Handbook on Plants and Cell Tissue Culture

Author: NIIR Board of Consultants & Engineers
Format: Paperback
ISBN: 8178330296
Code: NI157
Pages: 640
Price: Rs. 1,275.00 US$ 125.00
Publisher: Asia Pacific Business Press Inc.

Usually ships within 3 days

Contents

1. PLANT TISSUE CULTURE
Historical Events in Plant Tissue Culture
Basic Requirements for Tissue Culture Laboratory
  1. Area for Medium Preparation
  2. A Sterile Room
  3. Glasswares and Other Instruments
  4. A Constant Temperature Room
  5. A Shaker System
Formulation of Tissue Culture Medium
  1. Composition of M.S. Medium
  2. Preparation of M.S. Medium
Collection of Explant Materials
Surface Sterilization of Explant Materials
Preparation of Explants and inoculation
Incubation of Culture Flasks
2. SUBCULTURE OF CALLUS
Regeneration of Plants from Callus
Organogenetic Method
Embryogenesis Method

3. NUCELLUS CULTURE

4. EMBRYO CULTURE
Uses of Embryo Culture

5. MERISTEM CULTURE
Uses of Meristem Culture

6. ANThER CULTURE
Procedure For Anther Culture
Uses of Anther Culture

7. SUSPENSION CULTURE
Methods For Growth Measurement
Experiments to Assess the Cell Viability
Uses of Suspension Culture

8. DEVELOPMENT OF TISSUE CULTURE TECHNIQUES

9. PRINCIPLES OF CELL CULTURE

CELL
Fine Cell Structure
Nuclearcytoplasmic Relationships
Cellular Activity

CELL DIVISION

CELLTYPES AND TISSUES
BEHAVIOUR OF CELLS IN CULTURE GROWTH,
DIFFERENTIATION AND METABOLISM
Primary And Established Cell Lines
The Nature Of Cell Alteration Or Transformation

Do Cultured Cells Differentiate?

KINETICS OF CELL GROWTH
(a) Established cell lines
(b) Primary cell lines
The cell cycle
Interaction among cells
Genetics of cultured cells

METABOLISM
Carbohydrate metabolism
Synthetic mechanisms
Protein Metabolism
Lipid metabolism
Nucleic acids
Structural elements
Relation of metabolism to growth

SPECIAL FACTORS INFLUENCING GROWTH AND METABOLISM
THE CELL AND ITS ENVIRONMENT PRESUMABLY
Temperature
Osmotic pressure
Hydrogen ion concentration
Other inorganic ions
Carbohydrates
Gases
Amino acids
Vitamins
Proteins and peptides
Supplementary metabolites
Hormones
Other specific factors
The matrix
Balance among factors

MEDIA FOR CULTURING CELLS AND TISSUES

I. NATURAL MEDIA
PLASMA
BLEEDING FROM THE WING
BLEEDING FROM THE HEART
BLEEDING FROM THE CAROTID ARTERY
COLLAGEN
BIOLOGICAL FLUIDS
Preparation of serum
Placental cord serum
Aminiotic fluid
Ascitic and pleural fluid
Aqueous humour
Serum ultrafiltrates
Dialysed serum
Insect haemolymph
Coconut water (coconut milk)
TISSUE EXTRACTS
The preparation of embryo extract
Preparation of chick embryo extract
Preparation of embryo extract from young embryos
The preparation of bovine embryo extract
Ultrafiltrates of embryo extract
Other tissue extracts
Other media of biological origin

MEDIA FOR CULTURING CELLS AND TISSUES

II. DEFINED MEDIA
MEDIA FOR TISSUES FROM WARMBLOODED VERTEBRATES
Solubility of materials.
Compatibility of components
Purity of materials.
Chemical instability
Stock solutions.

BALANCED SALT SOLUTIONS
Materials
Preparing a balanced salt solution

PARTIALLY COMPLETE SYNTHETIC AND COMPLETE MEDIA
Preparation of Eagles Medium

MEDIA FOR CULTURE OF TISSUES FROM COLD BLOODED VERTEBRATES
MEDIA FOR INVERTEBRATE TISSUES
MEDIA FOR PLANT TISSUES

10. PREPARATION OF MATERIALS
PREPARATION OF APPARATUS
Glassware
Plastic vessels
Stoppers for culture vessels
Rubber tubing
Instruments, etc
CLEANING PROCEDURES GLASSWARE
Detergents
Alkalies
Oxidising acids
Ultrasonics
Special problems
Automatic washing machines
PREVENTION OF CONTAMINATION
I. STERILISATION PROCEDURES
Sterilisation by dry heat
Sterilisation by moist heat
Radiations
Antiseptics
Antibiotics
Filtration
Storage of sterile materials
Chronic contamination (especially PPLO and L forms)
Sterility testing
Elimination of contamination
Outbreaks of contamination
PREVENTION OF CONTAMINATION
II. ASEPTIC TECHNIQUE
Contamination from tissue
Contamination from the air
Contamination from the operator
DESIGN AND EQUIPMENT OF A TISSUE CULTURE LABORATORY
Sterilisation and cleaning facilities
Sterile working area
Storage for media
Incubator facilities
Special glassware and apparatus
General equipment
Special apparatus
Coverslip techniques
Rollertube techniques
Organ culture
Handling of strains
Sources of materials
LABORATORY DESIGN
A single-room unit
Laboratory suite for tissue culture
Sterilisation room
The preparation room
The aseptic room
Aseptic cubicle
Hot room
General facilities
11. PRIMARY EXPLANATION TECHNIQUES
I. TISSUE CULTURES
SLIDE CULTURES
THE PREPARATION OF SLIDE CULTURE

Single coverslip with plasma clot
Maximow double coverslip method with plasma clot
Single coverslip with liquid medium. Laying and hanging drop cultures

AFTERCARE OF SLIDE CULTURES

Washing and feeding double coverslip cultures
Patching
Transferring coverslips cultures

CARREL FLASK TECHNIQUE
PREPARATION OF CULTURES

Renewal of medium
The transfer of tissue

TESTTUBE CULTURES
Plasma clot technique
Feeding testtube cultures.
Patching testtube cultures
Transfer of cultures from testtube
Culture of primary explants in roller tubes without plasma.

Flying coverslips in test tubes

THREEDIMENSIONAL SUBSTRATES

PRIMARY EXPLANTATION TECHNIQUES
II. ORGAN AND EMBRYO CULTURE

Organ cultures on plasma clots
Cultures on agar
Fluid media

PREPARING AN ORGAN CULTURE ON A CELLULOSE ACETATE RAFT

SETTING UP AN ORGAN CULTURE OF EMBRYONIC LIMB BONES ON A GRID

Set up apparatus
Prepare dishes
Prepare explants
Set up explants (e.g. chick limb bones)
Subculture (The medium should be changed every 48 hours.)

CHOPPED TISSUE TECHNIQUE

Cultivation of poliomyelitis virus in minced tissue suspensions

CUTTING CHICK EMBRYONIC HEART EXPLANTS BY MEANS OF THE McILWAIN TISSUE CHOPPER

WHOLE EMBRYO CULTURE

Culture of preimplantation mammalian embryos
Culture of postimplantation mammalian embryos

PRIMARY EXPLANTATION TECHNIQUES
III. DISAGGREGATION METHODS

PREPARATION OF CELL SUSPENSIONS FROM FRESH TISSUES

Disaggregation of embryonic limb buds
Preparation of trypsinised embryonic carcass
Trypsinisation of monkey kidney tissue
Preparation of primary human amnion cells
Trypsinisation procedure
Trypsinisation in the cold
Cloning of primarily disaggregated cells

12. CELL LINES

STATIC CULTURE METHODS
SUSPENDING CELLS FROM A MONOLAYER CULTURE
INOCULATION OF NEW VESSELS
FEEDING AND MAINTENANCE
Agar slope cultures
SUSPENSION CULTURES
Media for suspension cultures
Gas phase
General methods
General management of suspension cultures
Batch cultures
Continuous medium replacement
GROWTH OF PLANT CELLS IN SUSPENSION
CLONING CELLS
Cloning of HeLa cells by the dilution technique
Agar suspension technique
Cloning in fibrin gels
Cloning cells by the isolation technique
Technique
Characterisation of cell lines
SPECIAL ASPECTS OF HANDLING PRIMARY CELL LINES
General maintenance
Seed stocks
13. ISOLATION METHOD FOR MICROORGANISMS FOR CULTURE
SOURCES OF ORGANISMS AND SOME SAMPLING STRATEGIES
DIRECT ISOLATION METHODS
Pretreatment of Samples
DILUTION AND INCUBATION OF SAMPLES
Media Considerations
ENRICHMENT CULTURE METHODS
Baiting Methods
General Chemical Enrichment
Specialized Enrichment Systems and their Applications
Enrichments from sea water
Enrichments for biomass production
Enrichments for nitratereducing bacteria
Enrichments in complex media
Biodegradation
Heterogeneous continuous flow systems
14. CULTURE PRESERVATION AND STABILITY
PROCEDURES PRIOR TO SELECTING A PRESERVATION METHOD
Object of Preservation
Good Record Keeping of Previous Treatment and Lineage
Notation of Reported Characteristics of a Culture
Culture Preservation and Stability
DETERMINANTS FOR CULTURE IDENTITY, CHARACTERISTICS AND PURITY
Authenticated Cultures Confirmation of Stated Traits
Morphological
Biochemical
Physiological
Research and Development Strains
Elimination of leaky mutants
Assurance of auxotrophic traits (elimination of mixed genetic bag)
Selective pressure for maintaining specific culture traits
Longterm Storage
Cost efficiency
Minimal maintenance
Endurance of label
Precise inventory system
Shortterm Storage
Ease of sample preparation
Label reliability
Economic aspects
Reliability
Ease of retrieval
Rapid retrieval

SELECTION OF MAINTENANCE CONDITIONS AND PROCEDURES FOR IMPLEMENTATION, BASED ON CULTURE USE
Longterm Storage
Analytical organisms
Comparison strains
Manufacturing plant cultures
Shortterm Storage
New metabolite producers for investigative studies
Clones from populations for improved metabolite producers
Working stocks of analytical organisms

CULTURE RESTORATION AND GROWTH
CONSIDERATIONS
Restoration
Concentration of inocula
Nutrition
Osmotic (rehydration)
Temperature (rehydration and/or rate of melting)
Growth
Requirements
Temperature
Aeration (including dissolved gases)
Duration
Verification of Purity

15. GENETIC MODIFICATION OF INDUSTRIAL MICROORGANISMS
MUTATION
DNA Repair Mechanisms
Mutagen Specificity
Survival Curves and Optimum Conditions for the Use of a Mutagen and Expression of Mutations
Site Specific Mutagenesis
Applications of Mutation to Antibiotic-producing Microorganisms

RECOMBINATION
Protoplast Fusion
Conjugation and Natural Plasmids
Transformation
16. IN VITRO RECOMBINANT DNA TECHNOLOGY
GENERATION AND CLONING OF DNA FRAGMENTS
Fragmentation of DNA
Class II restriction enzymes
Random DNA fragments and the generation of genomic libraries
Enrichment for specific DNA sequences
Synthesis of cDNA
Chemical synthesis of DNA
Covalent Linkage of DNA Fragments to Vector Molecules
Ligation to vector molecules
Methods favouring formation of hybrid DNA molecules
Modification of DNA Extremities
Isolation of Recombinant Molecules and Interspecies DNA Transfer
Transformation and transfection
In vitro packaging
CLONING VECTORS
Plasmid Vectors
Vectors Derived from Bacteriophage λ
Phage vectors
Cosmids vectors
Special Purpose Cloning Vectors
Expression vectors
Single-stranded phage vectors
Plasmid vectors for subcloning and sequencing
Vectors for the detection of transcription and translation signals
Vector Systems for Organisms other than E. coli
DETECTION AND ANALYSIS OF CLONES
Screening Recombinant Clones
Nucleic acid homology
Translation in vitro
Immunological screening
Characterization of Cloned DNA
Isolation of cloned DNA
Physical characterization of cloned fragments
Characterization of products expressed by cloned fragments
MANIPULATION OF CLONED GENES
IN VITRO
Mutagenesis
Generation of deletions and insertions
Point mutations
Efficient Expression of Cloned Genes
Constructions that maximize expression
Secretion of cloned products
17. NUTRITIONAL REQUIREMENTS OF MICROORGANISMS
BACTERIA AND FUNGI
Macronutrients
Carbon
Nitrogen
Hydrogen
Oxygen
Phosphorus
Sulfur
Potassium
Magnesium
Micronutrients
Growth requirements
Effects of trace elements
Addition of trace elements
Chelation
Growth Factors
Vitamins
Amino acids
Miscellaneous growth factors
ALGAE
Macronutrients
Carbon, oxygen and hydrogen
Nitrogen
Phosphorus and sulfur
Potassium and magnesium
Micronutrients
Growth Factors
PROTOZOA
18. DESIGN, PREPARATION AND STERILIZATION OF FERMENTATION MEDIA
MEDIUM DESIGN
MEDIUM PREPARATION
STERILIZATION
19. NUTRIENT UPTAKE AND ASSIMILATION
NUTRIENT UPTAKE
Simple Diffusion
Transport Systems
Facilitated diffusion
Active transport
Redundancy of Transport Systems
ASSIMILATION
Assimilation of Carbon
Assimilation of Nitrogen
Control of nitrogen assimilation
Assimilation of Other Elements
20. MODES OF GROWTH OF BACTERIA AND FUNGI
GROWTH OF UNICELLULAR ORGANISMS
Cocci
Grampositive Rods
Gramnegative Rods
Budding Yeasts (Saccharomyces)
THE CELL CYCLE
GROWTH OF FILAMENTOUS ORGANISMS
Germination of Fungal Spores
Hyphal Morphology
Growth of Individual Hyphae
The extension zone
Cytology of the nonextending part of fungal hyphae
The peripheral growth zone
Growth of Mycelia

YEASTMYCELIAL DIMORPHISM

COLONY GROWTH
Growth of Colonies on Solid Media
Growth of Colonies in Liquid Media

EFFECT OF GROWTH RATE AND OTHER VARIABLES ON CELL COMPOSITION AND MORPHOLOGY

Unicellular Organisms
Fungi and Actinomycetes

21. MIXED CULTURE AND MIXED SUBSTRATE SYSTEMS

MIXED CULTURES
Methods of Study
Enrichment of Mixed Cultures
Analysis of Twospecies Systems
Analysis of Multispecies Communities
Kinetics of Mixed Cultures
Genetic Interactions
Mixed Culture Processes
Spontaneous mixed culture processes
Defined mixed cultures
Contamination and Degradation
Contamination
Industrial fermentations with unstable strains

Environmental Biotechnology

MIXED SUBSTRATES
Patterns of Mixed Substrate Utilization
Control of Mixed Substrate Utilization in Batch Culture
Control by regulation of substrate transport
Control by regulation of enzyme synthesis
Control by regulation of enzyme activity
Mixed Substrate Utilization in Continuous Culture
Double substrate limited growth
Efficiency of growth on mixed substrates

COMETABOLISM
Cometabolism in the Environment
Technological Potential

22. PROTOPLAST TECHNOLOGY

ISOLATION OF PROTOPLASTS
1. Mechanical Method
2. Enzymatic Method

MAINTENANCE OF PROTOPLASTS
Viability Tests for Protoplasts
1. FAD Test
2. Phenol Safranin Test
3. ColflourWhite Test
4. Microscopic Observation of Cytoplasmic Streaming
Plant Regeneration from Protoplasts
Applications of Protoplast Culture

PROTOPLAST FUSION
Methods of Protoplast Fusion
Selection of Hybrid protoplasts
Regeneration of Plantlets
Uses of Protoplast Fusion
INVITRO MUTATION BREEDING
Induction of invitro Mutagenesis
Uses of Invitro Mutation Breeding

23. GERMPLASM STORAGE
GERMPLASM STORAGE BY CRYOPRESERVATION
1. Collection of Plant Materials
2. Addition of Cryoprotective Agents
3. Freezing Treatment
4. Longterm Cold Storage

REUSE OF PRESERVED TISSUE
1. Thawing
2. Removal of Cryogen
3. Callus Induction
4. Plant Regeneration

Achievements
Advantages of Cryopreservation

STORAGE OF GERM PLASM OF POTATO

24. GENETIC ENGINEERING THROUGH THE TRANSFER OF CELL ORGANELLES
1. Isolation of Cell Organelles
2. Isolation of Protoplasts
3. Induction of protoplast to uptake cell Organelles
4. Selection of Transformed Protoplast
5. Regeneration of Plantlets

Advantages of Organelle Uptake Method

SUBPROTOPLASTS
Production of Cybrids

Applications of Cybrids

25. SPECIAL CONSIDERATIONS FOR DIFFERENT TISSUES

VERTEBRATE TISSUES
Embryonic tissues

DISSECTION OF THE CHICK EMBRYO
Chick embryonic limbbones for organ culture

MAMMALIAN EMBRYONIC TISSUES

ADULT TISSUES

PREPARATION OF EXPLANTS OF THE BUFFY COAT
Culture of peripheral blood leucocytes
Human skin fibroblasts

PROLONGED CULTURE OF DIFFERENTIATED CELLS

CULTIVATION OF TISSUES FROM COLDBLOODED VERTEBRATES

CULTURE OF INVERTEBRATE TISSUES
Arthropods
Other invertebrates

STORAGE OF TISSUE BEFORE CULTURING

CULTURE OF PLANT TISSUES
Preparation of tissues from plants
Cultivation of plant tissues
Culture of tomato roots
Culture of carrot callus

26. CULTIVATION OF CELLS IN VIVO TRANSPLANTATION
Transplantation into embryos
PROCEDURE
Transplantation into tolerant chimeras
Transplantation into genetically similar hosts
Transplantation into nonvascular areas
Procedure for anterior eye chamber implantation
Procedure for brain implantation
Diffusion chambers
Transplantation to irradiated and cortisonetreated animals
scites tumours
Maintenance of sterility
27. LARGESCALE CULTURE METHODS
Preparation and sterilisation of apparatus
Preparation and sterilisation of media
Cells and media
APPARATUS FOR MASSIVE CULTURE OF CELLS ON GLASS SURFACES
Largescale Roux flask cultures
Roller bottle methods
Solid matrix perfusion systems.
The multiple surface tissue culture propagator
MASSIVE SCALE SUSPENSION CULTURE
Culture vessels
CONTROL OF CULTURE CONDITIONS
Temperature
pH
Oxygen
28. PRESERVATION, STORAGE AND TRANSPORTATION OF LIVING TISSUES AND CELLS
Maintenance at slightly reduced temperatures
Maintenance at refrigerator temperature
Preservation by freezing
Equipment
General Procedure
Transportation of cells
29. MORPHOLOGICAL STUDIES
Morphological Studies
COMMON FIXATION AND STAINING TECHNIQUES
FOR TISSUE CULTURE MATERIAL
I. Commonly used fixatives
II. Routine stains
III. Special histochemical stains
Chromosome spreading technique
Determining the mitotic coefficient
Planimetry
Examination of living cells
Photography
PERFUSION OR CIRCUMFUSION CHAMBERS
Timelapse cinemicrography
QUANTITATIVE OPTICAL METHODS
Auto radiography
Preparation of cultures for electron microscopy
30. APPLICATIONS OF TISSUE CULTURE
I. Micropropagation
2. Elimination of Pathogens
3. Germplasm Storage
4. Somaclonal Variation
5. Embryo Rescue
6. The Production of Haploids
7. Artificial Seeds
   Types of Artificial Seeds.
8. Production of Secondary Metabolites
9. Production of Somatic Hybrids
10. Transgenic Plants
    Secondary Metabolites
Culture of Plant Cells for the Extraction of Secondary Metabolites
1. Designing of Bioreactor
2. Selection of Explant Source
3. Surface Sterilization
4. Preparation of Explant
5. Callus Culture
6. Suspension Culture
7. Cell Plating
8. Testing for Biosynthetic Activity
9. Culture of more Productive Clones
10. Extraction of Secondary Metabolites
    Biotransformation In Plant Cells
    Elicitor dependent Biosynthesis
    Immobilization of Plant Cells
    Hairy Root Clones
31. LIST OF CULTURE
    NCTC 109 AND NCTC 135
32. SOURCES OF MATERIALS FOR TISSUE CULTURE
    General suppliers of laboratory apparatus
    General glassware (in addition to above firms)
    General biological products and biochemicals
    General chemicals
    Special tissue culture media
    Suppliers of cell cultures

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes varies process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India. Email: npcs.india@gmail.com Website: NIIR.org