriers for drug delivery system (DDS), which potentially respond to high ATP concentration in cancer tissues and release the loaded drug. Another possible application could be as real-time sensors for disease-indicating denatured proteins by attaching GroEL to biotin-coated gold nanoparticles, whose encapsulation of guests is expected to be sensed by surface enhanced Raman spectroscopy (SERS).

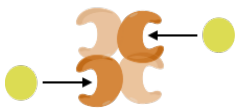

Figure 2: trans-Strep

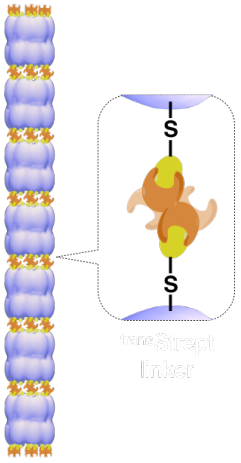

Figure 3: GroEL^{bitoin} trans-Strept Nanotube

1. Biswas, S. et al. Nat. Chem. 2013, 10,1038.
2. Fairhead, M. et al. J. Mol. Biol. 2014, 426, 199-214

Access Guide From TOKYO

- **Using a train from Akihabara station**
  Take a Tsukuba Express train TX (~45-60 minutes) from Akihabara Station and get off at Tsukuba Station (next to the Tsukuba Center Bus Terminal). Take exit A3 for bus/taxi/AIST shuttle.
  *From Tsukuba Center Bus Terminal, you can take public bus, taxi, or AIST shuttle bus.
  - Public bus: Take the Kanto Tetsudo bus going to "Arakawaoki Station (West Entrance) via Namiki" or "Ami Chuo Kominkan" from platform #4 at Tsukuba Center Bus Terminal. Get off at "Namiki 2-chome (namiki ni-chomé)". Walk to the auditorium (~3 minutes).
  - Taxi: Take a taxi at Tsukuba Center Bus Terminal (~15 minutes, ~1500 yen).
    *If you have any trouble communicating in Japanese with taxi drivers, please show them the Japanese sentence below. **産業技術総合研究所つくばセンター・つくば中央までおねがいします。**(Please take me to the AIST Tsukuba Central.)
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- **Using Highway bus (JR) from Tokyo station**
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About EcoCycle Corporation

We at EcoCycle Corporation are focused on developing cutting-edge technologies for various environmental problems the world is facing today. We have in-house dedicated team of engineers and scientists working on site investigation, soil and groundwater remediation, and water treatment technologies providing one stop solution to the client. We have developed technical partnership with many leading Japanese and American companies specialized in contaminated site investigation and remediation. With the help of inter-disciplinary technical team consisting of hydrogeologists, environmental engineers, chemical engineers, environmental microbiologists, civil engineers and others we can provide tailor-made solutions to the clients worldwide.

- Our Products: Our remediation products have been successfully applied for cleaning of over 500 sites contaminated sites with chlorinated hydrocarbons, chromium (VI), petroleum oils and cyanide in Japan, US, Taiwan & other countries. EcoCycle has joint venture company in China, and offices in Taiwan, Thailand and have support team for India, Australia, Indonesia, and Korea
- Technical capabilities: Knowing the problem as a team, we can successfully implement site-investigation program to understand the extent of contamination, make risk assessment, develop remedial action plan, implement the site cleanup, close the site and deal with the regulating agencies. We do support brownfield site development.
- The solution: Though we are specialized in bioremediation, depending on the problem and available budget, the team is capable of implementing various remediation options such as pump and treat, zero-valent iron treatment, chemical oxidation, soil gas vapor extraction or dig and dispose as lost option.

Some of our Bioremediation Products

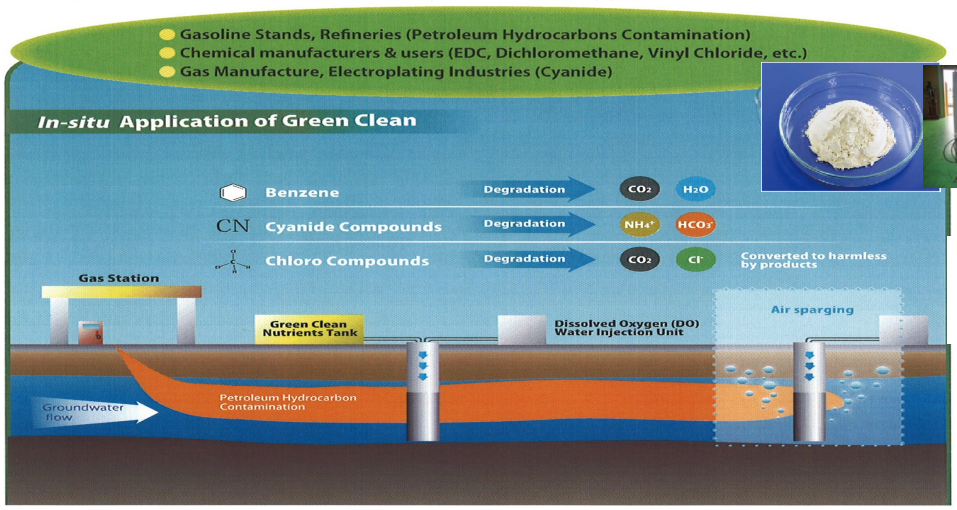
EDC or EcoClean is wholesome food for specific soil microorganisms. Whereas EDC-E is an emulsified formula designed to release hydrogen over extended period of time and useful for cleaning contaminations of high concentrations in silty or clayey soils. Both the products are diluted in water and injected into subsurface to stimulate native microorganisms in the contaminated site that are capable of degrading chlorinated hydrocarbons.

Target contaminants: Chlorinated hydrocarbons, namely, Tetrachloroethylene, trichloroethylene, trichloroethane, carbon tetrachloride, chloroform, dichloroethylenes, dichloroethane, vinyl chloride, chloromethane, chlorobenzenes, chlorophenols, pesticides, etc.

HAR or Green Clean is a biostimulant for aerobic microorganisms. The product is diluted in oxygen rich water and injected into the contaminated soil and groundwater to stimulate microorganisms that can degrade petroleum hydrocarbons, cyanide compounds, chlorinated hydrocarbons, etc.

Target contaminants: Petroleum hydrocarbons such as Gasoline, diesel, light oil, BTEX , MTBE etc. and Cyanide compounds, dichloroethane, dichloromethane, vinyl chloride, 1,4-dioxane, etc.

EcoCycle holds several patents on its products and application methods.



Oxygen source

HAR-OX

Salient Features of our Remediation Products

Low remediation cost, 1/3 of the cost of most of the existing conventional methods, short remediation time, ultra-Low energy requirement and safe, our products are made of food grade materials and are degraded completely.

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