Sylllabus for certificate course in cytogenetics

Duration -6 months

INTRODUCTION

History and basic principles of Cytogenetics.

Mitosis and Meiosis: Crossing over with translocations/inversions, recombination. The results of reproduction .
Laboratory safety and general procedures.

A. General Biology

1. Basic anatomy and physiology and principles of embryology
2. Cell cycle and cell division – mitosis and meiosis
3. Lyon hypothesis and mosiacism
4. Structure and function of the cell
5. Structure of DNA
6. Structure of RNA
7. Protein synthesis.
8. Genetic code
9. Major congenital anomalies
10. Chromosomes in cancer

Microscopy: Microscopes, cell counts, staining and banding.

Image Capture/Photography

DNA: Structure and function

CHROMOSOMES

Normal structure , number, autosomes, sex chromosomes ,

Euploidy /aneuploidy ,mosaicism,

Structural alterations: translocations, inversions, duplications, deletions. Partial (tertiary) trisomy from unbalanced translocation, rings, markers, bisatellited, dicentrics.

Chromosome identification

PERIPHERAL BLOOD CYTOGENETICS

Principles and practice of culture, harvesting, slide making, and banding methods.

Principles of synchronization. Normal Variants.

PRENATAL CYTOGENETICS

Amniotic fluid, chorionic villus, cord blood.

Suspension and in situ cultures

Reporting of cases and commonly seen abnormalities

Mosaicism - true ,pseudo , confined placental.

CANCER CYTOGENETICS

Basic principles of bone marrow culture, cell counts.

Specimen collection.

Disease types and expected cytogenetic changes.

SOLID TUMOUR CYTOGENETICS

General principles and types of cultures.

Cytogenetic changes in different tumour types.

MOLECULAR TECHNIQUES

Fluorescence in situ hybridisation (FISH) – Principle, methods, analysis, interpretation.

Polymerase chain reaction (PCR)- Principle, methods, analysis, interpretation.

INTERNATIONAL SYSTEM OF CYTOGENETIC NOMENCLATURE (ISCN)

General principles.

Explanation of how to write karyotype /FISH results.

B. General Principles of Laboratory Work

Flow cytometry - Principle, methods, analysis, interpretation.
Use and maintenance of laboratory equipment - pH meter, balance, laminar flow hood, carbon dioxide incubator, oven, water bath, centrifuge.

Record keeping - samples and patient results.

1. Conversion to metric system
2. Preparation of solutions
3. Cleaning of glassware
4. Preparation of materials for autoclaving
5. Laboratory cleaning
6. Commonly used methods of sterilization and disinfection
7. Identification of laboratory hazards
8. Precautions required to minimize laboratory hazards

C. Instruments: Use, maintenance and cleaning of the following:

1. pH meter, Pasteur pipettes, automatic pipettes
2. Weighing balance
3. Centrifuge, vortex mixer

4. Laminar flow hood
5. Carbon dioxide incubator
6. Oven , incubator ,refrigerator and freezer
7. Calculation of relative centrifugal force

D. Microscopy

1. Parts of a microscope
2. Use of a microscope
3 .Maintenance of microscopes
4. Type of microscopes - bright field, inverted ,phase contrast, fluorescent.

TECHNICAL DETAILS

Reagent preparation- transport medium, cell culture media, phytohemagglutinin, colcemid, potassium chloride, fixative, Hank's balanced salt solution, phosphate buffered saline, phosphate buffer, trypsin, Giemsa and Leishman stains.

Washing of slides and glassware.

E. Handling of specimens and record keeping

1.Describe collection of blood

2.Types and mode of action of anticoagulants

3.Hazards and safety precautions

4. Sample identification

5 Logging in of samples

6. Maintenance of records

7. Filing slides and reports

8. Patient confidentiality

9. How to ship a specimen

10.Recognize sources of error

F. Cell Culture

1.Aseptic technique

2.Review use of laminar flow hood and priniciples of sterilisation

3.How to prepare media

4.Constituents of media and their actions

5.Type of media and their uses

6.Culturing of blood, bone marrow, chorionic villus, amniotic fluid, skin, tumour

7.Setting up cultures for chromosome breakage syndromes

8..Types of culture: stimulated , unstimulated ,synchronized, adherent, suspension

9..Maintenance of culture: feeding, subculturing

10.Decision making regarding readiness for harvest: identification of doublets

11.Preparation of labels for patient identification

G. Harvesting

1.Description of steps

2.Preparation of reagents

3.How to perform harvests of different types of cultures

H. Slide making

1.Review use of phase contrast microscope and cleaning of glassware

2.Principles of slide making

3.Methods of slide making

4.How to assess slide quality

I.Banding

1.Principles of banding

2.Types of banding

3.Preparation of reagents

4.How to assess quality of staining

5.Review use of microscope

6.Coverslipping

J. DNA extraction and Polymerase chain reaction (PCR)

1. **Principles**
2. **Explanation**
3. **Demonstration**