MADRAS MMA MANAGEMENT ASSOCIATION ESTD. 1956

THE PENINSULA FOUNDATION

KONRAD ADENAUER STIFTUNG

JUNE 15 2022

Lecture

WEDNESDAY, 6:00 PM - 7:30 PM

MMA MANAGEMENT CENTER, CHENNAI

POTENTIAL OF GENOME EDITING:

Food Security, Health, and Surviving Climate Change Impact

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THE PLATFORM

The development of new technologies has raised the potential of intervening in the genome to new heights. Theoretically, these technologies make it possible for genome editing to take place in all living organisms - be it a microorganism, a plant, animals, and even human beings. Unlike previous methods to change the gene, present technology makes genome editing more precise and can, in most cases, be inexpensive, effective, beneficial, and most importantly, accessible. It is these factors that raise important questions of how we wholly understand the concept of genome editing - its positives as well as associated risks, the ethical concerns inherent in undertaking such an endeavour, and its scope of application.

Genome editing applications promise significant benefits in agriculture - for consumers, this includes nutritional enhancement, improved food safety and reduced food waste; for farmers, this includes resistance to disease, weeds and pests, greater seed affordability due to cheaper seed production, and enhanced climate resilience including tolerance to drought; for society, this includes ecosystem services, such as increased biodiversity in cropping systems.

In understanding gene editing, also referred to as genome editing, we must clarify terminologies. While genetic modification and genome editing both alter the DNA of the subject, the methodologies and outcomes vary distinctly. Genetic modification involves the introduction of foreign material to modify the host genetic material, whereas genome editing involves minor deletions, insertions, and alterations in the same genetic material. Gene editing is a method to generate DNA modifications at precise genomic locations. These modifications can result in the knockout or knockdown of one or multiple genes without the permanent insertion of any foreign DNA. Transcription activator-like effector nucleases (TALENs), Zinc Finger Nucleases (ZFNs), and CRISPER/Cas systems have all been utilised to achieve precise gene edits.

Global warming-related climate change will have a significantly adverse impact on food production and biodiversity. One meta-review of more than 130 studies has estimated that one in six species may go extinct due to the changing climate. Genome editing provides options to address these problems by enabling greater survivability, resilience, disease resistance, better yield, and saving biodiversity. For example, engineering tomato architecture using CRISPR/Cas9 has enabled improvements such as drastically increased fruit size and altered plant morphology. By identifying and editing six genes associated with key domestication traits, researchers were able to domesticate a wild tomato relative, increasing fruit size 3-fold and fruit number 10-fold and yield while also improving nutrition, abiotic stress tolerance, and disease tolerance.

THE PLATFORM

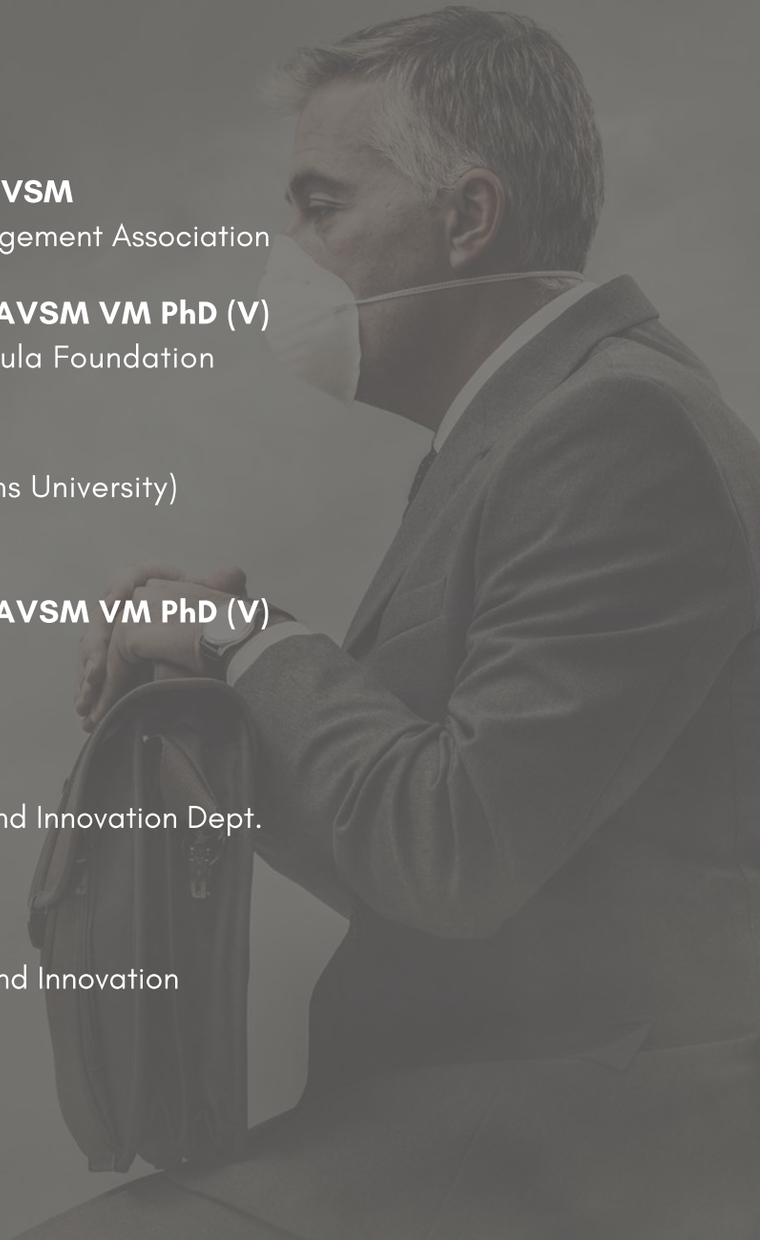
Nevertheless, GMO and Genome editing continue to raise many concerns in the context of ethics, preservation of nature and biodiversity, and issues of unintended consequences. The EU largely regards genome editing as a subset of genetic modification and is, as a result, circumspect with regulations. The European Court of Justice, in 2018, ruled that organisms obtained through mutagenesis (a newer method of genome editing) would not be excluded from the EU GMO Directive. The mandatory labelling of GMO ingredients in consumer products is another sticking point for European countries on GMOs. The US, on the other hand, takes a transnational approach to the debate. US companies like Monsanto, Dupont, Dow Chemical Company, Syngenta, and Pioneer enjoy an unrivalled monopoly over the GMO market and continue to push for greater adoption of GMOs in the European market.

India, on 30th March 2022, announced its decision to ease regulations governing genome-edited plants, excluding them from the laborious norms of genetically modified organisms. This move opens new vistas for using genome editing technologies to improve and increase crop production to meet the demands of overpopulation, food scarcity and depletion of soil fertility. India's only tryst with GMOs has been the successful introduction of Bt Cotton into the market. Fear over the impact of the usage of GMOs could persist, in part, due to the long-term consequences India is experiencing because of the Green Revolution. While the immediate solution to the food security crisis India was facing at the time, over time, India's usage of pesticides and inorganic fertilisers has risen. The soil, agricultural lands and crop production have been adversely impacted. India also lost nearly 1 lakh indigenous varieties of rice and saw a sharp decline in the cultivation of indigenous varieties of lentils and millets.

The debate in favour of genome editing - with its applications in disease prevention and treatments in humans, increasing yields and providing a solution to food security, building disease resistance, and improving product quality in both animals and plants - is met with questions on the risks of genome editing. The gene in any organism forms the core of a living being. Do humans have the right and authority to make changes to something as fundamental as an organism's genome? Is genome editing technology the solution to the world's current social problems and if yes, under what conditions would genome editing be safe for application? What impacts can we expect on biodiversity in undertaking the process of genome editing or genetic modification? And most importantly, given the experiences of the US and Europe union, where must India position itself in the debate? These will be some of the questions that this special lecture will seek to answer.

PROGRAMME

5:15 PM	Registration & High Tea	
6:00 PM	Welcome Address	**Gp Capt R Vijayakumar (Retd), VSM** Executive Director, Madras Management Association
6:05 PM	Chairman's Opening Remarks	**Air Marshal M Matheswaran AVSM VM PhD (V)** Founder & President, The Peninsula Foundation
6:15 PM	Theme Address by the Guest of Honour	**Dr S Chandrasegaran** Professor Emeritus (Johns Hopkins University) Baltimore, USA
6:35 PM	Fireside chat led by	**Air Marshal M Matheswaran AVSM VM PhD (V)**
	Distinguished Panelists	**Dr S Chandrasegaran** **Dr Manikandan Muthu** Associate Professor - Research and Innovation Dept. Saveetha University **Dr Judy Gopal** Associate Professor - Research and Innovation Saveetha University.
7:15 PM	Q & A	
7:30 PM	Vote of Thanks	



PROFILE

Dr S Chandrasegaran

Professor Srinivasan Chandrasegaran is a Managing Trustee and Vice President of Science & Technology at The Peninsula Foundation. He is a Senior Scientist and Professor Emeritus of Genome Studies in the Department of Environmental Health and Engineering at Johns Hopkins Bloomberg School of Public Health in Baltimore, USA.

Dr. Chandrasegaran is an alumni of Presidency College, Chennai, and obtained his PhD in 1981 from Georgetown University. He is the inventor of the “Zinc Finger” methodology (ZFN) of synthetic genome editing. ZFNs offer a general way to deliver a targeted site-specific Double-Strand Break (DSB) to the genome. The ZFNs were originally developed in Johns Hopkins Laboratory under Dr S Chandrasegaran’s leadership. They have become powerful tools for enhancing gene-targeting in cells. He is leading teams that are working on the chemical synthesis of Chromosome IX.

He has published widely and innumerable research papers and is a frequent speaker on the subject across the world. His work has initiated a new era of “Biology by Synthesis”. This has huge potential for addressing India’s agriculture and public health requirements.

PROFILE

Air Marshal M Matheswaran AVSM VM PhD (V)

Air Marshal M Matheswaran is an Indian Air Force veteran with 39 years of active service. He is the Founder-President of The Peninsula Foundation, a policy research think-tank based in Chennai. He is a fighter pilot, an Experimental Test Pilot, and a Fighter Combat Leader, and has flown over 40 types of aircraft. He is an alumnus of IAF's prestigious institutions, ASTE and TACDE where he was Commandant and Deputy Commandant respectively. The Air Marshal is also a graduate of the Defence Services College, Wellington and the National Defence College, New Delhi. He has held various operational and command appointments that include Senior Air Staff Officer of Eastern Air Command, Assistant Chief of Air Staff (Space), Air Officer Commanding (Maritime Air Operations), Principal Director (Air Staff Acquisition) and Director of Ops at the Strategic Forces Command.

The Air Marshal has a master's in military science, M Phil, and PhD in Defence and Strategic Studies from the University of Madras. He also has a post graduate diploma if financial management. He has done a Senior Fellowship in National and International Security from the Harvard Kennedy School of Governance, Harvard university. He has been advisor to HAL, Cyient and also as President, Aerospace Business in Reliance Defence. He continues to be involved in strategic consultancy in Defence and Aerospace.

The Air Marshal is a recipient of Presidential awards – AVSM (Ati Vishisht Seva medal) and VM (Vayu Sena Medal) – and Commendation by the Chief of Air Staff.

PROFILE

Dr Manikandan Muthu

Dr Manikandan Muthu, is working as an Associate Professor in the Department of Research and Innovation, Saveetha Institute of Medical and Technical Sciences (SIMATS) Chennai. He has a sound postdoctoral research and teaching career spanning over premier research institutes like the Indian Institute of Technology Madras (IITM), Academia Sinica, Taiwan, National Sun Yat-Sen University, Taiwan, and Konkuk University, South Korea for more than a decade. He has worked in diverse fields of biology and chemistry. His research expertise includes: (i) salt-loving extremophilic microorganisms of Indian salterns, their metagenomics and their purified protein native conformations; (ii) functional characterization of SUMO Protease protein in Chlamydomonas model system its role on size mediated cell cycle control (@ ABRC, Academia Sinica, Taiwan) and (iii) developing agile MALDI MS and DESI-MS methodologies for combatting limitations in biological analysis (@ National Sun Yat Sen University, Taiwan and IIT Madras, India). He has had a very successful research career and has published over 80 research papers in highly reputed international SCI journals. He also has 3 Taiwan patents to his credit. He has been honored with young scientist awards by different forums internationally and nationally. With a keen personal passion to revolutionize the agricultural practices in Tamil Nadu, he has developed his own test facility at Marakanam, where he has applied his natural farming expertise gained in Korea, to successfully develop peanut/paddy crops using natural farming.

PROFILE

Dr Judy Gopal

Prof. Judy Gopal, recently joined the Research and Innovation Team, at Saveetha School of Engineering. She is basically a biologist, with Gold medals from Stella Maris College, Chennai. She did her Master's at University of Madras and cleared GATE 2001 to be eligible for interdisciplinary PhD in Metallurgy-Microbiology at Indira Gandhi Centre for Atomic Research, Kalpakkam. During her PhD she also worked as Project Assistant at Indian institute of Science, Bangalore towards a IISc Bangalore-IGCAR collaborative research project. Immediately after her PhD she was absorbed to work as Visiting Scientist at Kalpakkam. From 2010 onwards till 2014, she worked as post-doctoral researcher at various institutions including NSYSU, Taiwan and IIT, Madras. In September 2014, she was hired as full time Assistant Professor at Konkuk University, Korea, where she worked till 2018 at the Environmental Health Sciences Department. Dr. Judy continues to serve as scientific writing instructor and research project collaborator with Konkuk University, Korea and Jazan University, Saudi Arabia. Dr. Judy has had a dynamic, multifaceted research career, cutting across multiple research domains and disciplines. Her interdisciplinary career has yielded fruit in areas of microbiology, nanotechnology, food science, plant biology, materials science, environmental biology, analytical chemistry. She has more than 100 publications in standard high impact SCI International journals. She has numerous young scientist awards and young researcher awards and women scientist awards to her credit. She is a vibrant speaker, and scientific program anchor, with multiple presentation awards.

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