AJK Medical College Muzaffarabad

Study Guide

CMB Module (CMB-0102)

(1st Year)



Prerequisite: Foundation Module Duration: 4-Weeks

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Caution

Eighty percent (80%) mandatory attendance to appear in Modular / Professional / University Examination as per Pakistan Medical and Dental Council (PM&DC) regulation.

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CMB Module Team

| 1 | Prof. Jamshed Ali | Principal/Chairman |
|---|-----------------------------|--------------------|
| 2 | Porf. Alam Khan | Module Planner |
| 3 | Dr. Fauzia Hameed | Module Coordinator |
| 4 | Dr. Sarmad Latif Awan | DME |
| 5 | Prof. Sarosh Majid Sulehria | Member |
| 6 | Dr. Zahid Azeem | Member |
| 7 | Dr. Asad Bilal | Member |
| 8 | Dr. Ishfaq Ahmed | Member |

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Rationale

Cell and molecular biology (CMB) Module includes the Cell cytology, Genetics, physical Development, enzymology, haematology and skin. This module has six themes; which will introduce you to the basic functioning of the cell, Genetics, body homeostasis, molecular biology (in diagnostics and therapeutics), enzymology and its clinical application, haematology, embryology, physical development and dermatology. In this module you will learn how a single cell (zygote) divides, grows and differentiates into a complete human being. Your teaching & learning will be case-based to create clinical relevance and emphasize why it is important for you as medical students to know about the Basic Sciences.

MODULE ORGANIZATION

LEARNING STRATEGIES

Module consists of themes, each based on learning objectives, the module will apply different modes of instruction briefly describe below. Major emphasis will be on Discussion, Analysis and deduction; All by the student and guided by faculty.

Entire Curriculum will be delivered by the clinical case scenarios, each related to a theme. Read the cases and learning objectives of the theme which you are supposed to encounter next day. Understand and explain the cases to yourself and read the relevant information. Following learning/teaching strategies will be employed to discuss the cases.

SMALL GROUP DISCUSSION

Main bulk of the course content will be delivered in the small group sessions. Each theme has an associated case. The case will be the centre around which learning will take place. Depending upon the case you might be required to deduce objectives or learning issues. Every group will have a facilitator assigned to it. Small group discussions will be followed by a wrap up session.

LARGE GROUP

Large group instruction will be employed at time sparingly. Attend large group session to resolve queries, conceptual learning and to standardize learning of all groups.

HANDS ON ACTIVITIES/PRACTICAL

Practical activities, linked with case, will take place.

LABORATORY

Attend your schedule Lab and take advantage of the open times to continue study. Use your Labs to correlate text structures to actual specimen in Lab practice.

SELF DIRECTED LEARNING (SDL)

A few SDLs have been added in between to create an environment for you to search literature as well as to deduce and synthesize information from different sources to meet the learning objectives.

JOURNAL CLUB MEETING

Few Journal Club meetings are also schedule in the module.

ASSESSMENT

In this, 04-week module, you will have surprise quizzes and formative assessments. Comprehensive written assessment (SAQ, MCQ) will be held at the end of the module: whereas, performance assessment (IPE) will be held at the end of the block-1. The marks obtained will contribute 30% towards the end of year professional Examination/summative assessment.

| Themes | |
|-----------------------|----|
| Unit of life | 25 |
| Nucleus | 30 |
| Genetic Abnormalities | 25 |

Table of Specifications (CMB Module)

#

1

2

3

4

5

Enzymes

Grand Total

Basic and Specialized Tissues

%

10

10

100%

LEARNING OBJECTIVES

Theme-1: Unit of Life

At the end of the module the students should be able to:

- Describe structure of various components of cell membrane and correlate with its functions.
- Describe cell-cell communication.
- Differentiate between the mechanisms by which various substances are transported across the cell membrane and explain the importance of these mechanisms in various clinical abnormalities.
- Differentiate between the intracellular and extracellular environment of the body
- Compare and contrast the different homeostatic control systems of the body.
- Define receptors and describe their role in regulation homeostasis.
- Enumerate different types of cells along with one salient feature of each.
- Draw the structure of a generic cell & organelles
- Draw structure of mitochondria and explain electron transport chain.
- Elaborate structure and functions of each cytoplasmic organelle.
- Elaborate functions of cytoskeleton.
- Draw and label Cell cycle; Describe each step of cell cycle in terms of its function & Regulation.
- Compare and contrast mitosis and meiosis.

Theme-2: Nucleus

At the end of the module the students will be able to:

- Describe and draw a normal karyotype labelling different chromosomes according to nomenclature.
- Describe genomic organization of nucleic acid.
- Enumerate steps involved in the process of DNA replication / Duplication, Tranversion and translocation.
- Enumerate steps involved in the process RNA Transcription and RNA Translation; Elaborate Post-translational modifications.
- Describe Gene expression and repression.
- Differentiate among the major classes of RNA on the basis of structure and function.
- Describe the major steps of protein synthesis and correlate the action of various antibiotics.
- Define epigenetics and discuss mechanism of chromosomal modelling and remodelling.

THEME-3 : Genetic Abnormalities

Case Scenario: Pedigree

Shahpal is a student of 1st year at Army Public School, Muzaffarabad. During this hot season he felt hyperthermia and become unconscious, upon referral to physician he was diagnosed genetic abnormality. Clinical features include loss of hairs throughout the body during 1st two years of his life, small papules were found at his arms, chest & face, diminished sweating. Skin biopsy revealed absent hair follicles, sebaceous glands were malformed. Pedigree of the patient is as under:



At the end of the module the students will be able to:

- Draw common numerical and structural chromosomal abnormalities and their clinical implications.
- Define non-disjunction, mosaicism and draw the karyotypes of Down syndrome, Turner Syndrome and Klinefelter syndrome
- Describe types of mutations and polymorphisms. heterozygous and homozygous; recessive and dominant alleles, genotype and phenotype
- Correlate different types of mutations with their effect on DNA sequence and cellular function.
- Describe DNA damage and repair mechanism. Explain how their abnormalities can lead to cancer.
- Draw a 3-generation pedigree using standard pedigree symbols.
- Analyze pedigrees to determine their mode of inheritance (autosomal recessive, autosomal dominant, X-linked recessive, X-linked dominant, Y-linked and mitochondrial).
- Demonstrate the basic skills of genetic counseling
- Describe various assays used in genetic testing
- Describe the use of DNA as a tool in forensics.
- Describe the use of cloning techniques for the production of therapeutic agents (recombinant DNA technology)
- Define gene therapy and discuss its implications in medicine

THEME-4: Enzymes

A 35 years old man presented to outpatient department with deep jaundice and fatigue. On examination liver was enlarged. His ALT and AST was markedly elevated. He was diagnosed as case of Hepatitis B.

At the end of the module the students should be able to:

- Classify the enzymes and enumerate the various types of enzymes.
- Enlist the properties of enzymes and the conditions that affect enzymatic reactions.
- Describe the enzyme kinetics and its interactions
- Differentiate among the major types of enzyme inhibitors.
- Describe the importance of enzymes/isoenzymes in diagnostics and therapeutics.

THEME-5: Basic and Specialized tissue

A 50 years old man presented in outdoor with 3 days history of rash on right cheek, side of neck and the back. There were associated symptoms of malaise and feeling of being unwell. Later he was diagnosed as a case of Herpes zoster.

At the end of the module the students will be able to:

- Define, classify and differentiate various types of epithelia.
- Identify epithelia under light microscope; give two key points of identification of each type of epithelium.
- Compare & contrast simple, stratified and special epithelia.
- Describe different layers of skin with its contents. Identify the layers of skin under light microscope and give two points of identification.
- Compare & contrast the process of gametogenesis in both genders.
- Illustrate the steps, mechanism and outcomes of fertilization & implantation.

PBL-1 As per facilitator directions / desire

PBL-2

Miss Tahira is a student of BA at University of AJK, Muzaffarabad. When doctor's team working on genetic abnormalities visited university, they noticed some phenotypic abnormalities. Clinical features include microgenia (abnormally small chin), oblique eye fissures on the inner corner of the eyes, muscle hypotonia, a flat nasal bridge, a single palmer fold, a protruding tongue (due to small oral cavity and an enlarged tongue near the tonsils), a short neck, white spots on the iris, excessive joint laxity, excessive space between large toe and second toe, a single flexion furrow of the fifth finger, a higher number of ulnar loop dermatoglyphs and short fingers. Cytogenetic analysis was performed that showed She has 47, XX, +21 karyotype in skin and lymphocytes.



Recommended Books

Last's Anatomy

Ellis Anatomy

Clinical Anatomy by regions (Snell)

KLM Text book of Clinically Oriented Anatomy

Textbook of Human Physiology (*Guyton and Hall*)

Biochemistry – Lippincott's Illustrated Reviews (6th edition) (*Champe, Harvey and Ferrier*)

Marks' Essentials of Medical Biochemistry – A Clinical Approach (*Lieberman, Marks and Smith*)

Harper's Illustrated Biochemistry (Murray, Bender, Botham, Kennelly, Rodwell and Weil)

Wheater's Functional Histology (Young, Lowe, Stevens and Heath)

DiFore atlas of histology.

The Developing Human: Clinically Oriented Embryology (*Moore and Persaud*)

Emery's Elements of Medical Genetics 14th Edition

(Turnpenny and Ellard)



Genetic Counselling

Any couple that has had a child with a serious abnormality must inevitably reflect on why this happened and whether any child(ren) they choose to have in future might be similarly affected. Similarly, individuals with a family history of a serious disorder are likely to be concerned that they could either develop the disorder or transmit it to future generations. They are also very concerned about the risk that their normal children might transmit the condition to their offspring. For all those affected by a genetic condition that is serious to them, great sensitivity is needed in communication. Just a few words spoken with genuine caring concern can put patients at ease and allow a meaningful session to proceed; just a few careless words that make light of a serious situation can damage communication irrevocably. The importance of confidence and trust in the relationship between patient and health professional can never be underestimated.

Realization of the needs of such individuals and couples, together with awareness of the importance of providing them with accurate and appropriate information, has led to the widespread introduction of genetic counselling clinics in parallel with the establishment of clinical genetics as a recognized medical specialty.

An individual who seeks genetic counselling is known as a consultand. During the genetic counselling process it is widely agreed that the counsellor should try to ensure that the consultand is provided with information that enables him or her to understand:

1. The medical diagnosis and its implications in terms of prognosis and possible treatment

2. The mode of inheritance of the disorder and the risk of developing and/or transmitting it

3. The choices or options available for dealing with the risks.

It is also agreed that genetic counselling should include a strong communicative and supportive element, so that those who seek information are able to reach their own fully informed decisions without undue pressure or stress

Excerpt from: Emery's Elements of Medical Genetics

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Schedule of Studies CELL & MOLECULAR BIOLOGY MODULE 1st Year MBBS 2016

Week-1

| Time Monday Tuesday Wednesday Thursday | Friday |
|--|------------------|
| | - |
| 8:00- Pak Studies Practical Practical | <u>Practical</u> |
| A: Histology B: Histology | C: Histology |
| 9:00- Islamiyat B: Physiology C: Physiology | A: Physiology |
| C: Biochemistry A: Biochemistry | B: Biochemistry |
| Break | |
| LGIS LGIS DSL | |
| Introduction to CMB Carbohydrates Lipids Transport across cell | |
| 11:30 AM Module membrane | |
| Prof. Ayub & Module Dr. Alam Khan Dr. Alam Khan | |
| Team | |
| DSL PBL-1A LGIS LGIS | |
| 11:30 AM-Structure of animalMitosisEnzyme chemistry & | |
| 12:30 PM cell action | |
| Dr. Ghuncha | |
| Dr. Zahid | |
| LGIS LGIS | |
| 12:30- Dr. Churshe (Arad | |
| 1:30 PM Dr. Gnuncha/ASad | |
| Dr. M. Ayub | |
| Break | |
| SGD SGD SGD SGD | |
| 2:00- Functions of organelle Homeostasis Composition of cell membrane Nomenclature in Anatomy | |
| 3:00 PM of cell Team 2 Team 2 Team 1 | |
| Team 2 WU: WU: WU: | |
| 3:00- WU: Dr. Fauzia Dr. Zahid Dr. Asad | |
| 4:00 PM Dr. Fauzia | |

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CMB Module 1st Year MBBS

Week-2

| Date | | | | | | |
|-----------------|--|---|---|---|--|--|
| Time | Monday | Tuesday | Wednesday | Thursday | Friday | |
| 8:00- 9:00 | Pak Studies | Practical A: Biochem: (1-33) B: Physiology: (34- 66) C: Histology: (67- 100) | Practical A: Physiology: (1-33) B: Histology: (34-66) C: Biochem: (67-100) | Practical A: Physiology: (1- 33) B: Histology: (34- | LGIS Genomic organization Dr Zahid | |
| 9:00- 10:00 | LGIS Chemistry of amino acids & proteins Dr. Alam | | | 66) C: Biochem: (67- 100) | | |
| | Coffee Break (10:00–10:30 AM) | | | | | |
| 10.30- 11:30 | LGIS Transport across cell membrane Dr. Fauzia | LGIS Protein structures Dr Zahid | SKILL LAB Dehydration Dr. Ashfag | SGD DNA & RNA Team-2 an <u>Wrap-up</u> h Dr. Alam | LGIS Cell Cycle Dr. Zahid Azeem | |
| 11:30- 12:30 | Practical A: Histology: (1-33) | | Dr. Khalid awan Dr. Munnazah | | <u>LGIS</u> <u>Clinical</u> Application of | |
| 12.30- 1:30 | B: Biochem: (34-66) C: Physiology: (67- 100) | <u>PBL-1B</u> Prof. M. Ayub | <u>LGIS</u> <u>Mitosis</u> <u>Dr Ayub</u> | <u>LGIS</u> Nucleic Acid Dr. Zahid | <u>Enzymes</u> Dr. Munnazzah | |
| | Lunch and Prayer Break (1:30–2:00 PM) | | | | | |
| 2:00- 4:00PM | SGD Carbohydrate Dr. Zahid Team-2 DSL Function of Cell mem | SGD Function of cell membrane Dr. Ajaz Team-2 <u>Wrap-up</u> Dr. Ajaz | <u>Enzyme kinetics</u> <u>Wrap up</u> <u>Team-2</u> <u>Dr Zahid</u> | LGIS Cell receptors Dr Fauzia SDL | SDL | |

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CMB Module-1st Year MBBS

Week-

| Date | | | | | | |
|-----------------|--|--|---|--|---|--|
| Time | Monday | Tuesday | Wednesday | Thursday | Friday | |
| 8:00– 9:00 | Pak Studies | LGIS Eukaryotic Replication Dr. Zahid | LGIS Transcription Dr. Alam | LGIS Transcription Termination Dr Zahid | LGIS Prokaryotic Gene expression Dr. Zahid Azeem | |
| 9:00- 10:00 | <u>LGIS</u> Meiosis Dr. Asad and team | LGIS Prokaryotic Replication Dr Zahid | LGIS Transcription Machinery Dr Zahid | LGIS Cell Surface specialization Dr Shakeel | LGIS Eukaryotic Gene expression Dr Zahid | |
| | Coffee Break (10:00–10:30 AM) | | | | | |
| 10.30– 11:30 | <u>DSL</u> Making a pedigree | Practical A: Histo: (1-33) B: Biochem: (34-66) | <u>Practical</u> A: Physio: (1-33) B: Histo: (34-66) | Practical A: Biochem: (1-33) B: Physi: (34-66) | PRL-2R | |
| 11:30- 12:30 | <u>SGD</u> Replication | C: Physio: (67-100) | C: Biochem: (67-100) | C: Histo: (67-100) | Team-2 | |
| 12.30– 1:30 | Team-2 <u>Wrap-up</u> Dr. Zahid | LGIS Cytoskeleton Dr Asad/Team | LGIS Cell Junctions Dr Ijaz | <u>LGIS</u> Carbohydrates-II <u>Dr. Zahid</u> | Dr. Ijaz | |
| | Lunch and Prayer Break (1:30–2:00 PM) | | | | | |
| 2:00-3:00 | PBL-2A | <u>SGD</u> Post transcriptional | <u>SGD</u> RNA Translation Team-2 | SDG Intracellular transport Team-2 | DSL Gene expression | |
| 3:00-4:00 | Team-2 | Dr Zahid | WU: Dr. Alam | WU: Dr Ijaz | | |

AJK Medical College, Muzaffarabad Schedule for CMB Module – Class of 2016-21 (1st Year)

Week-4

| Date | | | | | | |
|------------------------------------|---|--|---|---|--|--|
| Time | Monday | Tuesday | Wednesday | Thursday | Friday | |
| 8:00– 9:00AM | Pak Studies | LGIS Gametogenesis Dr. Shakeel | LGIS Pedigree & inheritance Prof. Alam Khan | LGIS PCR & recombinant DNA technique Dr. Zahid Azeem | LGIS Disease and homozygosity-2 Dr. Zahid | |
| 9:00-10:00 | LGIS Prokaryotic Gene expression-2 Dr. Zahid Azeem | LGIS Eukaryotic Gene expression Dr Zahid | LGIS Chromosomal abnormalities Dr. Zahid Azeem | LGIS Disease and homozygosity-1 Prof. Alam Khan | LGIS Skin & appendages Dr. Sadaf Fasih | |
| | Tea Break (10:00–10:30 AM) | | | | | |
| 10.30– 11:30 11:30- 12:30 | <u>PBL-2B</u> Dr. Asad & Team-1 | <u>SGD</u> <u>Chromatins</u> Dr Zahid &Team-2 | <u>SGD</u> General anatomy of muscles Team-1 <u>Wrap-up</u> Dr. Asad | <u>SGD</u> General anatomy of joints Team-1 <u>Wrap-up</u> Dr. Asad | LGIS DNA & fingerprints Dr. Naseer Sheikh | |
| 12.30– 1:30 | LGIS Mutation Prof. Alam Khan | <u>Pedigree</u> <u>DSL</u> | DSL PCR | LGIS Gene cloning Dr Zahid Team-2 | Revision | |
| | Lunch and Prayer Break (1:30–2:00 PM) | | | | | |
| 2.00- 4:00PM | Skill Lab Pedigree Team-2 | <u>SGD</u> General anatomy of bones Team-1 <u>Wrap-up</u> Dr. Asad Bilal | <u>Skill Lab</u> Genetic counselling Drs. Khalid, Dr. Munazzah | SGD DNA damage & repair Team-2 <u>Wrap-up</u> Prof. Alam Khan | SDL | |



For Inquiries & Trouble Shooting please contact: Department of Medical Education Tel: +92-5822-920527-8/808, 816 Engell of Medical ad

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