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INDIAN SCIENTISTS ASSOCIATION IN JAPAN

NEWSLETTER

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From the Editor's desk

Greetings and a warm welcome to the Second Issue of ISAJ Newsletter!

We sincerely apologize for the delay in coming up with the present issue after successfully launching the first issue in March 2016. Unfortunately, our initial content plan for the second issue went haywire due to unforeseen circumstances. We shall do our best to avoid such delay through careful planning in the future.

We wish to thank you all our esteemed readers for your generous support and valuable feedback on the inaugural issue. Your appreciation means a lot to us, and it will go a long way toward motivating us to move forward and do our best.

In this issue, you will get three technical contributions by our community members under the section titles: "Research Updates", "Research Spotlights", "From the Pen of Young Mind".

In "Research Updates" section, the article deals with the ongoing research activities on the prediction of climate changes and their application as being undertaken by the research group in Application Laboratory of JAMSTEC. It underlines the complexities involved in the climate predictions and its dependency upon the accuracy of the numerical model being adopted. Furthermore, it emphasizes the importance of accuracy in prediction because of various applications in socioeconomic sectors such as agriculture, health and water resources, and scope for potential integration that could help in decision-making at a regional and local level.

The article in the "Research Spotlights" section is about genomic medicine and deals with a novel drug delivery system concept by implementing ultra-small siRNA-caplet. Apart from briefing the outline of the concept, the author presents interesting results from the validation experiments.

In the section "From the Pen of Young Mind", the article deals with the highlights of the results from the research work on the application of genetic engineering approach for Sheath Blight Resistance in Rice (*Oryza sativa*) which could potentially contribute to increasing the yield rate of the rice crop.

We sincerely hope you will enjoy reading the present issue. Please let us know what you think of this issue by sending your comments/suggestions to us. That would enable us to improvise the contents further in the future issues. We also look forward to the contribution of articles from you to the newsletter.

In This Issue

News and Notes

Funding and Job opportunities

Science and Engineering Board, India

Scheme	From *	To*
Early Career Research Award	Sep 01	Sep 30
National Post Doctoral Fellowship (N-PDF)	Oct 01	Oct 31
Extra Mural Research Funding (Individual Centric)	Nov 01	Dec 31

For more details:

http://serbonline.in/SERB/HomePage.do

*Year : 2016

Climate prediction and application studies at JAMSTEC

Weather and climate forecasts on time-scales of days to season is very important to reduce vulnerability to extreme floods and droughts. Substantial progress has been made in recent years on the development and applications of climate predictions due to the availability of observational data and also due to advancement of supercomputer facilities. One way of climate forecasting is to use the climate models which are presently adopted by many research and operational center all over the world.

Our research group in Application Laboratory of Japan Agency for Marine-Earth Science and Technology (JAMSTEC) has been involved with the research on seasonal climates forecasts for the last few decades. It is known that tropical air-sea coupled climate phenomena e.g. El Niño/Southern Oscillation (ENSO), ENSO Modoki, Indian Ocean Dipole (IOD), subtropical Indian Ocean dipole, Ningaloo Niño, California Niño and Dakar Niño have significant impacts on our society through various ways and they are mostly associated with oceanic variations with typical time-scales of months to seasons. Though some of these climate phenomena develop in the tropics, their influences can be seen on different parts of the globe. We are trying to predict such climate modes because accurate predictions of such variability and dissemination of predicted information are important to mitigate influences of extreme weather and climate events.

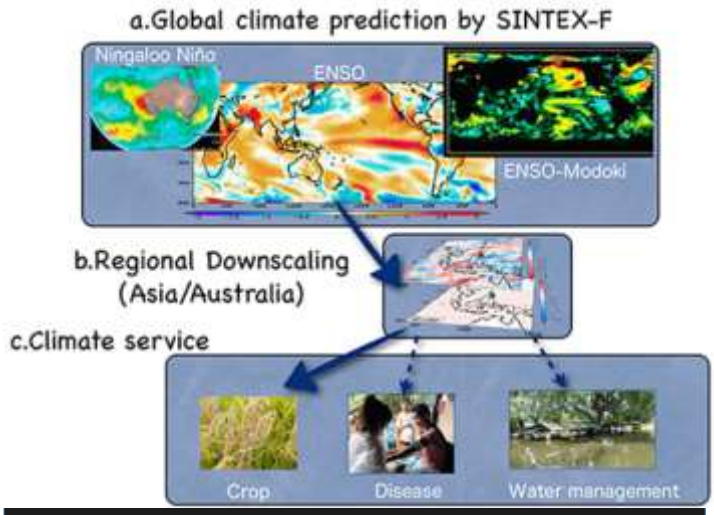

Fig. 1: An example of climate prediction and application studies (Source: http://www.jamstec.go.jp/apl/ertdf2-1405/issues_en.html)

We have been investigating oceanic and atmospheric processes responsible for those climate and ocean variations, mostly using a high-resolution coupled model (SINTEX-F) and other available observations. The SINTEX-F model has been known to predict IOD, ENSO and other climate modes on long lead-times. Our seasonal predictions are being generated every month and these prediction information are made available in the JAMSTEC website (http://www.jamstec.go.jp/frcgc/research/d1/iod/e/seasonal/outlook.html).

Recently we have started to use the seasonal forecasts for the societal applications in different socioeconomic sectors such as agriculture, health and water resources. Our main aim is to generate accurate seasonal prediction using numerical models and integrating this to societal applications that should help in decision making at a regional and local level. To achieve the climate prediction at a regional scale, we use downscaling approach by using the regional climate models at a higher spatial resolution (up to 5km) for the target specific regions. The examples of possible applications are warnings of the severe high impact weather (e.g. droughts, floods); water management and agriculture (e.g. cultivation, harvesting) and disease control (e.g., malaria, cholera, and dengue) particularly in developing countries (Ex: http://www.jamstec.go.jp/apl/satreps_sa/e/ and https://eos.org/meeting-reports/climate-predictions-and-infectious-diseases-in-southern-africa).

Although, we see some progress in the seasonal prediction systems there are still some gap exists to accurately predict the extreme climate events and also for the use of seasonal prediction products for many other sectors of the society. We are continuing to work in this direction.

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Currently working as Project Scientist at JAMSTEC in Yokohama Japan. Prior to the current position, he had worked as Junior Scientist at the Euro-Mediterranean Center for Climate Change (CMCC) in Bologna, Italy. He had also worked for Centre for Development of Advanced Computing (CDAC) in Pune, India for two years.

Dr. Ratna has earned his doctorate degree from Andhra University Visakhapatnam, India in Meteorology after completing Master degree in Oceanography from Berhampur University (Odisha), India.

He is a member of the executive body of ISAJ and has been actively contributing to various activities of our community.

Genomic Medicine: Ultra-small siRNA-caplet for Delivery Application

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Currently, pursuing his research in drug delivery system at laboratory of Prof. Takuzo Aida of the University of Tokyo as Post-Doctoral Researcher. His present research interest is to develop siRNA-carriers for the efficient drug delivery system using synthetic supramolecular approach

Dr. Hashim has earned his doctorate degree from Hokkaido University and master degree from Aligarh Muslim University (UP), India.

He is an active member of our ISAJ community and has been actively involved in the annual ISAJ Symposium since 2010.

Disaster diseases such as cancer affects millions of people worldwide accounting 8.2 million deaths in 2012 [1]. Sadly, cancer treatment strategies or clinically available drugs (typically by small molecule) are insufficient and have several limitations, for instance, widely used chemotherapy causes Hair loss of patient because of non-targeted interactions to Hair follicles. Genomic medicine that stands for using 'gene fragment' (e.g. siRNA) as pharmaceutical agent plausibly works as an excellent alternation avoiding undesired targets with 100% efficiency [2]. However a 'delivery vector' such as natural virus, chemical conjugates, encapsulated in polymer micelles or networks is essential to protect siRNA from enzymatic degradation upon in vivo administration. The delivery vectors must be non-toxic, appropriate size (nanometer range) and surface charge, and degradable (pH, reductive, enzyme). Here we present the construction of a siRNA/carrier conjugate smaller than 10 nm using polymer chemistry approach, i.e a water-soluble Gu+ monomer bearing two thiol termini undergoes disulfide polymerization upon oxidation in the presence of a siRNA-template to form polymer-siRNA complexes (siRNA-nanocaplet) (Fig. 1) [3]. The disulfide polymers obtained by oxidative polymerization can be reductively cleaved in glutathione (GSH)-rich media such as cytoplasm.

The siRNA-nanocaplet was mostly uniform in size as evident from cryogenic transmission electron microscopy (cryoTEM), dynamic light scattering (DLS) and fluorescence correlation spectroscopy (FCS), and was stable against serum proteins. The siRNA-nanocaplet was efficiently taken up into the living cells as evident from the confocal laser scanning microscopy (CLSM) images as well as flow cytometry analysis, and suppresses the target gene in mutant Hep3B cells stably expressing luciferase (Hep3B -luc), without any notable toxicity. Moreover, upon in vivo administration in mice, this small siRNA-nanocaplet was found to be accumulating selectively in kidney, plausibly suggesting a method to treat renal diseases. Further generality of the concept is demonstrated as protein-nanocaplet using different proteins (BSA, Cytochrome C, b-galactosidase) for the intracellular delivery of proteins.

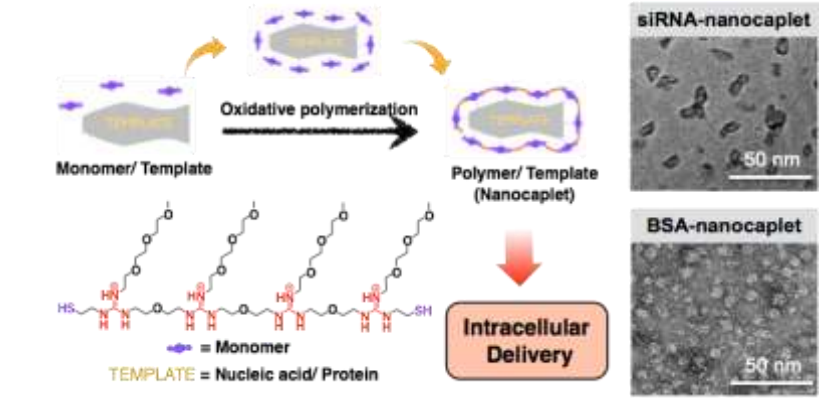

Fig.1: Scheme showing the oxidative polymerization of Gu+ monomer in the presence of a template. TEM image of nanocaplet prepared with siRNA or BSA template.

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Engineering Sheath Blight Resistance in Rice (*Oryza sativa*)

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Ambika K. Dudhate is a first-year doctoral student in the University of Tokyo and major in Life Science. Currently, she is working on characterisation of B-regulatory subunits of protein phosphatases type 2A in Arabidopsis mutants. Prior to this, she had completed her master degree from Tamil Nadu Agricultural University (TNAU), Coimbatore, India.

She is one of the best poster awardees at 6th ISAJ Annual Symposium-2015.

Sheath blight is fungal disease of intensive rice production especially in temperate and tropical production areas caused by R.solani, and has dwindled the crop yield by 5-8%. Only partial genetic resistance for sheath blight in rice has been reported so far and no other major gene has been reported yet [1]. On other hand, traditional breeding of rice varieties for ShB resistance is laborious, time consuming and is also complicated by cross-ability barriers between wild and cultivated types and by polygenic nature of the trait. The Undesirable environmental and health impacts of fungicides necessitate alternative strategies for fungal disease management. And promising proposal will be Genetic Engineering Approach. Moreover, currently, it is a routine to engineer ShB resistance in cultivated rice by introducing certain defence genes encoding chitinases [2,3] and thaumatin -like proteins (*tlp*) [4,5]. In this Study, I have analyzed the role of two transcription factors *Phytochrome* and *Flowering Time 1 (OsPFT1)*: mediator complex in disease resistance and *OsMYC: a* negative transcription factor against defense related pathway in rice against Sheath blight.

In the quest to identify the role of *OsPFT1* gene in rice, *pUbi*:*OsPFT1 (overepressed)* gene construct was mobilized into *Agrobacterium* strain LBA4404 by triparental mating method. Sheath blight susceptible *indica* rice cultivar, ASD16 was used for *Agrobacterium* -mediated transformation of *pUbi*:*OsPFT1* construct. Several rounds of co-cultivation resulted in the generation of 16 putative transgenic plants of three independent events. PCR analysis for *hpt* gene and *OsPFT1* gene showed that all the 16 plants contained the transgene. Screening for sheath blight disease

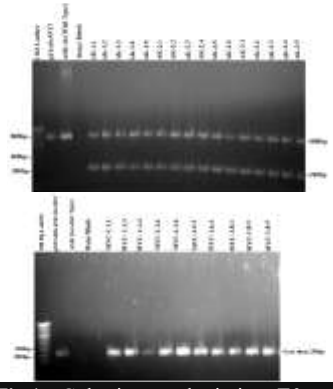

Fig.1: Gel picture depicting T0 transgenic plants positive for top image: gene (*OsPFT1)* and bottom image: ocs terminator for *OsMYC*

showed enhanced level of resistance in two out of the three transgenic events.

In order to silence the MYC gene of rice, pStargate: OsMYC gene construct was used for *Agrobacterium*-mediated transformation of *indica* rice, ASD16. Several rounds of co-cultivation resulted in the generation of 21 putative transgenic plants of single event. PCR analysis done on 10 T_1 transgenic plants showed the presence of the *hpt* gene and *OCS* terminator. Bioassay done for sheath blight disease showed enhanced level of resistance in transgenic plants silenced for *OsMYC* gene compared to ASD16 control plants

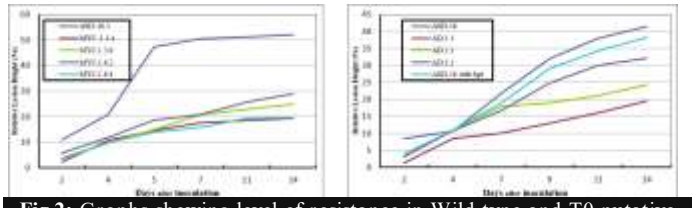

Fig.2: Graphs showing level of resistance in Wild type and T0 putative transgenic lines of ASD16 cultivars. L: overexpressing *OsPFT1* R: Silenced *OsMYC*

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