e-Refresher Course Contents

About the e-Refresher Course

Indian ecosystem was known to be most serine, sublime and full of blessings of Nature. The entire biosphere of India was driven by the ancient researchers, scientists who had contributed their efforts in life science and souls like Dr. Har Gobind Khorana, awarded Nobel Prize in Medicine, 1968 for researching over 'Genetic Code and Functions in Protein Synthesis', with this in series more contributions were added from India from past few decades. Since from last 10 years, India is gaining prominence as a partner of choice in bilateral cooperation in this field. India is emerging as a Biotechnology Hub in novel biopharmaceuticals production including novel vaccines and antibiotics. Vaccines manufactured in India is procured in large quantities internationally. Domestic companies have developed strong capabilities in vaccine development. The biotechnology industry in India, comprising about 800 companies, is expected to be valued at US$ 11.6 billion in 2017. The government has to invest US$ 5 billion to develop human capital, infrastructure and research initiatives if it is to realize the dream of growing the sector into a US$ 100 billion industry by 2025, as per Ministry of Science and Technology, Govt. of India. In India, Department of Biotechnology (DBT) a governmental body which is separately stands to recognize and affiliate all projects and grants to various researchers and academicians to inspire, innovate and engage with scientific community. India has become a Pioneer in the field of Biotechnology Research and development and incorporating novel technology for climate resilient crops, regenerative medicines, novel vaccines, antibiotics, probiotics and functional foods, future biofuels, industrial enzymes, rapid diagnostics of infectious diseases, novel immunity booster products and bioprocessing & bioprospecting by adopting advanced biotechnologies such as next generation sequencing technology, gene editing methods and specific genetic engineering techniques. Now, we are well aware about sustainable exploitation of genetic biodiversity present in the Indian subcontinent.

This "e-Refresher Course" opens to all biotechnology learners to join. This e-Refresher Course is designed in such a way that biotechnology learners can upgrade themselves and innovate by advance biotechnology learning. This course has twenty rigorous workshops designed based on present and future challenges related with infectious disease, malnutrition, environmental sustainability, bioprocess and bioprospecting and welfare of mankind. This e-Refresher Course is on 21st Century: Era of Biotechnology platform where participants will be rigorously engaged to learn advances in biotechnology with Scientific and Industry Experts from various organizations from CSIR/DBT/ ICAR/ICMR Labs of Department of Science and Technology, Government of India and many leading BioPharma Industries. We welcome all members of Biotechnology Fraternity to join this program with enthusiasm. We wish that this e-refresher Course will surely going to create a novel opportunity for all of you by learning advances in biotechnology for innovation.

Best Wishes!

Chairman of the Program
Dr. Ashok Pandey
Founder President, Biotech Research Society, India
Eminent Scientist Center of Innovative & Applied Bioprocessing, SAS Nagar Mohali-160 071, Punjab, India

Course Convener & Coordinator
Dr. Kamlesh Choure
Professor & Head
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e-Refresher Course Content Details

	Workshops	About the Workshops of e-Refresher Course
Orientation Program	**Orientation Program and Interactive session between participants and Organizing Team** **Schedule Date: 3 and 5 September 2020** **Schedule Time: 11:00 AM to 12:30 PM**	Objective of organizing this orientation program is to interact with the participants of e-Refresher Course and let them know in detail activities including introduction to various workshops and speakers of the eminence and experts from the industry. All information will be deliberated related with registration, login in online platform, conduct of Q&A Sessions and feedback of all workshops of this e-Refresher Course. (It is Mandatory to attend for all the participants)

Workshop-I	**Next Generation Sequencing Technology** **Convener:** **Dr. Piyush Pandey** **Professor & Head,** **Department of Microbiology** **Central University Assam** **Silchar** **Training Partner:** **Premas Life Sciences Pvt. Ltd., Okhla, New Delhi** **Scheduled Dates:** **7-8 September, 2020**	Next Generation Sequencing (NGS), a recently evolved technology, have served a lot in the research and development sector of our society. NGS methods are highly parallelized enabling to sequence thousands to millions of molecules simultaneously. This technology results into huge amount of data, which need to be analysed to conclude valuable information. Analysis of NGS data unravels important clues in quest for the treatment of various life-threatening diseases; improved crop varieties and other related scientific problems related to human welfare. **What will you Learn:** • Overview of NGS & detailed understanding • Data Retrieval (NCBI SRA) & Introduction to data types • Read Quality Check (FastQC & Cutadapt) • Alignment of reads using reference Genome (Tophat) • Visualization of mapped reads (UCSC / IGV / ArrayGen Genome Browser) • Gene Expression Quantification (Coverage,FPKM) • Differential expression analysis (Cufflink, cuffmerge & cuffdiff) • Different plots (Heatmap,volcano plot etc) using CummeRbund & R • Pathway & Gene ontology enrichment analysis • Pathway Network analysis using stringDB(PPI) & Cytoscape • Pathway Network Analysis using KEGG Mapper tool for all DEG genes

Workshop-II	**Gene Editing: CRISPR Technology** **Training Partner: ArrayGen Ltd. Pune** **Scheduled dates:** **Scheduled Dates: 9-10 September, 2020**	CRISPR/Cas9 workshop will provide an understanding to grasp the mechanism of gene editing as well as an introduction to the concepts of gene over-expression in bacterial system. It will surely help in unlocking the potential of genetic cures at a much faster, cheaper, more accurate, and more efficient level than other existing genome editing methods. **What will you learn?** • Introduction to different types of Genome editing like ZFNs, TALENs, CRISPR • Understanding CRISPR for Gene & Genome editing • Introduction to major and minor CRISPER-cas types • Understanding CRISPR associated systems like Cas9, Cpf1 • Understanding Data Retrieval from biological database /Sequence alignment BLAST & ClustalW • Primer Designing and specificity check using bioinformatics tools for CRISPR • Mutagenesis analysis & Mechanism of knock out mutagenesis & Knock in mutagenesis • Understanding the concept of single guide RNA (sgRNA) • Bioinformatics Pipeline to design sgRNA • Identification of target sites and target screening for single guide RNA • Searching CRISPR Sequences in the genomic samples • Exquisite targeting precision for therapeutic genome editing

Workshop-III	**Genomics-Assisted Strategies for climate resilient crops** **Convener:** **Dr. P. K. Shukla** **Associate Professor** **Department of Biological Sciences** **SHUATS, Prayagraj** **Scheduled Dates:** **12-13 September, 2020**	In last decades highly significant developments genetic improvement for resistance/ tolerance to biotic and abiotic stresses, yield and quality traits in different crops, as a result of which, a number of improved high yielding stress tolerant and nutrient enriched high yielding crop varieties have been developed which are being grown commercially across the country. **This workshop aims:** • To provide information on basic concepts, rational strategies and applied aspects of research that can effectively be utilized in developing crop varieties using genomics-assisted breeding. • To provide virtual experience in undertaking genomics-assisted approaches. **Topics:** • Molecular markers: Introduction and application in plant breeding • Genome sequence: applications in plant breeding • Bioinformatics in plant breeding • Diversity analyses and phylogenetic relationships • Fingerprinting of germplasm: methods and applications • Linkage analyses and mapping function • Mapping population: basic concepts and development • Mapping genes and QTLs • Association mapping in crops • Marker-assisted selection in crop improvement
Workshop-IV	**Biofuels: The future of moving world** **Convener:** **Dr. Pavan Jutur** **Group Leader, Biofuels** **International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi.** **Scheduled Dates:** **14-15 September, 2020**	Presently, biotechnology is playing a very vital role in the development of biofuels which is prerequisite for sustaining of future moving world. Unlike other renewable energy sources, biomass can be converted directly into liquid fuels, called "biofuels," to help meet transportation fuel needs. There are four types of biofuels: 1st, 2nd, 3rd and 4th generation biofuels. They are characterized by their sources of biomass, their limitations as a renewable source of energy, and their technological progress. This workshop will provide an interactive platform for discussion and learning about production process of biofuels and biotechnology intervention for developing a low-cost biofuels production technology. All the eminent speakers of this workshop will cover the basics to advances in field of Biofuel production to enhance the learning of all the participants.

Workshop-V	**Fermentation Technology: Microbial Technology for Industries and Bioprocessing** **Convener:** **Dr Vivekanand,** **Coordinator** **Centre for Energy and Environment** **Malaviya National Institute of Technology Jaipur** **Jaipur-302 017, Rajasthan** **Scheduled Dates:** **17-18 September, 2020**	The major objective of the course will be to impart training on fermentation principles and engineering fundamentals of growing microorganisms in a bioreactor to express industrially important biomolecules. This workshop will also help the participants to gain fundamental understanding of the relationship between process design and product quality. Participants of the workshop will also engage in hands-on pilot-scale laboratory experiences that define and explore the critical control parameters required to achieve a robust fermentation process.
Workshop-VI	**Intellectual Property Rights and Patenting** **Training Convener** **Dr. Sachindra Pandey** **Senior Patent Attorney** **K&S Partner, New Delhi** **Scheduled Dates:** **19 September, 2020**	Intellectual Property (IP) is the fuel that powers the engine of prosperity, fostering invention and innovation. The increasing significance of intangible assets in the global economy is forcing business organizations to actively manage their IP as a key driver for building and sustaining their competitive advantage and achieving superior performance Awareness on Intellectual Property Rights • Patentability Criteria; Patent law, Innovation to commercialization. • Prior-art • Search; national search database • Patenting Procedure and Licensing

Workshop-VII	**Bioinformatics for Metagenomics** **Convener:** **Dr. Piyush Pandey** **Professor & Head,** **Department of Microbiology** **Central University Assam Silchar** **Training Partner:** **SHRM Biotechnologies, Kolkatta** **Scheduled Dates:** **22 September, 2020**	**Introduction to Bioinformatics** • Understanding Genomics Bioinformatics • Databases & tools (NCBI, UCSC, BLAST, BLAT etc) • Gene Prediction • Genome Annotation • Biological Functional Annotation • Genome Vizualization **Introduction to Metagenomics** • Quality Check & Filtering (FastQC, Cutadapt) • Prepare mapping file containing features and barcodes • Demultiplexing and quality filtering sequence reads • OTUs identification (Qiime) • Retrive analysis summary from BIOM file • Diversity Analysis • Taxonomic composition and relative abundance plots • Taxonomic Heatmap Analysis • Estimation of species richness and sampling depth analysis • Phylogenetic Analysis of Identified community (MEGA, iTOL) • Species enrichment plots for each sample (KRONA)

Workshop-VIII	**Molecular Docking and Drug Designing** **Convener:** **Dr. Kishor Shende** **Information Officer** **Department of Biotechnology** **Barkatullah University, Bhopal** **Training Partner:** **SHRM Biotechnologies, Kolkatta** **Scheduled Dates:** **23-24 September, 2020**	The training course for the workshop has been designed to provide the theoretical background as well as a hands-on approach to Molecular Docking and Virtual screening. The workshop will also cover the use of different software and will focus on Cheminformatics methods for lead identification and optimization. Computer aided drug designing workshop will provide hands on training on structure and target-based design, molecular modeling, quantum mechanics, drug likeness properties, QSAR and pharmacokinetic and dynamics • Introduction to Drug Designing • Designing of Lead Molecule by ChemSketrch/MarvinSketch • Pharmacokinetics and Pharmacodynamics of a Drug • Insilico Screening (ADME) • Taking a look into other biologics as a probable drug. • Drug Toxicity Determination • Drug Target Identification and Validation • Database Searching and getting familiar with the various Databases • Homology Modelling • Virtual Screening • Multiple Sequence Alignment • Molecular Dynamics Simulations using Chimera and AMBER.

Workshop-IX	**Recent Advances in Molecular Biology Techniques, Real Time PCR and Sequencing** **Training Partner: Merck High Skilled Development Centre, IMTECH-CSIR, Chandigarh** **Scheduled Dates: 28 September-2 October, 2020**	• This workshop will cover basic theoretical concepts and laboratory techniques of molecular biology and PCR-based applications such as pharmacogenomics, gene expression analysis, genotyping, and DNA sequencing. • Lecture topics include nucleic acid structure and function, DNA replication, nucleic acid purification, design and theory of the polymerase chain reaction (PCR), and real-time PCR theory and fundamentals of data analysis. • Virtual Laboratory exercises include DNA purification and quantification, PCR, analysis of DNA by gel electrophoresis, and real-time PCR assays and analysis.
Workshop-X	**Probiotics and Immune System** **Convener:** **Prof. P.S. Bisen** **Ex. Vice Chancellor** **Jiwaji University, Gwalior** **Scheduled Dates: 3 October, 2020**	Probiotics are "living microorganisms" which exert a prophylactic and therapeutic effect by improving the internal microbial balance. Probiotics exerts several beneficial effects on gastrointestinal infections, the reduction of serum cholesterol, the protection of the immune system, anti-cancer properties, antimutagenic action, anti-diarrheal properties, the improvement in inflammatory bowel disease and suppression of *Helicobacter pylori* infection, Crohn's disease, restoration of the microflora in the stomach and the intestines after antibiotic treatment, etc. are proven by addition of selected strains to food products. This workshop is mainly focused to cover the production process of effective probiotic products including fermentation, strain selection, production technology selection, blending, testing, and packaging in detail.

Workshop-XI	**Microbial Biodiversity: Source of Novel Antimicrobial therapeutics and Industrially important Enzymes** **Chairman** **Dr. Ragini Gotalwal** **Prof. & Head,** **Department of Biotechnology** **Barkatullah University, Bhopal (MP)** **Convener** **Dr. Nidhi Pareek** **Department of Microbiology** **Central University of Rajasthan Bandarsindri Kishangarh Ajmer (Rajasthan)** **Scheduled Dates:** **5-6 October, 2020**	The overuse and incomplete prescription of antibiotics emerged as major reasons for adaptation of pathogenic microorganisms for antibiotic resistant. This is one of the most important health challenges of the 21st century. To overcome this major issue novel classes of molecules, such as engineered antibodies, antibiotic enhancers, siderophore conjugates, engineered phages, and photo-switchable antibiotics are needed. To search and prepare novel antimicrobial compound assessment of microbial biodiversity is always envisaged. The genome editing by using CRISPR/Cas system is also providing new avenues to facilitate the development of antimicrobial therapies. The application of micro-engineering is driving the discovery of antimicrobial compounds using metagenomic assessment for finding novel antibiotic coding genes from uncultivable microorganisms. This workshop is planned for understanding novel biotechnology approaches to find out the novel antimicrobial therapeutics. Microbial enzymes are of great importance in the development of industrial bioprocesses. Current applications are focused on many different markets including pulp and paper, leather, detergents and textiles, pharmaceuticals, chemical, food and beverages, biofuels, animal feed and personal care, among others. Today there is a need for new, improved or/and more versatile enzymes in order to develop more novel, sustainable and economically competitive production processes. Microbial diversity and modern molecular techniques, such as metagenomics and genomics, are being used to discover new microbial enzymes whose catalytic properties can be improved/modified by different strategies based on rational, semi-rational and random directed evolution. Most industrial enzymes are recombinant forms produced in bacteria and fungi.

Workshop-XII	**Rapid Diagnostics: Detection of Infectious Diseases** **Convener:** **Prof. A. M. Deshmukh** **National President** **Microbiologists Society, India** **Training Partners:** **SHRM Biotechnologies, Kolkatta** **3B BlackBio Ltd. Bhopal** **Scheduled Dates:** **8 October, 2020**	It is very important to detect the infectious diseases timely so that proper quarantine measures may be taken to stop the community transmission. Hence, rapid diagnostics based on polymerase chain reaction (PCR) methods and Antibody based Detection because these tests are faster, more reliable, and more widely available than ever. At the core of the recent boom is rapid molecular diagnostics (RMD), based on polymerase chain reaction (PCR) and Antibody based Detection allows laboratory technicians to detect specific genes that indicate the presence of infectious agents. This workshop is designed in this way that after attending it participants could be able to join as technologist at various testing centres for infectious diseases screening as well as conduct experiments. **Main Features:** • This workshop will include rigorous expert lectures from industries on PCR and its applications, RNA extraction, cDNA synthesis, Real Time PCR and applications of qPCR in COVID19 diagnosis. • Lectures will be followed by live demonstrations of all techniques on gene amplification through PCR Machine, RNA extraction from non-pathogenic Biological sample, cDNA preparation using PCR Machine, run of the of Real Time machine for specific gene expression and real time PCR data analysis. • Antibody based Detection of Infectious Diseases

Workshop-XIII	**New Insights in the development of novel Biofertilizers and Biopesticides** **Convener:** **Dr. Anil Prakash, Professor & Head Department of Microbiology, Barkatullah University, Bhopal (MP)** **Scheduled Dates:** **12 October, 2020**	Microbes have attracted worldwide attention due to their role in disease management and desired levels of crop yield through the use of biofertlizers and biopesticides. Functional diversity of plant growth-promotion activity of rhizobacteria, use of vesicular arbuscular mycorrhizal fungi, and utilization of microbial resources for making availability and supply of micronutrients. **This workshop will cover following points:** • Presents strategies for the management of soil and crop diseases • Integrated microbial approaches to control viral and insect pests and improved crop yield • Nitrogen fixation, phosphate-solubilizing, potassium mobilization and sulfur-transforming microbes for nutrition of crops • Functional diversity assessment for plant growth-promotion activity and the utilization of microbial resources • Entrepreneurship in production of novel biofertilizers and biopesticides

Workshop-XIV	**Stem Cell Engineering** **Convener:** **Dr. Nibedita Lenka, Scientist F** **Stem Cell Biology** **National Centre for Cell Sciences (NCCS), Pune, India** **Coordinator:** **Dr. Sugandha Singh** **Head, Biotechnology** **Sant Hirdaram Girls College, Bhopal** **Scheduled Dates:** **13 October, 2020**	This course is intended to teach current understanding of stem cells with a specific focus on their characterization, function, and role in regenerative medicine. The course will discuss in detail various bioengineering approaches to stem cell research including an overview of adult and pluripotent stem cells and their basic characteristics, isolation, expansion, and therapeutic potential of multi-potent adult progenitor cells from the bone marrow stromal tissue, three - dimensional culture systems, biomaterials and different biophysical tools used in stem cell research, and advancements in the field of stem cells and regenerative medicine.
Workshop-XV	**Vaccine Designing and Development** **Convener** **Dr. Parul Johri** **Amity Institute of Biotechnology** **Amity University, Lucknow** **Scheduled Dates:** **15 October, 2020**	Vaccines are standing as one of the most important discoveries to play vital role to control high risk infectious diseases in mankind. These have been proven their successful role in preventing infectious diseases and reduced the incidence of mortality in children. In the present changing environment, many potential threats are emerging from novel viruses and multi-drug resistant bacteria to Humans. To overcome these challenges from emerging diseases the demand of new vaccines potential threats effective vaccines is required. This workshop will provide overview of Vaccine design and production, Subunit vaccines, structure-based vaccines, tools and techniques required to design a vaccine, antigenicity modification, antigen display and delivery platforms, infectious agents and their vaccines, R & D and production requirements for vaccines.
Workshop-XVI	**Plants of Opportunity: Source of novel drug candidates for emerging diseases** **Convener** **Dr. Anita Tilwari** **Sr. Scientist** **Centre of Excellence in Biotechnology** **MP Council of Science & Technology, Bhopal (MP)** **Scheduled Dates: 16 October, 2020**	Pharmacognosy is the study of medicinal drugs derived from plants or other natural sources. It is also defined as the study of crude drugs. Medical Ethnobotany is the study of the traditional use of plants for medicinal purposes. For thousands of year's Pharmacognosy and natural products have played a very important role in health care and prevention of diseases. It is estimated that about 70% of the supply of herbal raw material for Ayurveda and other homeopathic medicines in India comes from the wild. This workshop aims to provide all basic to advance knowledge about exploitation of plant materials as a source of novel drug for major challenging infectious diseases. Participants will learn the process to screen the drug molecules from plant materials from leading scientists and industry experts.

Workshop-XVII	**Plant Tissue Culture: Scope and Opportunities** **Convener:** **Dr. Pragti Shukla** **Coordinator** **Plant Tissue Culture Unit** **Department of Biotechnology** **SHUATS, Prayagraj** **Scheduled Dates: 17 October, 2020**	Development of a plant tissue culture unit by complete understanding of Plant Tissue Culture techniques: Demonstrations and Hands-on lab experiments Principles and applications of tissue culture, Preparation of tissue culture media, sterilization, Quick update on latest techniques / developments. Virtual training for various tissue culture techniques, Workshop is intended to learn basic tissue culture techniques.

Workshop-XVIII	**Scope, Career and Entrepreneurship in Biotechnology** **Interaction with Experts: Scientific & Industrial Experts and Bioentrepreneurs** **Scheduled Dates: 20 October, 2020**	Biotechnology degree programs ignite experimental and research skills in young minds. Biotechnology alumni have an excellent career opportunity after completion of undergraduate/ postgraduate programs. Students can pursue a career in pharmaceuticals, biotechnology, food technology, biomedical science, agri-sciences, environmental management, and upcoming area of IPR (intellectual property rights). This workshop is designed in such way that participant could be able to take up a particular area as future objective in the field of Biotechnology. This workshop will prove as a day of great learning and interaction towards Start-up- India and Fostering entrepreneurship spirit among biotechnology students and research scholars. They will learn from industry professionals to about biotechnology commercialization, grow professional networks, and explore entrepreneurial opportunities that build on basic research.
Workshop-XIX	**Discussion on Learning Outcomes of Refresher Course with the Participants** **Scheduled Dates: 21 October, 2020**	This one-day session is dedicated to Interaction between participants and conveners of the series of workshops organized under this virtual refresher course with the following objectives: 1. To know the learning outcomes of this program. 2. To answer the queries of the participants 3. To assess the feedback of the participants 4. To finalize the future objectives
Workshop-XX	**Valedictory Session of the e-Refresher Course** **Scheduled Dates: 21 October, 2020**	Eminent Speakers from National Academy of Sciences, India (NASI) and AKS University Authority will be present to grace this session.

Chief Patron **Shri. B. P. Soni** Hon'ble Chancellor AKS University, Satna (MP) 485001	**Patrons** **Shri. Anant Soni** Hon'ble Pro Chancellor AKS University, Satna (MP) 485001 India **Prof. P. K. Banik** Hon'ble Vice Chancellor AKS University, Satna (MP) 485001 India
Co-Patrons **Dr. R. S. Tirpathi** Pro-Vice Chancellor, Admin AKS University, Satna (MP) 485001 India **Dr. Harshwardhan** Pro-Vice Chancellor, Development AKS University, Satna (MP) 485001 India **Prof. R. N. Tripathi** OSD, AKS University, Satna (MP) 485001 India	**Convener of the Course** **Dr. G.P. Richariya,** Dean, Faculty of Life Science & Technology, AKS University, Satna (MP) **Co-Chairman of the Course** Prof. Shivesh Pratap Singh, Secretary, NASI-Bhopal Chapter, Govt. PG College, Satna (MP) **Coordinator (IT Support)** **Mr. S. K. Soni,** Chief IT Administrator AKS University, Satna (MP) 485001 India

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Must Join & follow Telegram for updates of e-Refresher Course

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