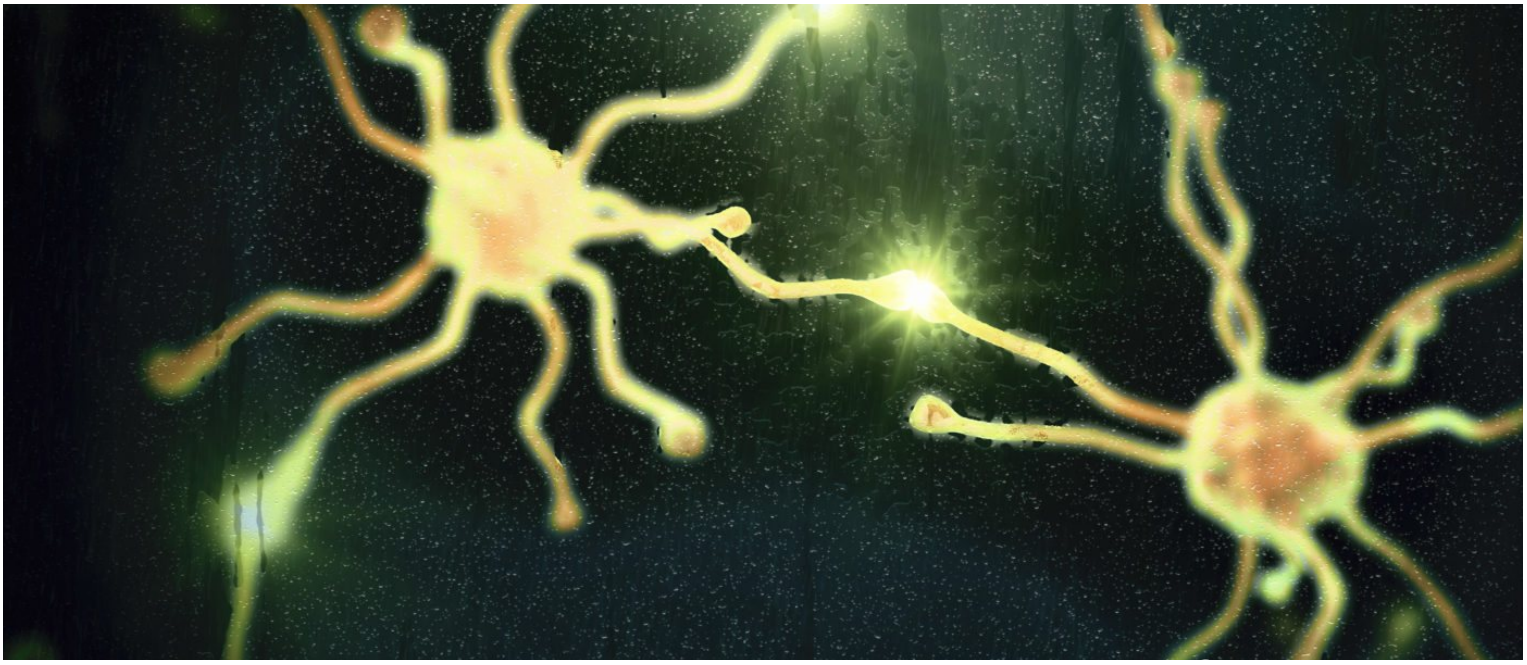
JULY 2021 | VOLUME 3

Synapse

OFFICIAL E-NEWSLETTER OF DEPT. OF BIOTECHNOLOGY
RAMA DEVI WOMEN'S UNIVERSITY



In This Volume

Synapse
by Dept. of Biotechnology

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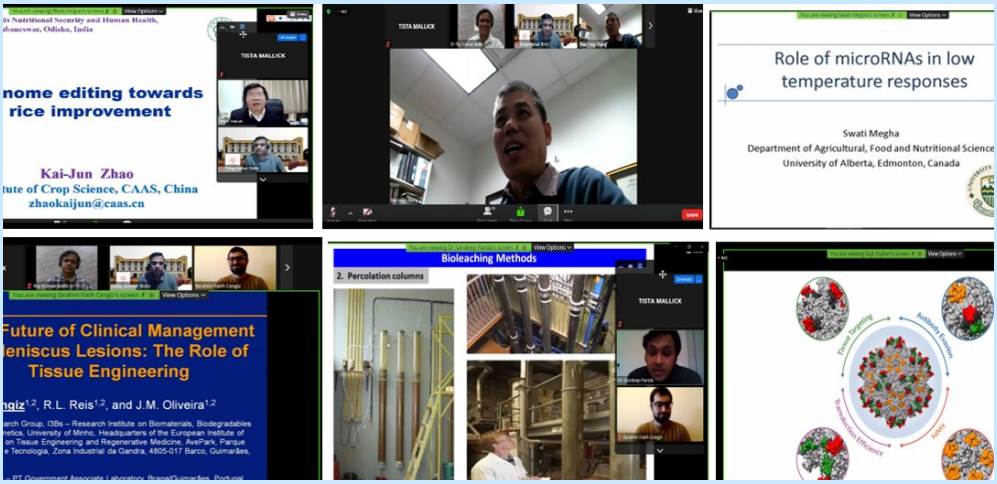
EDITOR's Desk

The world has just come out of the COVID-19 pandemic which shook us from our core. Biotechnology has immensely contributed in the rapid control of this fatal disease which griped the entire world a year before. This gives a sense of satisfaction that we are very much in our pursuit for better life and sustainable environment. This issue focuses on the recently concluded international conference ICBNH-2021. It also includes feature information and science stories.

Department Activities

ICBNH 2021

Department of Biotechnology organized a three-day international conference on "**Biotechnology towards nutritional security and human health**"- **ICBNH 2021**, on 4th-6th March, 2021. Prof. Dinabandhu Sahoo, Vice Chancellor, Fakir Mohan University was the Chief Guest. The conference focused on relevance of Biotechnology in today's world, recent developments, its importance in the field of agriculture, crop development, medical



ICBNH 2021

biotechnology and human health, stress tolerance, environmental protection, and computational biology. The conference was conducted virtually through Zoom platform and the total number of registered participants were 200.

The conference was attended by eminent speakers from across the world including Prof. Kaijun Zhao, Academy of Agricultural Sciences, China, Prof. Baohong Zhang, East Carolina University, USA, Dr. Subash Das, Takeda Pharmaceuticals, USA, Dr, Ibhrahim Fatih Cengiz, 3B Research Group of Minho, Portugal, Dr. Sujit Pujari, School of Medicine, South Carolina, USA, Prof. Nihar Nayak, School of Medicine, University of Missouri, USA, Dr. Swati Megha, University of Alberta, Canada, Dr. Sandeep Panda, Suleyman Demirel University, Turkey who spoke on different aspects of the theme of the conference. Various researchers working in industries and academia came together under one roof to discuss on innovative and comprehensive overview of recent advances in Biotechnology in relation to nutritional security and human health.

Achievements

STUDENT ACHIEVEMENTS

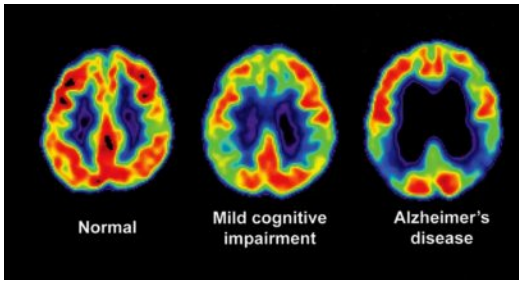
• Students of UG and PG batches have actively participated in various **seminars and workshops** organized by **DBT India, CSIR-IMMT , Merck Innovation lab and Rajiv Gandhi Center for Biotechnology** about scientific writing, nucleic acid science and technology, plant genetic engineering, programming for biologists and related fields of Biotechnology.

• The students have completed various **online courses** such as 'Communicating during global emergencies' from **Emory** University, disability orientation and epidemiology courses offered by World Health Organization and 'Plant Bioinformatics' from University of Toronto.

Science Stories

FDA APPROVES NEW ALZHEIMER'S DRUG

The U.S. Food and Drug Administration has approved a controversial Alzheimer's treatment, the first that promises to slow the disease's destruction in the brain, not just improve symptoms. The drug, aducanumab, sold under the brand name Aduhelm, is the first new Alzheimer's treatment approved since 2003.



Scans that illustrate the differences in three brains: a person who's brain is healthy, left, one with mild cognitive impairment, center, and one with Alzheimer's disease. Alzheimer's patients have clumps of sticky material made from protein fragments, called beta amyloid, in their brains. Source : Science Magazine

Researchers evaluated Aduhelm's efficacy in three separate studies representing a total of 3,482 patients. The studies consisted of double-blind, randomized, placebo-controlled dose-ranging studies in patients with Alzheimer's disease. Patients receiving the treatment had significant dose-and time-dependent reduction of amyloid beta plaque, while patients in the control arm of the studies had no reduction of amyloid beta plaque.

Aduhelm represents a first-of-its-kind treatment approved for Alzheimer's disease. It is the first new treatment approved for Alzheimer's since 2003 and is the first therapy that targets the fundamental pathophysiology of the disease.

These results support the accelerated approval of Aduhelm, which is based on the surrogate endpoint of reduction of amyloid beta plaque in the brain—a hallmark of Alzheimer's disease. Amyloid beta plaque was quantified using positron emission tomography (PET) imaging to estimate the brain levels of amyloid beta plaque in a composite of brain regions expected to be widely affected by Alzheimer's disease pathology compared to a brain region expected to be spared of such pathology.

The prescribing information for Aduhelm includes a warning for amyloid-related imaging abnormalities (ARIA), which most commonly presents as temporary swelling in areas of the brain that usually resolves over time and does not cause symptoms, though some people may have symptoms such as headache, confusion, dizziness, vision changes, or nausea. Another warning for Aduhelm is for a risk of hypersensitivity reactions, including angioedema and urticaria. The most common side effects of Aduhelm were ARIA, headache, fall, diarrhea, and confusion/delirium/altered mental status/disorientation.

For more details, go to: https://www.fda.gov/news-events/press-announcements/fda-grants-accelerated-approval-alzheimers-drug

RNA BREAKTHROUGH CREATES CROPS THAT CAN INCREASE YIELD BY 50 PERCENT

Manipulating RNA can allow plants to yield dramatically more crops, as well as increasing drought tolerance, announced a group of scientists from the University of Chicago, Peking University and Guizhou University.
In initial tests, adding a gene encoding for a protein called FTO to both rice and potato plants increased their yield by 50% in field tests. The plants grew significantly larger, produced longer root systems and were better able to tolerate drought stress. Analysis also showed that the plants had increased their rate of photosynthesis.

"The change really is dramatic," said University of Chicago Prof. Chuan He, who together with Prof. Guifang Jia at Peking University, led the research. "What's more, it worked with almost every type of plant we tried it with so far, and it's a very simple modification to make.

We rely on plants for many, many things - everything from wood, food, and medicine, to flowers and oil; and this potentially offers a way to increase the stock material we can get from most plants.

The rice plants grew three times more rice under laboratory conditions. When they tried it out in real field tests, the plants grew 50% more mass and yielded 50% more rice. They grew longer roots, photosynthesized more efficiently, and could better withstand stress from drought.

Rice nudged along : For decades, scientists have been working to boost crop production in the face of an increasingly unstable climate and a growing global population. But such processes are usually complicated, and often result only in incremental changes.

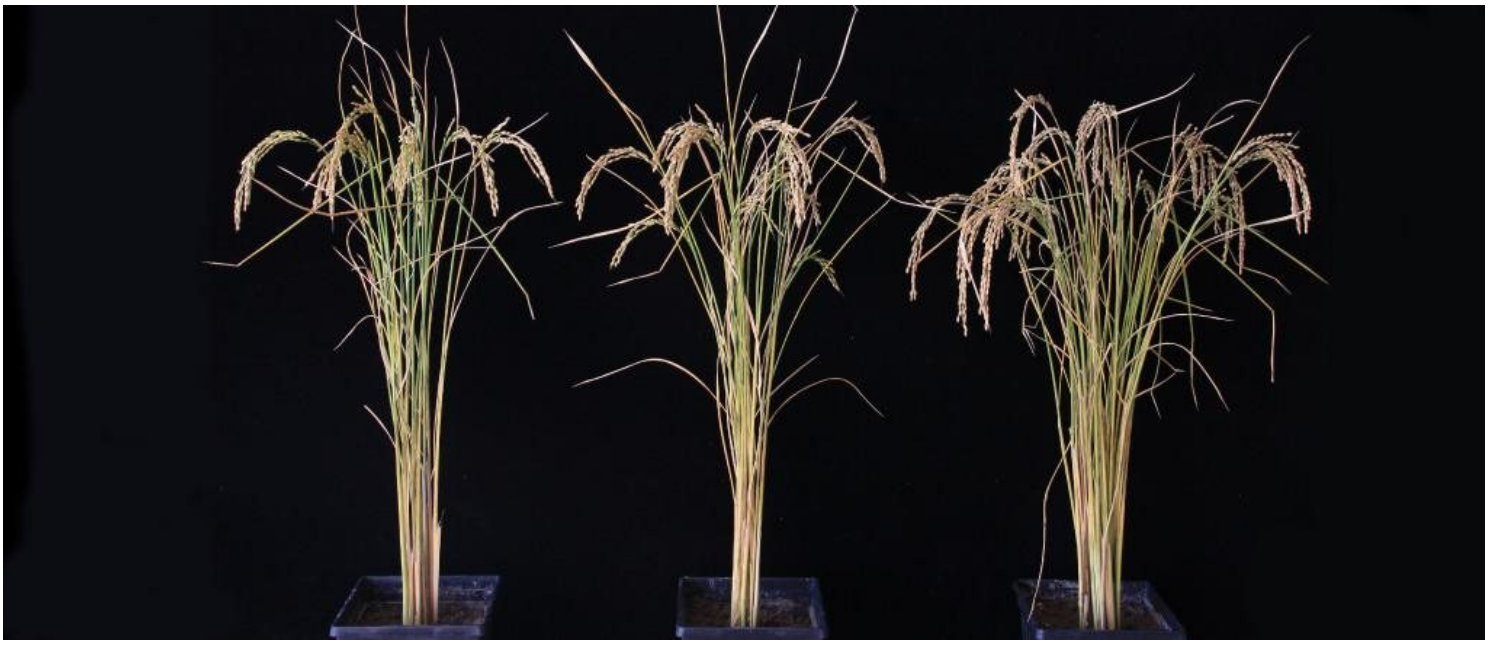
FTO is the first known protein that erases chemical marks on RNA. The scientists inserted the gene for FTO into rice plants and they were amazed to see the plants grew three times more rice under laboratory conditions. In real field tests, the plants grew 50 percent more mass and yielded 50 percent more rice. They grew longer roots, photosynthesized more efficiently, and could better withstand stress from drought. They repeated the experiments with potato plants and the results were the same.
Scientists believe that FTO controls a process known as m6A, which is a key modification of RNA. In this scenario, FTO works by erasing m6A RNA to muffle some of the signals that tell plants to slow down and reduce growth.

Many of us remember RNA from high school biology, where we were taught that the RNA molecule reads DNA, then makes proteins to carry out tasks. But in 2011, He's lab opened an entire new field of research by discovering the keys to a different way that genes are expressed in mammals.

It turns out that RNA doesn't simply read the DNA blueprint and carry it out blindly; the cell itself can also regulate which parts of the blueprint get expressed. It does so by placing chemical markers onto RNA to modulate which proteins are made and how many.

It took the scientists longer to begin to understand how this was happening. Further experiments showed that FTO started working early in the plant's development, boosting the total amount of biomass it produced.

For more details, go to :
https://news.uchicago.edu/story/rna-breakthrough-crops-grow-50-percent-more-potatoes-rice-climate-change



On the left, rice plants without the RNA modification. On the right, a rice plant with the RNA modification that boosts yield.
Source : Yu et al. , Peking University, China

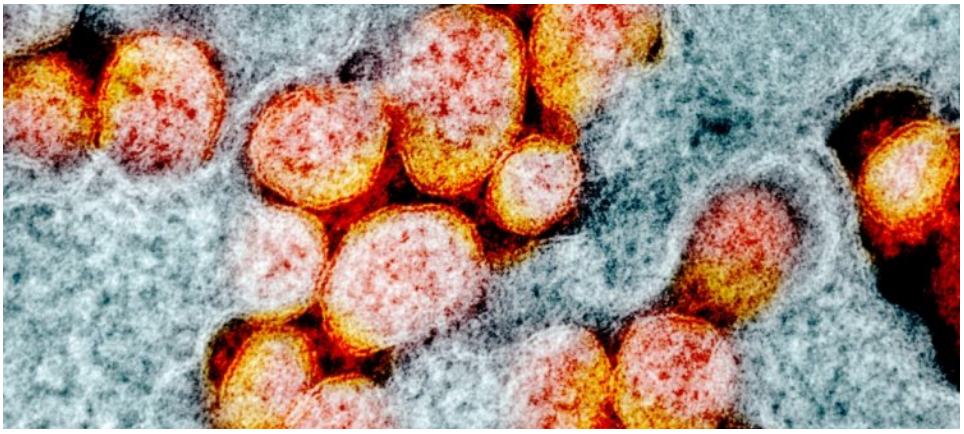
SARS-COV-2 VARIANTS, SPIKE MUTATIONS AND IMMUNE ESCAPE

Although most mutations in the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) genome are expected to be either deleterious and swiftly purged or relatively neutral, a small proportion will affect functional properties and may alter infectivity, disease severity or interactions with host immunity. The emergence of SARS-CoV-2 in late 2019 was followed by a period of relative evolutionary stasis lasting about 11 months.

Since late 2020, however, SARS-CoV-2 evolution has been characterized by the emergence of sets of mutations, that impact virus characteristics, including transmissibility and antigenicity, probably in response to the changing immune profile of the human population.

There is emerging evidence of reduced neutralization of some SARS-CoV-2 variants by postvaccination serum; however, a greater understanding of correlates of protection is required to evaluate how this may impact vaccine effectiveness. Prediction of the mutational pathways by which a virus such as SARS-CoV-2 will evolve is extremely challenging. An important part of this process will be the preparation of updated vaccines tailored to emerging antigenic variants that are maximally cross-reactive against all circulating variants. All of these processes will benefit from close international collaboration and the rapid and open sharing of data.

As highly deleterious mutations are rapidly purged, most mutations observed in genomes sampled from circulating SARS-CoV-2 virions are expected to be either neutral or mildly deleterious. This is because although high-effect mutations that contribute to virus adaption and fitness do occur, they tend to be in the minority compared with tolerated low-effect or no-effect 'neutral' amino acid changes4. A small minority of mutations are expected to impact virus phenotype in a way that confers a fitness advantage, in at least some contexts. Such mutations may alter various aspects of virus biology, such as pathogenicity, infectivity, transmissibility and/or antigenicity



Viruses enter cells to make copies of themselves and cause infection. One secret of SARS-CoV-2 is hiding from the immune system by spreading between cells. This transmission electron micrograph shows COVID-causing virus particles that were isolated from a patient. Source : National Institute of Allergy and Infectious Diseases, NIH

Subsequent studies indicated that D614G confers a moderate advantage for infectivity8,9 and transmissibility10. Several other spike mutations of note have now arisen and are discussed in this Review, with particular focus on mutations affecting antigenicity.

The extent to which mutations affecting the antigenic phenotype of SARS-CoV-2 will enable variants to circumvent immunity conferred by natural infection or vaccination remains to be determined.
However, there is growing evidence that mutations that change the antigenic phenotype of SARS-CoV-2 are circulating and affect immune recognition to a degree that requires immediate attention. The spike protein mediates attachment of the virus to host cell-surface receptors and fusion between virus and cell membranes.

Due to this aggregation, calculated scores are relatively insensitive to the effects of single amino acid substitutions. Scores were calculated for the spike protein in both the closed conformation and the open conformation. It has been estimated that ~34% of spike proteins are closed and 27% are open (with the remainder in an intermediate form) following furin cleavage50.

Scores rescaled between 0 and 1 are plotted for the closed conformation in Fig. 2a and are represented on the structure in Fig. 2b. A limitation of this approach is that it does not account for glycan shielding of residues and likely overestimates scores at the base of the ectodomain for residues closest to the carboxy terminus.

For more details, go to :
https://www.nature.com/articles/s41579-021-00573-0