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South Asia Biosafety Program

INDIA

Novel Food from Genetically Modified Microorganisms: Opportunities and Safety

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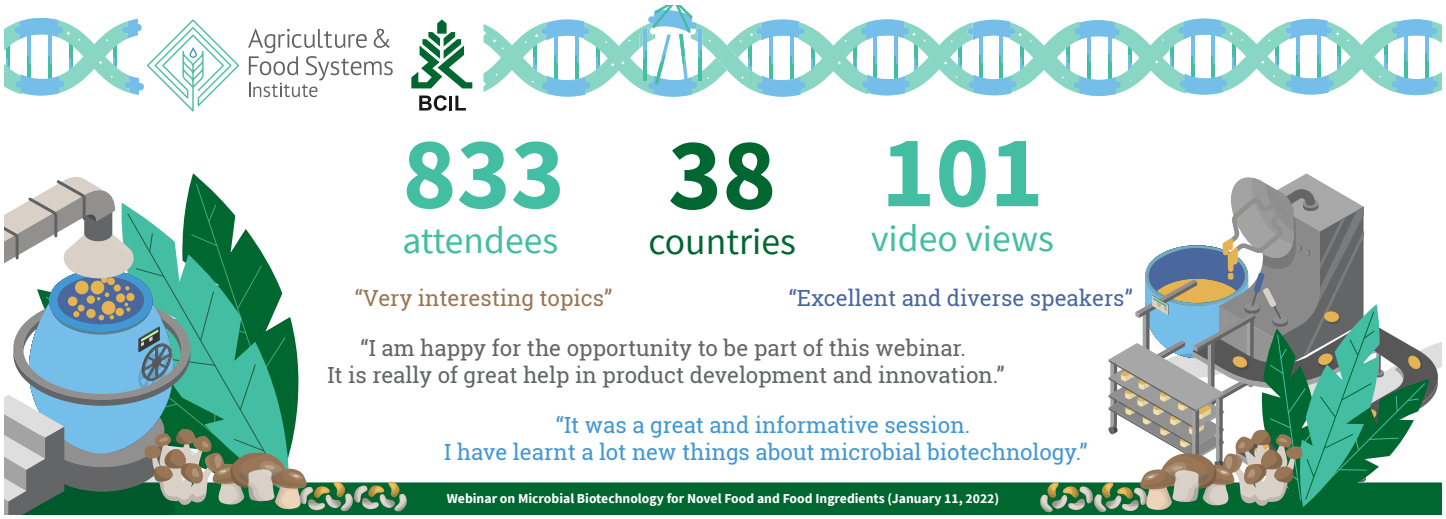
STUDENT SHOWCASE

To encourage written discourse on topics related to biosafety and biotechnology among the younger generation, the *SABP Newsletter* dedicates space in select issues to spotlight pieces written by students residing in South Asia. Since articles with the "Student Showcase" tag are meant to reflect the actual views and capabilities of the author(s), they are not revised for content and only lightly edited to conform with the newsletter's style guide.



Attendee information and participant feedback from the webinar on Microbial Biotechnology for Novel Food and Food Ingredients (January 11, 2022)

We are living in the part of the cosmic time when the wonders of modern science are starting to flourish, especially in the field of biology and biotechnology. We all know the population is increasing and so is the demand for food. There is a need to supplement the traditional methods of food production with new technologies. Microbial biotechnology is one such technology that contributes to efficient production of industrial and valuable products using microbes. To shed light on this topic, the Agriculture & Food Systems Institute (AFSI) and Biotech Consortium India Limited (BCIL) organized the webinar *Microbial Biotechnology for Novel Food and Food Ingredients* on January 11, 2022. It was a very informative webinar discussing India's food microbial biotechnology industry, safety assessments, regulation, and real-life experience with products of microbial biotechnology.

Microbial biotechnology is one such technology that contributes to efficient production of industrial and valuable products using microbes.

Reliance Industries, the pioneering industry in India in the field of microbial biotechnology, is working with microalgae to produce bio-crude and high-value compounds, including proteins for human consumption. Dr. Manish Shukla, Lead - Synthetic Biology Food & Feed Ingredients, Reliance Industries, discussed the ever-increasing demand for sustainable meat substitutes that are animal and cruelty-free, both in India and worldwide, in the context of the market demand for novel microbial products. The processing of these products requires genetically modified microorganisms (GMMs) for efficiency and sustainability, which was explained through an example of heme protein production for "impossible burgers" to impart a meaty taste to the plant-based burger.

Dr. Paul Hanlon, Director - Regulatory, Scientific & Government Affairs, Abbott Nutrition, gave some examples of products that are traditionally made utilizing microbes that are now made using GMMs for environment and animal friendliness, sustainability, and cost-effectiveness, such as fermentation products, including bread, yogurt, cheese, and beer. He gave examples of high-value products *viz.* food additives like stabilizers, flavors, and sweeteners, nutrients like amino acids, vitamins like riboflavin, animal product substitutes, and food enzymes.

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These examples demonstrate the role of GMMs in the coming days. But, what about the safety of these products? Dr. Hanlon pointed out that there is safety regulation in place. Regulatory agencies in Canada, the EU, and the US evaluate the safety of the finished product as well as that of the whole manufacturing process. A detailed description of various parameters of the safety evaluation was explained, which is required to identify the hazards, and this is done via a risk assessment process.

The Indian perspective on this issue was then detailed by Dr. Lalitha Gowda, Former Chief Scientist, Central Food Technological Research Institute (CFTRI), Council of Scientific and Industrial Research (CSIR), and Member, Genetic Engineering Appraisal Committee. She talked about the current regulations and pathways for approval of food ingredients in India, the regulatory framework of the Food Safety and Standards Authority of India (FSSAI), and standards. She specifically described the safety regulation of food additives and processing aids, where risk assessment and management are done for every product by the scientific panel using OECD test guidelines. She explained these through examples.

The final speaker, Dr. Jasvir Singh, Lead - Regulatory, Scientific & Government Affairs, International Flavors and Fragrances, also shared his experience with the evaluation and regulatory processes, as well as his experience traversing the regulatory system. He suggested harmonization of the regulatory framework as a global approach to avoid trade barriers and facilitate faster access to technology.

After these presentations, there was a panel discussion with the speakers and additional panelists, who answered questions from the audience. The motto of the webinar was to discuss regulation and science communication of low risk and well-characterized food ingredients that are derived from genetically engineered microorganisms, as described by Dr. Vibha Ahuja, Biotech Consortium India Limited. This was well executed throughout the webinar.

Microbial biotechnology is a future where we will be able to meet our day-to-day needs with great efficiency, without harming nature. It takes less space and time to produce a product using GMMs than by traditional methods. But, implementation of sound regulation is key to every safe product, and though there are many regulations in place, they need to be updated to be more efficient and relevant. Also, consumers need to be educated and made aware of these products and practices. Communication around the science with the public could contribute to increasing their knowledge about modern biotechnology. Let us connect the public with science, scientists, and industries to enable a better understanding of safe and sustainable products derived through microbial biotechnology.

Emerging Trends India's Food Technology Industry
Dr. Manish Shukla

Science of Microbial Biotechnology
Dr. Paul Hanlon

Regulatory Requirements for Food Ingredients and Processing Aids, Including Those Derived from Microbial Biotechnology
Dr. Lalitha Gowda

Navigating the Regulatory System in India: Challenges and Experiences
Dr. Jasvir Singh

Panelist
Prof. Ashok Pandey

Panelist
Dr. Sridevi A. Singh

Panelist
Dr. N. Bhaskar

Organizers, speakers, and panelists at the webinar on Microbial Biotechnology for Novel Food and Food Ingredients (January 11, 2022)

The South Asia Biosafety Program's Year in Summary: 2021

Sium Ahmed, South Asia Biosafety Program

Dr. Rakha Hari Sarker. Country Coordinator, SABP (left) and Mr. Sium Ahmed, Biosafety Support Officer, SABP (right) at the First Workshop of the IBO Training Program (December 2, 2021)

Due to the COVID-19 pandemic, all kinds of normal activities have been disrupted, and we have been forced to maintain very different type of life. The ongoing pandemic has also created a very unusual kind of social relationship, attitude, and working environment. However, the year 2021 has appeared as a transition period for the people trying to adapt to "new normal" lifestyles. This has changed our perception globally about how we meet, greet, and communicate. The way of learning and communication mechanisms have been changed and continue to be changing to the state where we are not required to be present in the same room to meet with others. This virtualized phenomenon has been unavoidable throughout the year. Eventually, virtual meetings, seminars, and conferences became very typical and turned into regular events, although all these activities are clearly challenging.

Despite all the challenges imposed by the ongoing situation, the South Asia Biosafety Program (SABP) had a very productive year in 2021. SABP has been instrumental in its ongoing biosafety capacity building activities at public research institutes and universities. SABP organized meetings with its stakeholders to understand their requirements and priority areas. Moreover, SABP successfully continued its publications and ongoing grants program.

In addition to all the regular activities, SABP also took the initiative to redesign and update the *Bangladesh Biosafety Portal,* which was launched in 2017 and serves as a consolidated repository of documents that inform biosafety regulation in Bangladesh.

Continuing the digital dialogues on biosafety, which had been initiated in 2020, two webinars were organized in a more coherent context. The first one was arranged for the students and faculty members of the Department of Biotechnology and Genetic Engineering, Mawlana Bhashani Science and Technology University (MBSTU). This webinar focused on the development of genetically engineered (GE) crops as a case study so that participants could understand and correlate the prevailing biosafety requirements at each stage of GE crop development. The second one was arranged for researchers at the Bangladesh Institute of Nuclear Agriculture (BINA), giving them a snapshot of biosafety with a global and local perspective, as well as how regulatory requirements prevail in research and development. A total of 131 participants attended these webinars.

In addition to regular capacity building initiatives, SABP, together with Bangladesh Academy of Sciences (BAS), organized a webinar entitled *Genome Editing in Agriculture: Potential Opportunities and Way Forward in Bangladesh* on October 4, 2021. This webinar was a knowledge-sharing initiative focused on developments in gene editing and the need for enabling policies in Bangladesh, so as to make use of this new technology in order to meet the urgent need for improved crops. The webinar brought together diverse stakeholders from the government institutes, universities, and other public and private sector organizations engaged in research and development of biotechnology. A total of 191 participants attended this webinar.

Throughout the year, SABP has conducted several virtual meetings with stakeholders and partners from the Ministry of Agriculture, Ministry of Food, Department of Environment, Bangladesh Agricultural Research Council, and Bangladesh Food Safety Authority to discuss SABP's work plan and facilitation of support and cooperation in potential areas.

In response to the need from stakeholders, SABP organized the *First Workshop of the Institutional Biosafety Officers (IBO) Training Program* in collaboration with the Ministry of Agriculture, Government of the People's Republic of Bangladesh on December 2, 2021. This training workshop was conducted in hybrid mode, i.e., both in person and virtually. In this training workshop, biosafety requirements in conducting research and development of genetically modified (GM) crops was discussed. The event also aimed to establish a network of trained IBOs/scientists to coordinate biosafety activities across the entire regulatory system. Additional events in the IBO Training Program have been planned for 2022.

As part of the SABP's publication efforts, in the first quarter of the year, SABP published the second installment in the *Biosafety Resource Book Series* entitled *Frequently Asked Questions: Genetically Engineered Plants and Biosafety*. In this book, some of the most common concerns regarding biotechnology and biosafety are addressed. The misconceptions regarding GE technology, as well as the required biosafety practices, are presented in this book. In 2021, the book was downloaded 106 times.

The *SABP Newsletter* is published monthly and sent to 1200 local and more than 10,000 international recipients. The newsletter covers SABP's activities in South Asia and recent developments in biosafety and biotechnology. In 2021, SABP launched a new section in the newsletter called "Student Showcase Articles," where enthusiastic students can share their views and ideas on environmental safety or food safety of GE organisms, biosafety regulation, policy developments, capacity building activities/events, and other related aspects.

The third phase of the Biosafety Research in Bangladesh Grants Program (BRBGP) was initiated in 2021, with the request for pre-

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proposals announcement. A virtual workshop on writing pre-proposals was organized to encourage potential researchers and share information and requirements for the grants program. 23 pre-proposals were received, of which 9 were selected and requested for full-proposal submission. After rigorous evaluation by the review board, 2 proposals were selected for funding. In addition, progress review meetings were also arranged for the first- and second-year grant recipients in the final quarter of 2021.

In addition to all the regular activities, SABP also took the initiative to redesign and update the *Bangladesh Biosafety Portal* (https://bangladeshbiosafety.org), which was launched in 2017 and serves as a consolidated repository of documents that inform biosafety regulation in Bangladesh. Relaunched in early 2021, the updated portal became a user-friendly, multi-dimensional, and resourceful platform so that researchers and regulators can find all the information in one place, without much effort. In 2021, the portal has been visited by 5983 users.

SABP has been working relentlessly to facilitate the implementation of transparent, efficient, and responsive regulatory frameworks for products of modern biotechnology that meet national goals as regards the safety of novel foods and feeds and environmental protection. In the future, SABP aims to continue with more robust and impactful activities.

INDIA

Webinar on Genome Editing in Agriculture: Science, Potential, and Policies

Dr. Radheshyam Sharma, Biotechnology Centre, Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur

In recent years, genome editing has emerged as a novel tool for crop improvement, as it enables both precise and efficient modification of a plant's genome. An application of gene-editing to advance agricultural sustainability and nutrition security is receiving significant interest. The Nobel Prize in chemistry in 2020 was awarded to inventors of the CRISPR/Cas9 genome editing technology, i.e., Dr. Emmanuelle Charpentier from France and Dr. Jennifer Doudna from the USA. CRISPR/Cas9 and other genome editing techniques are currently being used extensively worldwide to incorporate desirable traits in different crops, including cereals, pulses, oilseeds, fruits, and vegetables. Translating these research initiatives into products requires enabling policies. Under this context, a webinar on *Genome Editing in Agriculture: Science, Potential, and Policies* was organized by the Biotechnology Centre, Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, in association with Biotech Consortium India Limited (BCIL) on January 20, 2022. This webinar was a knowledge-sharing initiative focused on developments in gene editing and the need for enabling policies in Madhya Pradesh to make use of this new technology to meet the urgent need for improved crops. About 150 students, scientists, faculty members, and government officials participated in the webinar.

Dr. Vibha Ahuja [...] emphasized the applications of genome editing in improving crops, restoring biodiversity, screening, diagnosing diseases, and last but not least, in treating some deadly diseases.

At the onset, Prof. Sharad Tiwari, Director, Biotechnology Centre and Dean, College of Agriculture, JNKVV, Jabalpur, expressed gratitude to all participants and welcomed them to the webinar. Prof. Tiwari introduced Dr. C. Viswanathan, Head, Principal Scientist, Division of Plant Physiology, ICAR-Indian Agricultural Research Institute, Delhi, who holds many scientific accolades, as well as an excellent academic and professional career. Dr. Viswanathan spoke about how gene-editing technology can be a game-changer. He emphasized the importance and possibilities of various genome editing technologies, especially CRISPR/Cas9, in crop improvement. Dr. Viswanathan also explained gene-editing principles and applications, and he presented CRISPR/Cas9 technology applications in the agricultural sector. In addition, he addressed the dire need to improve crops given the growing population, consumer demand, and climate change. He further explained how one could select gene-edited plants without foreign genes, as CRISPR/Cas9 gene editing can occur trans. He also mentioned that plants with valuable properties had been produced by down-regulating genes using CRISPR/Cas9 technology.

The second speaker, Dr. Vibha Ahuja, Chief General Manager, Biotech Consortium India Ltd., gave a brief overview of the requirements for gene-edited plants in various countries. She emphasized the applications of genome editing in improving crops, restoring biodiversity, screening, diagnosing diseases, and last but not least, in treating some deadly diseases. In conclusion, she elaborated on how gene editing can be a blessing for India's agricultural sector.

Dr. K. C. Bansal, Secretary, National Academy of Agricultural Sciences, India and Former Director, National Bureau of Plant Genetic Resources, presented the recommended framework for regulating gene editing in plants in India. Dr. Bansal gave a brief introduction of new techniques used for plant breeding, such as site-directed nucleases (SDN-1, SDN-2, and SDN-3), oligonucleotide-directed mutagenesis (ODM), base editing (BE) and prime editing (PE), and science-based regulation. He mentioned some of the critical observations of the National Academy of Agricultural Sciences regarding genome-edited products. He remarked that it is not necessary to regulate products obtained using SDN-1 and SDN-2 and that these should be exempted from risk assessment, as they do not carry any vector DNA and are similar to the products of spontaneous or induced mutations. In conclusion, Dr. Bansal proposed that global regulatory coordination is necessary for sustainable agricultural innovation and international trade. However, no additional regulation is necessary if the products could have been generated using "conventional" breeding methods and possess no foreign DNA.

During the panel discussion, Prof. Sharad Tiwari, Director, Biotechnology Centre, JNKVV, Jabalpur, talked about the effects of climate change, with increases in environmental stresses like salinity, drought, and high temperature, and the imperative to develop climate-resilient crop varieties. He presented the centre's ongoing work and gave the future opinion of genome editing technology for implementation.

Dr. M. Tripathi, Professor & Head, Department of Biotechnology, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, Madhya Pradesh, shared his work in the field of agricultural biotechnology and emphasized the importance of gene editing in speed breeding programmes.

Dr. Milind Ratnaparkhe, Principal Scientist, ICAR-Indian Institute of Soybean Research, Indore, MP and Dr. Pawar Deepak, V. Scientist, ICAR-Directorate of Weed Sciences, Jabalpur, MP discussed the applications, possibilities, and progress made in the field of crop improvement by incorporating desirable agronomic traits with the use of genome editing technology. Dr. S.S. Sandhu, Professor & Director, Design Innovative Centre, Rani Durgawati University, Jabalpur, MP, emphasized the role of CRISPR in treating deadly human diseases and stated that since 2012, the CRISPR/Cas system has been widely used in studying gene function in human and human-related traits. He shared the possibility of using CRISPR to resurrect lost species and drew attention to the ethical concerns of genome editing in terms of fairness, safety, and religious objections.

At the end of the webinar, the Vote of Thanks was delivered by Dr. Vibha Ahuja, Chief General Manager, BCIL & Senior Advisor, SABP.

CALENDAR OF EVENTS

EVENT	ORGANIZED BY	DATE	WEBSITE
BANGLADESH			
The Annual Botanical Conference: Innovative Research in Plant Science for Sustainable Development	Bangladesh Botanical Society	February 25-26, 2022 Dhaka	https://www.bdbotsociety.org
INDIA			
International Conference on Sustainability of the Sugar and Integrated Industries: Issues and Initiatives (SUGARCON-2022)	ICAR-Indian Institute of Sugarcane Research, Lucknow	February 16-19, 2022 Lucknow	https://iisr.icar.gov.in/iisr/
43rd Annual Meeting of the Plant Tissue Culture Association–India (PTCA-I) & International Symposium: Advances in Plant Biotechnology and Nutritional Security (APBNS-2022)	ICAR-National Institute for Plant Biotechnology, New Delhi	February 17-19, 2022 New Delhi (in person and online)	http://www.nrcpb.res.in/
National Symposium on Ornamental and Edible Horticulture: Emerging Challenges and Sustainable Goals	Bidhan Chandra Krishi Viswavidyalaya	February 21-22, 2022 Nadia, West Bengal	https://www.bckv.edu.in
7th National Youth Convention - Food Security to Nutritional Security: Youth Perspective	AIASA, ICAR and TNAU, Coimbatore	March 24-25, 2022 Coimbatore (in person and online)	https://tnau.ac.in/news-events/
ICGEB-DBT Workshop: Re-Designing Smart Crops for Sustainable Agriculture - Dynamics of CRISPR-Cas Breeding, NGS, and Beyond	International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi & Department of Biotechnology, Government of India	May 23-27, 2022 New Delhi	https://www.icgeb.org/activities/meeting-and-courses/
INTERNATIONAL			
Regional Conference on Biosafety	Food and Agriculture Organization of the United Nations (FAO) - Sri Lanka	March 10-11, 2022 Colombo, Sri Lanka (online)	https://fao.zoom.us/webinar/register/WN_ZTVq_y8ZR2K0bFkz_5_LLA
24th Meeting of the Subsidiary Body on Scientific, Technical, and Technological Advice	Secretariat of the Convention on Biological Diversity	March 14-29, 2022 Geneva, Switzerland	https://www.cbd.int/meetings/
3rd Meeting of the Subsidiary Body on Implementation			
3rd of the Open-Ended Working Group on the Post-2020 Global Biodiversity Framework			

SOUTH ASIA BIOSAFETY PROGRAM

The South Asia Biosafety Program (SABP) is an international development program implemented in India and Bangladesh with support from the United States Agency for International Development (USAID). SABP aims to work with national governmental agencies and other public sector partners to facilitate the implementation of transparent, efficient, and responsive regulatory frameworks for products of modern biotechnology that meet national goals as regards the safety of novel foods and feeds, and environmental protection.

Agriculture & Food Systems Institute

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