Jomo Kenyatta University of Agriculture and Technology

Institute of Biotechnology Research

Syllabus

Short Courses

SEPTEMBER 2011
Short Course: Introduction to Plant cell, tissue and organ culture

Introduction

Plant Tissue Culture is a biotechnology tool that has found wide application in Kenya and around the world. It is a useful technique for mass production of disease free planting material, mass propagation endangered tree species especially those trees which are widely used and their reproductive biology cannot allow for its sustainable exploitation. Tissue culture is also key to the genetic transformation of plants using genes that will improve the qualities of our crops. This course will introduce participants to the fundamentals of cell, tissue and organ culture in plant systems. Participants will become familiar with sterile technique and media preparation. Participants are also expected to learn transformation and regeneration of plants from culture. This course will include an introduction to theoretical aspects of plant cell and organ culture with emphasis on practical application. Laboratory exercises will be the primary focus of the course. Students will be responsible for reading and discussing current literature in order to become familiar with the utility of these techniques in biotechnology.

Course Objectives

- To apprise participants about the theoretical concepts and experimental protocols in the area of Micropropagation
- To provide an overview of the application of tissue culture in the fields of forestry, horticulture, floriculture, and medicinal and aromatic plants

Target Group

It targets technicians and entrepreneurs planning to establish commercial Micropropagation units, commercial growers, NGOs, other end-users and promoters of tissue culture technology; and those carrying out research in agriculture/horticulture/forestry and requiring practical training in tissue culture.

Course Outline

Introduction to plant nutrition
- A review of plant nutrition and plant nutrients
- Phytohormones

Introduction to plant tissues
- Introduction to plant tissues and organs key to tissue culture

The tissue culture process
- Introduction to Plant Tissue Culture Technology
- Infrastructure in a TC laboratory
General aspects of plant tissue culture

- Selection of mother plant, explant and culture initiation
- In vitro regeneration and multiplication of shoots: axillary shoot proliferation/somatic embryogenesis
- Rooting - in vivo and in vitro
- Acclimatization (hardening)
- Quality control in TC Laboratories

Tissue culture mass production

- Commercial Micropropagation
- Production planning

Plant transformation

- Genetic engineering: Techniques and applications

NB: Practical classes will include, Explant sterilization and culture establishment, Shoot multiplication, Rooting and hardening of plantlets, Plant DNA Isolation, Plasmid isolation, Agrobacterium mediated transformation, Molecular marker techniques – RAPD method. Regeneration of shoots and roots from callus in culture takes approximately ten weeks, so for the students to be able to observe plant regeneration it is necessary to have callus tissue growing for no less than one month, and ideally six weeks prior to the first day of the course.

Course Materials

- Lecture Notes
- Practical Handouts/Laboratory manuals

Course Duration: 2 Weeks

For more information about Application contact: jneondo@jkuat.ac.ke or waribuj@yahoo.com,

JKUAT IS 9001:2008 ISO CERTIFIED
Setting trends in Higher Education, Research and Innovation
Short-Course: Basics of Molecular Biology

Introduction

Molecular Biology has changed forever the teaching of life sciences around the world. Any life scientist who refuses to embrace the use of molecular tools is slowly but surely committing academic suicide. The characterisation and identification of any living thing is now incomplete without the use of molecular tools. The search and discovery of novel drugs, drug targets, enzymes and other useful Biological products can now be better achieved using molecular Biology tools. Diagnosis of Plant, animal and human pathogens can better be done if we embrace molecular diagnostics. This short course in Molecular Biology aims to equip researchers; lecturers and technicians in Molecular Biology skills to enable them improve their research and teaching. On completion of the module, the student should be able to: have a strong theoretical foundation in molecular genetics concepts; Apply the use of prokaryotic and eukaryotic genetics to gene manipulations; Plan and perform basic molecular biology laboratory manipulations; Develop an understanding of micro-organisms and their applications; Demonstrate skills and techniques in recombinant DNA technology; Apply theory to practice in order to interpret experimental data from gel electrophoresis, cloning experiments, DNA sequencing, restriction digestion, PCR, etc; Do simple troubleshooting and critically analyse procedures with regards to controls and standards

Course Objectives

To equip students with an understanding of the central dogma of genetics and the use of bacteria and bacteriophages as a workhorses for cloning

To introduce participants to various tools for used cloning, gene expression and library screening

Minimum entry requirements: Bachelor of Science in any Biological Science

Target group: Postgraduate students, researchers and lecturers wanting to advance their knowledge and skills in molecular biology

Course Structure

Structural analysis of DNA and its replication

• Structure of DNA
• Differences between DNA and RNA
• Evidences supporting DNA and RNA as the genetic material
• DNA replication in details
• Telomerase and problem posed by DNA replication

Transcription and translation

• Genetic code and overlapping genes
• Transcription in prokaryotes and eukaryotes
• Post-transcriptional modifications of RNA in eukaryotes
• Protein synthesis in prokaryotes and eukaryotes
Genetics of bacteria and bacteriophages
- Generalised and specialised transduction
- Lytic and lysogenic life cycles of bacteriophages

Tools of cloning
- Restriction enzymes, vectors for cloning
- Cloning to obtain recombinant DNA and proteins

Introduction to Basic Equipment in a Molecular Biology Laboratory
- Equipment: Use, operation and maintenance

Applications of DNA technology I
- Genomic libraries, cDNA libraries, promoter and TATA boxes
- Southern Blot, Northern Blot and Western Blot
- Study of gene expression, reporter vectors, expression vectors

Applications of DNA technology II
- Nucleic Acid probes
- Polymerase chain reactions
- Restriction enzyme mapping
- DGGE, TGGE, RFLP, T-RFLP, FISH
- DNA sequencing
- DNA Microarray

Course Materials
- Lecture Notes
- Practical Handouts/Laboratory manuals

Course Duration: 2 Weeks

For more information about Application contact: jneondo@jkuat.ac.ke or waribuj@yahoo.com,

Short-Course: Basic Microbiological Techniques

Justification
Microorganisms are the most abundant and most successful organisms in nature and they have enormous potential for exploitation in various processes. They constitute what has come to be known as “the hidden resource” since less than 1% of the microbial diversity has been characterized. Yet from this small percentage we derive many products from microbes including foods, drinks, medicines, biopolymers, vitamins, enzymes, biopesticides etc. On the other hand microbes especially bacteria are responsible for some of the most debilitating disease afflicting both to man, animals and plants. Successful exploitation and control of microorganisms will depend largely on how well we understand them.
Course Objectives:

To provide participants with the skills to understand the physiology of microorganisms, design culture media for aerobes and strict anaerobes and other skills essential in the characterization of microorganisms especially bacteria and fungi.

Target Group:

Technicians, Technologists, Post graduate students, Researchers and Lecturers wanting to advance their ability to work with microorganisms.

Course Structure

Introduction to Microbiology
- A brief History of Microbiology
- An overview of Microbial Diversity
- Diversity of Microbial habitats

Observation of the Microorganisms
- The Microscope: Types, handling, care and usage
- Aseptic Techniques

Culturing microorganisms
- Microbial Nutrition and Microbial Culture Media
- Influence of physico-chemical factors on microbial growth
- Methods in Enumeration of microorganisms
- Isolation of microorganisms

Fungi and anaerobes
- Skills in handling of fungi
- Special techniques for working with anaerobic organisms

Characterization of microorganisms
- Morphological and physiological characterization of Microorganism
- Antimicrobial Bioassays
- Use of Molecular techniques in the study of microorganisms
- Modern approaches to bacteria identification and Systematics

Biosafety issues
- Good Laboratory Practice/Biosafety

JKUAT IS 9001:2008 ISO CERTIFIED
Setting trends in Higher Education, Research and Innovation
Course Materials

- Lecture Notes
- Practical Handouts/Laboratory manuals

Course Duration: 2 Weeks

For more information about Application contact: jneondo@jkuat.ac.ke or waribuj@yahoo.com.