



**King George's Medical University UP.,  
Lucknow-226003  
CENTER FOR ADVANCE RESEARCH**

| <b>SUMMER/WINTER: SHORT TERM TRAINING COURSE-DRAFT</b> |                                                                                               |                                                                                |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>DURATION: 30 DAYS</b>                               |                                                                                               |                                                                                |
| <b>Molecular Biology Unit-Genomics</b>                 |                                                                                               |                                                                                |
|                                                        | 10:00 to 12:00 AM                                                                             | 2:00 to 4:00 PM                                                                |
| Day 1                                                  | Lecture 1: Basics of Molecular Biology- DNA and RNA                                           | Blood Collection for DNA extraction<br><br>Blood Collection for RNA extraction |
| Day 2                                                  | Lecture 2: Real Time PCR-Principle and Application                                            | DNA extraction from Blood                                                      |
| Day 3                                                  | Trizol RNA extraction from tissue, monolayer cell culture and cell suspension                 | RNA extraction from Blood                                                      |
| Day 4                                                  | Quality Check of RNA and DNA                                                                  | cDNA preparation                                                               |
| Day 5                                                  | Primer check                                                                                  | Gradient PCR                                                                   |
| Day 6                                                  | Real Time PCR                                                                                 | Discussion - Data Analysis                                                     |
| <b>Molecular Biology Unit-Metabolomics</b>             |                                                                                               |                                                                                |
| Day 1                                                  | Lecture 1: Principle of Metabolomics and its application in Medicine                          | Sample extraction and Preparation using Dionex ASE350                          |
| Day 2                                                  | Lecture 2: Gas Chromatography Mass Spectrometry/Mass Spectrometry- Principles and Application | Demonstration of GC-MS instrument                                              |
| Day 3                                                  | Fundamentals of metabolite derivatization                                                     | Preparation of GC-MS/MS for loading Samples                                    |
| Day 4                                                  | Analysis of Metabolites using GC-MS                                                           | Demonstration of sample derivatization by chemical reaction                    |
| Day 5                                                  | Analysis of Homocysteine and Methyl Malonic Acid                                              | Demonstration of Analysis of Methylmalonic acid and Homocysteine               |
| Day 6                                                  | Analysis of Pesticides                                                                        | Estimation of Pesticides in food items                                         |
| <b>Cell Culture Unit: Basic Cell Culture</b>           |                                                                                               |                                                                                |
| Day 1                                                  | Lecture 1: Safety in cell culture laboratories                                                | Demonstration of various hazards in laboratories                               |
| Day 2                                                  | Lecture 2: Introduction of cell culture laboratory                                            | Preparation of serum from the given blood sample                               |
| Day 3                                                  | Sterilization of Media                                                                        | Sterilization of plastic ware, glassware                                       |
| Day 4                                                  | Cell culture media, Reagents and buffers                                                      | Media preparation for cell culture                                             |



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|---------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Day 5                                       | Trypsinization of adherent cells and sub-culturing of monolayer cell cultures                       | Cell counting and viability determination                                 |
| Day 6                                       | Preservation of cells                                                                               | Protein quantification                                                    |
| <b>Cell Culture Unit: Stem Cell Culture</b> |                                                                                                     |                                                                           |
| Day 1                                       | Lecture-1: Isolation, expansion and Characterization of human tissue-derived Mesenchymal Stem Cells | Peripheral Blood Mononuclear Cell Isolation                               |
| Day 2                                       | Lecture-2: Principles and Application of Flow Cytometry                                             | Bone Marrow Mononuclear Cell Isolation                                    |
| Day 3                                       | Mesenchymal Stem Cell Culture and Expansion                                                         | Mesenchymal Stem Cell Culture viability determination                     |
| Day 4                                       | Preparation of Stem Cells for Flow Cytometry                                                        | Instrument Preparation for Flow Cytometry                                 |
| Day 5                                       | Characterization of Stem Cells through Flow Cytometry                                               | Analysis of Stem Cells through Flow Cytometry                             |
| Day 6                                       | Demonstration of cell sorter-4-way-size-based sorting of blood cells                                | Discussion - Data Analysis                                                |
| <b>Cytogenetics Unit</b>                    |                                                                                                     |                                                                           |
| Day 1                                       | Lecture 1: Karyotyping: Overview and Procedure (chromosomal Organization)                           | Preparation of peripheral blood cells for Karyotyping-Culture and Plating |
| Day 2                                       | Lecture 2: Changes in Chromosome number<br>Genetic Control of Meiosis                               | Slide Preparation                                                         |
| Day 3                                       | Karyotyping/Chromosome Analysis                                                                     | Giemsa Staining-Banding of Chromosomes                                    |
| Day 4                                       | Haematological Chromosome Analysis                                                                  | Harvesting Method                                                         |
| Day 5                                       | Application in Diagnosis                                                                            | Haematological Chromosome Analysis in Down Syndrome                       |
| Day 6                                       | FLUORESCENCE IN-SITU HYBRIDISATION (FISH) and its Application                                       | Case-Discussion                                                           |



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Molecular Biology Unit-Genomics, Center for Advance Research

Lecture Session:

Lecture 1: Basics of Molecular Biology- DNA and RNA

- Components involved in Molecular Biology: DNA and RNA
- Principle of DNA/RNA Isolation and its Quality Check
- Tools used in Molecular Biology: Gel Electrophoresis, PCR and its application, RFLP, AFLP, RAPD, Short Tandem Repeats.

Lecture 2: Real Time PCR-Principle and Application

- Why Real-time PCR? Advantages and Disadvantages
- Theory of Real-time PCR
- Types of Real-time PCR Quantification
- Choosing Housekeeping Gene for Normalization

Practical Session:

- Blood Collection for DNA extraction-SOP-1.1.1
- Blood Collection for RNA extraction-SOP-1.1.2
- Trizol RNA extraction from tissue, monolayer cell culture and cell suspension-SOP-1.1.3
- DNA extraction from Blood-SOP-1.1.4
- RNA extraction from Blood-SOP-1.1.5
- Real-Time PCR with SYBR-Green-SOP-1.1.6



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Molecular Biology Unit-Proteomics, Center for Advance Research

Lecture 1: Principle of Metabolomics and its application in Medicine

Lecture 2: Gas Chromatography Mass Spectrometry/Mass Spectrometry-Principles and Application

Practical Session:

- Blood Collection for Metabolomics using Serum-SOP-2.1.1
- Neonatal Blood Collection for Metabolomics-SOP-2.1.2
- Preparation/Derivatization of Samples-SOP-2.1.3
- Preparation of GC-MS/MS for loading Samples-SOP-2.1.4
- Analysis of Metabolite like Methyl Malonic Acid-SOP-2.1.5
- Analysis of Pesticide-SOP-2.1.6



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Cell Culture Unit-Basic Cell Culture, Center for Advance Research

Lecture 1: Safety in cell culture laboratories

Lecture 2: Introduction of cell culture laboratory

Practical Session:

- Sterilization of Plastic ware, Glassware and Media-3.1.1
- Cell freezing Protocol-SOP-3.1.2
- Thawing and Plating of Cells-SOP-3.1.3
- Trypsinization of Adherent Cells and sub-culturing of Monolayer Cell Cultures -SOP-3.1.4
- Cell Counting and Viability determination-SOP-3.1.5
- Protein determination by ELISA-SOP-3.1.6



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## CENTER FOR ADVANCE RESEARCH

### Cell Culture Unit-Stem Cell Culture, Center for Advance Research

Lecture-1: Isolation, expansion and Characterization of human tissue-derived Mesenchymal Stem Cells

Lecture-2: Principles and Application of Flow Cytometry

- Principles of Flow Cytometry
- Cell Analysis
  - Immunophenotyping
  - Dyes that bind to nucleic acids (DNA, RNA)
  - Fluorescent proteins as Reporter Genes: GFP
    - Functional assays: Cell counting (Analyze and count)
- Cell Sorting (Analyze and sort): Fluorescence Activated Cell Sorting

### Practical Session:

- Peripheral Blood Mononuclear Cell Isolation-SOP-4.1.1
- Bone Marrow Mononuclear Cell Isolation-SOP-4.1.2
- Mesenchymal Stem Cell Culture and Expansion-SOP-4.1.3
- Preparation of Stem Cells for Flow Cytometry-SOP-4.1.4
- Characterization/Analysis of Stem Cells through Flow Cytometry-SOP-4.1.5
- Demonstration of cell sorter-4-way-size-based sorting of blood cells-SOP-4.1.6



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Cytogenetics Unit, Center for Advance Research

Lecture 1: Karyotyping: Overview and Procedure

- Chromosome abnormalities-Numerical and Structural abnormalities
- Chromosome preparation, spread, banding and Analysis

Lecture 2: FLUORESCENCE IN-SITU HYBRIDISATION (FISH) and its Application

Practical Session:

- Preparation of peripheral blood cells for Karyotyping-SOP-5.1.1
- Giemsa Staining of Chromosomes-SOP-5.1.2
- Banding-SOP-5.1.3
- Karyotyping/Chromosome Analysis -SOP-5.1.4
- Haematological Chromosome Analysis -SOP-5.1.5
- FISH Protocol-SOP-5.1.6