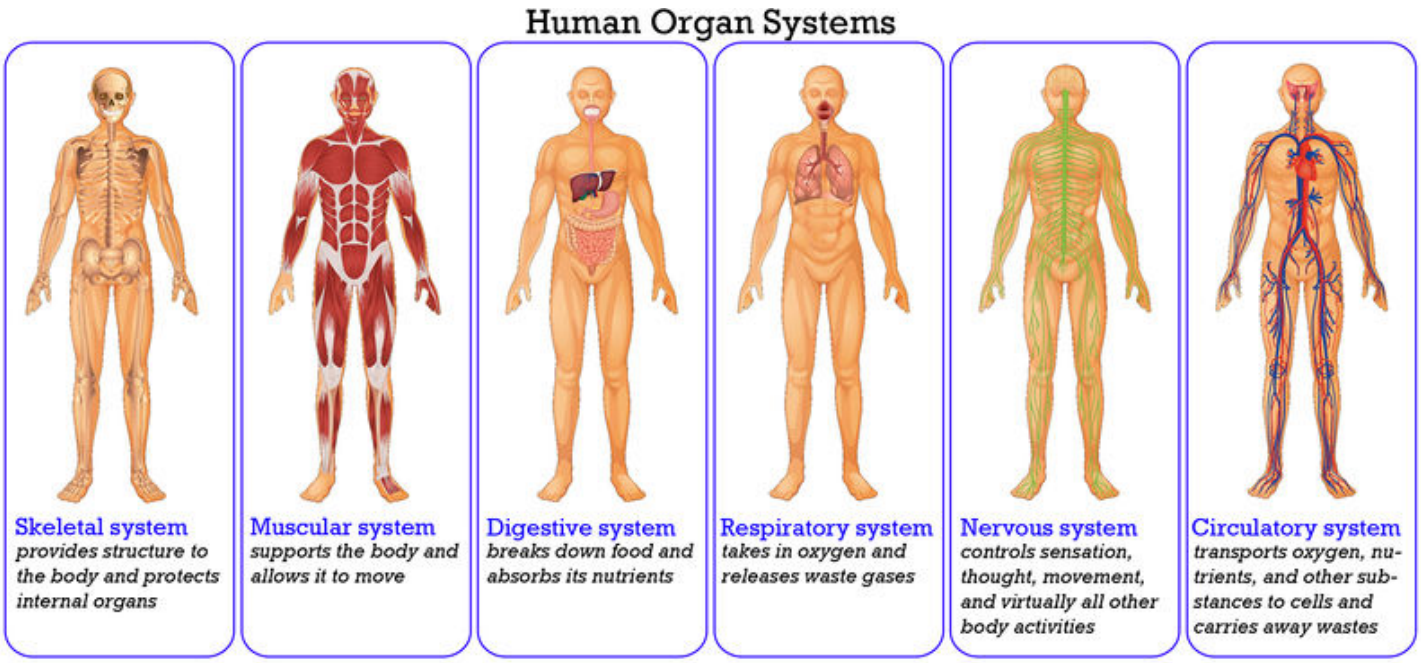
جامعة الفيصل
Alfaisal University



PreMed Bridging Block (2018)

Duration:
6 Weeks
24th June till 31st July 2018

Block Director: Dr. Ahmed Yaqinuddin
Block Co- Directors: Dr. Abdul Ahad and Dr Abdul Jabbar Rassol

Administrative Coordinator: Wail Dahhan

Course Description

The **human body** is the entire structure of a human being. It consists of a number of biological systems that carry out specific functions necessary for everyday living. It is composed of many different types of cells that together create tissues and subsequently organ systems. A system is a group of parts that come together, interacting and interdependent, to form a more complex whole unit. They ensure homeostasis and the viability of the human body. This block is designed as a **premed course** to provide an understanding of complex biological system beyond the molecular-level scale. The student will study models of system biology with an integrated and interacting network of genes, proteins and biochemical reactions along their structure function relationship. The students will also be exposed to Team Based Learning (TBL) and Problem Based Learning (PBL) the two teaching learning strategies adapted by the college of medicine. The aim is to inculcate critical reasoning, collaborative team work, and content application to solve problems effectively communicating in small group and competencies that are necessary for success in the health professions. Continuous assessment of students will be monitored through TBL and PBL whereas the end-of block assessment will be carried out in a formative way involving multiple choice questions (MCQ), and Objective structured practical examination (OSPE). At the beginning of the course students group will be asked to choose a research topic from a list and prepare and present electronic poster while working in a group. Each group members will submit a written summary of their contributions to the research effort. This activity is designed to inculcate presentation skills and is part of continuous assessment.

General learning objectives

This is a multidisciplinary course (block) integrating topics in basic and applied clinical anatomy, histology, embryology, biochemistry and physiology.

The goals of the preMed block are to introduce students to the systemic biology with emphasis on molecular basis and structure function relationship. The objectives of the preMed block are to:

a. Help student acquire the relevant knowledge related to systemic approach from molecular to structure functional relation.
b. Enhance logical thinking, active learning, and effective communication in small group through problem based learning (PBL) and through the application of the team based Learning (TBL).

Course Content

1. ANATOMY

General anatomy: Deals with Foundation of basic terminology of anatomy, body planes, movements, and classifications of Bones, joints, muscles and vascular & nervous systems.

Gross anatomy of musculoskeletal system: Deals with clinical anatomy of the upper and lower extremity mainly covered through anatomy labs

Learning objectives of Anatomy:

- Understand the various approaches to studying anatomy
- Discuss the common anatomical terminologies
- Outline the human skeleton system
- Define the terms like skin, fasciae, tendons, ligaments, aponeuroses, raphe etc.
- Describe the classification of bones
- Identify the bone markings particularly in long bones
- Understand surface anatomy (visible and palpable anatomy) of a system and its clinical importance
- Describe the different modalities used in viewing the human structures in clinical practice
- Understand the basic physics involved in modern imaging of human structures
- Understand various planes used in modern imaging
- Classify the joints and identify each joint in human body
- Classify the muscles
- Understand the overview of the nervous system
- Understand the overview of the vascular system
- Describe a formation of a typical peripheral nerve and segmental innervation of skin and muscles
- Discuss dermatomes and their distribution and clinical importance
- Know some common imaging techniques
- Describe the clinical anatomy of upper and lower limb

2. HISTOLOGY

General histology: Deals with microscopy, principles of staining methods and light microscopic study of cell and basic tissues (Epithelium and Supporting Tissue).

- Methods of study (Microscopy)
- Principles of staining
- Plasma membrane
- Organelles and inclusions
- Intercellular junctions
- Membrane surface specializations
- Epithelial tissue (List and describe the structure location and function of each type of epithelial tissue).
- Explain how glands are classified by using different criteria.
- Differentiate between an exocrine gland and an endocrine gland.
- Describe and give examples of the different types of exocrine glands.
- Classify connective tissue
- List and describe the major cell types found in connective tissue.
- List and describe the major types of fibers produced by fibroblasts. Give examples of where each type of fiber is found in the body.
- Describe white and brown adipose connective tissue.
- Differentiate between white & brown adipose tissue.
- Nervous tissue (describe, classify)
- Describe peripheral nervous tissue.
- Discuss the structure functional relationship of all basic tissues.
- Discuss the clinical application all basic tissues

Histology of muscle and bone

Muscle: Understanding

1) the differences amongst skeletal, cardiac and smooth muscle
2) the types of muscle fiber and muscle metabolism
3) the relationship of connective tissue to skeletal muscle and its role in:

a) providing a pathway for blood vessels and nerves, and b) its role in translating muscle fibre contraction into movement of bone or other structure

4) the structure of tendon sheaths and bursa that facilitate tendon movement
5) the structure of retinaculae and annular ligaments that prevent bowstringing and lateral slippage of tendons

Cartilage & Bone: Understanding

1) basic cellular arrangements and matrix components

2) how the matrix compositional differences between bone and cartilage account for the differing properties including manner of growth (appositional versus interstitial)
3) that bone has a high rate of metabolism and cartilage a low rate of metabolism and how this influences repair
4) ossification modes – intramembranous versus endochondral
5) bone articulations with an emphasis on tissue arrangements of sutures, symphyses and synovial joints
6) bone fracture repair

Histology of gastrointestinal tract

Describe the microscopic anatomy of GI tract and liver

3. EMBRYOLOGY

General Embryology: Deals with gametogenesis, fertilization and development of human being up to 8 weeks. Also deals with development of limbs and congenital abnormalities.

Learning Objectives:

- Review mitosis and meiosis
- Clinical correlates: Birth defects
- Describe the process of spermatogenesis and oogenesis
- Describe the process of ovulation
- Describe the process of fertilization
- Describe the cleavage of the zygote and implantation of blastocyst during 1st week of development
- Describe proliferation and differentiation of the trophoblast
- Understand the clinical problems associated with early embryonic development
- Describe the development of embryo from fertilization to week 8^{th} of development.
- Describe the development of limbs and associated congenital abnormalities

4. BIOCHEMISTRY

Biochemistry is the study of the chemical processes that drive biological systems. This part of the pre-med course explores the basic principles of biochemistry and develops the student's appreciation and understanding of biological networks. It introduces the structure and function of biological molecules with an emphasis on Proteins. It defines the enzymes; explain their functions, kinetics, regulations and inhibition as well as the role of coenzymes. It also summarizes the different metabolic pathways of intermediary metabolism of proteins, fats and carbohydrates with a brief introduction to metabolic disorders.

Objectives:

By the end of the course, the students should be able to:

1. Define Biochemistry
2. Identify the four classes of polymeric biomolecules and their monomeric building blocks.
3. List the 20 amino acids and describe their chemical structure.
4. Define the peptide bond and its characteristics.
5. Describe the primary, secondary, tertiary and quaternary structure and give examples of fibrous and globular proteins.
6. Define enzymes and their function
7. List the 6 classes of enzymes
8. Explain Enzyme kinetics, regulation and inhibition
9. Define the role of coenzymes
10. Explain how the metabolism of glucose leads ultimately to the generation of large quantities of ATP.
11. Describe how fats and amino acids are metabolized, and explain how they can be used for fuel.
12. Define the metabolic related disorders.

Lecture Learning Objectives:

1. Nucleic acids: DNA and RNA

    - Describe the structure of the nucleus
    - Differentiate between euchromatin and heterochromatin
    - Describe the structure of DNA as a double helix
    - Outline complementary base pairing.
    - Outline DNA replication
    - State the difference between translation and transcription
    - Outline the structure of RNA

2. Amino acids and Proteins

- Outline the classes of amino acids
- Describe the structure of amino acids, and the peptide bond
- Describe 1^{o}, 2^{o}, 3^{o} and 4^{o} structure of proteins
- Discuss the function of proteins
- State that mutations may result in changes in protein structure
- Suggest how protein structure determines function , and may result in disease

3. Enzymes and biological reactions

- Define enzymes as catalysts
- Describe classes of enzymes
- Describe the mechanism of enzyme action
- Outline the role of cofactors and coenzymes
- Outline the role of enzymes in regulation of metabolic pathways
- Describe the use of enzymes in diagnosing diseases

4. Cell cycle regulation and cell death

- Describe the cell cycle and its phases
- Outline the checkpoint regulation of the cell cycle
- Describe the stages of mitosis
- Outline apoptosis and necrosis as examples of cell death
- State that deregulation of cell death may result in cancer
- State the need to regulate cell populations

5. PHYSIOLOGY

Physiology is the branch of biology relating to the function of organs and organ systems. Physiology is the study of life, specifically, how cells, tissues, and organisms function. Physiology is important because it is the foundation upon which we build our knowledge of what "life" is, how to treat disease, and how to cope with stresses imposed upon our bodies by different environments. Physiological studies of normal biological function provide the basis for understanding the abnormal function seen in animal and human disease (pathophysiology) and for developing new methods for treating those diseases (translational research).

1. Cell structure and function-I
2. Cell structure and function-II

Organization of the cell; physical structure of the cell; membranous structures of the cell; cytoplasm and its organelles; nucleus, nuclear membrane, nucleoli and formation of ribosomes; comparison of the animal cell with precellular forms of life; functional systems of the cell; ingestion by the cell—endocytosis; digestion of pinocytotic and phagocytic foreign substances inside the cell—function of the lysosomes; synthesis and formation of cellular structures by endoplasmic reticulum and Golgi apparatus; extraction of energy from nutrients—function of the mitochondria; and locomotion of cells, amoeboid movement, cilia and ciliary movements.

3. Transport across membranes

The lipid barrier of the cell membrane and cell membrane transport proteins; diffusion through the cell membrane; diffusion through protein channels, and “gating” of these channels; facilitated diffusion; factors that affect net rate of diffusion; osmosis across selectively permeable membranes—net diffusion of water; active transport of substances through membranes; primary active transport; secondary active transport—co-transport and counter-transport; and active transport through cellular sheets.

4. Membrane potential and action potential

Lecture 4: Basic physics of membrane potentials; membrane potentials caused by diffusion The diffusion potential; resting membrane potential of nerves; origin of the normal resting membrane potential; nerve action potential; voltage-gated sodium and potassium channels; the events that cause action potential; initiation and propagation of the action potential; action potentials with plateau; rhythmicity of some excitable tissues — repetitive discharge; special characteristics of signal transmission in nerve trunks; and the refractory period after an action potential, during which a new stimulus cannot be elicited.

5. Skeletal muscle Physiology

Structure and anatomy of skeletal muscle; Mechanism of contraction of skeletal muscle; Characteristics and energetic of muscle contraction. Excitation of Skeletal Muscle: Neuromuscular Transmission and Excitation-Contraction Coupling. The neuromuscular function and motor end plate; Molecular biology of acetylcholine and ways of affecting its function; Muscle action potential; Excitation-contraction coupling.

6. Smooth muscle Physiology

Comparison between smooth muscle and skeletal muscle, similarities and differences structurally and functionally; Contraction and excitation of smooth muscle; Nervous and hormonal control of Smooth Muscle Contraction; Types of Smooth Muscle; Membrane Potentials and Action Potentials in Smooth Muscle; Sources of calcium ions that cause contraction in smooth muscle; Regulation of contraction by calcium ions.

7. Bone Physiology

Regulation of calcium and phosphate in plasma, Physiologic effects of calcium and phosphate in body fluids, relationship of extracellular calcium and phosphate to bone, calcium exchange between bone and extracellular fluid, remodeling of bone-bone deposition and absorption, vitamin D and its role in calcium phosphate regulation, and its effect on bone, parathyroid hormone (PTH) and its effects on calcium and phosphate concentrations in the extracellular fluid, calcitonin and its effect on plasma calcium ion concentration, integration of control of calcium and phosphate in the extracellular fluid, pathophysiology of PTH, vitamin D, and bone disease.

8. GI Physiology-I
9. GI Physiology-II

Regulatory mechanisms; neural and humoral, Mastication & salivary secretion, Chewing reflex, Composition and function of saliva. Neural regulation of salivary gland secretion, Swallowing & esophageal peristalsis Voluntary & involuntary components of the swallowing reflex, Primary & secondary peristalsis, Role of upper & lower esophageal sphincters, Gastric secretion, Composition of gastric secretions: acid, pepsin, mucus, Regulation of gastric acid secretion, Gastric motility, Receptive relaxation, contractile waves & gastric emptying

10. Liver and Pancreas

Composition of bile & storage function of gallbladder, Bile acid synthesis and secretion, Regulation of bile acid secretion, Enterohepatic circulation of bile acids, Composition of pancreatic secretion: enzymes & bicarbonate, Regulation of pancreatic secretion

Resource Centre (laboratory) activities

ANATOMY

Every week the students will have anatomy lab for four hours to identify important structures in relation to the upper and the lower limbs. The students will have hands on experience identifying and relating anatomical structures on prosected cadaver specimen and plastinated models.

Rules and Regulations of the anatomy lab:

College of Medicine has decided to carry out dissection of cadavers for teaching and learning. Every student must follow the rules and regulation of dissection of cadavers as stated below:

- Read the “Dissection series (posted in the computer-anatomy lab)-upper limb” ahead of time prior to dissection
- Bring your text book, lab manual, atlas to justify your findings
- Bring your dissection set if you have. Otherwise, we will provide you necessary tools.
- Please bring your own face mask to avoid inhalation of formalin
- Every student entering the anatomy dissection lab (present in the basement) must wear a lab coat. Anyone without a lab coat will not be allowed to participate in the dissection.
- For distribution of the students (groups) please contact your student representative.
- All dissections will be completed under strict supervision of Dr. Muhammad Atif Mazhar
- Please pay utmost respect to these cadavers. Please remember that these are donated bodies. The College of Medicine will not tolerate any improper behavior from any student. **Taking of photographs is not allowed under any circumstances in the anatomy lab.**
- No guest (or students from other colleges) will be allowed to visit the lab
- Students are not allowed to bring any food or drink in the lab
- Every student must wash his/her hand and face properly prior to leaving the University
- If you are having any illness or allergy, please contact Dr. Muhammad Atif Mazhar prior to coming to the dissection room

Team-Based Learning (TBL) Sessions

Team-based learning (TBL) is an active learning instructional strategy that provides students with opportunities to apply conceptual knowledge through a sequence of activities that includes individual work, team work and immediate feedback

The primary learning objective of TBL is to go beyond simply covering content and focus on course concepts to solve problems. In a TBL course, students are strategically organized into permanent TBL groups for the block typically five per group.

TBL consists of following steps:

1. **Pre-Reading**
   Out-of-class / individual; Students receive a list of learning activities, accompanied by a set of learning goals. Students study materials in preparation for TBL sessions. Learning activities may include readings, videos, labs, tutorials, lectures, etc.
2. **Individual Readiness assurance test (i-RAT):**
   In-class / individual; Each individual student completes a set (25-30) multiple-choice questions (MCQs) that focuses on the concepts they need to master in order to be able to get high scores.
3. **Identification of the learning gap:**
   In-class/team; Following the i-RAT students individually identify the misconception and record these on Post-it as a TBL group activity. It will be randomly assigned by the faculty to another TBL group members to clarify in front of the class after t-RAT discussion if further clarification needed.
4. **Team Readiness assurance Test (t-RAT):**
   In-class/team; The same set of questions are now answered by the team through a consensus-building discussion.
5. **Student lead discussion/ clarification of all questions and queries raised during the learning gap:**
   In-class/students; Two selected student facilitators will conduct this session. The result of i-RAT of the class will be used to discuss the answers selected by the students and the concerns and issues related to the questions (Post-it).

Problem-Based Learning (PBL) Sessions

Problem Based Learning (PBL) is based on problems. A problem is a description of a set of phenomena or events in need of explanation in terms of an underlying process, mechanism or principle. The task of a group of students is to explain the phenomena or events provided in the given problem. The problem is in the center of the focus should foster a process among the students of assessing and discussing the issues of the problem. The goal is to activate prior knowledge of the students and to help them to start a learning process by reconstructing their knowledge. PBL takes place in small group tutorials. The group composed of group members, chairperson, scribe and the tutor. Each of the above mentioned has a definite role to play in order to have a successful group. Optimally the group contains 8-10 students. Usually problem is discussed in two sessions; opening session and reporting session separated by student's research. We have three PBLs in our course during week 1 week 3 and week 5. Our PBL in this block is a bit modified from the typical PBL.

PBL consists of the following steps:

1. **Opening Session (Two hours)**
   After selecting group leader and scribe the students will discuss the case. The facilitator will take the attendance and will assess the group members for participation, communication skills, cooperation, team-work, comprehension and reasoning. The discussion will follow through Maastricht 7 steps approach:

   1) Clarifying terms
   2) Defining the problem
   3) Brainstorming
   4) Structuring and hypothesis
   5) Learning objectives

2. **Preparation of learning objectives/questions Individually (In between the session 2-3 days)**
   Students will prepare for group derived learning objectives and questions related to the problem.

   6) Self-study

3. **Reporting Session (One and half hour)**
   Students will report and reflect on the derived learning objectives. The facilitator will the group for knowledge and information gathering. At the end facilitator will provide question paper related to the problem to each student. Students will submit their answer sheets that will be graded later on.

   7) Synthesis

Student Research Seminars

The purpose of Student Research Seminar is for students to share aspects of their research as it develops with their advisors and other students. In the timetable sessions are reserved for student research seminars every week. A group of students will be assigned a mentor at the beginning of the course and will be asked to select a topic from the provided list. They will prepare the assigned topic under the supervision of their mentor. The mentor will monitor their research activities and portfolio. In the end each student will submit a summary of five hundred words on any one aspect of the topic and the group will present their e-poster in front of the class on 7th August 2017. Both these activities are graded and will be incorporated in their final assessment score.

Objectives:

At the end of the Student Research Seminar student should be able to:

1. Improve oral and written communication skills.
2. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
3. Apply principles of ethics and respect in interaction with others.
4. Enhance critical thinking skills and help them to write persuasive, well-reasoned compositions.

Evaluation & Assessment

1. **Continuous assessment:**

   ***Team-based learning.* 20%** Two TBL sessions will be held in this course on Thursday during week 2 and week 4. The material to be tested during TBL sessions will include all the lectures and dissection done before it.
   Problem-based learning. **20% (5% attendance and behavior 15% synthesis and reasoning)** Three PBL sessions will be held in this course on Thursday during week 1, week 3 and week 5.The topic will be based on the theme of the week.
   Student Research Seminars. **10% (5% individual summary and 5% group e-Poster presentation)** A group of selected students from males and females will be asked to select from given list of topics. They will prepare these topics under the supervision of assigned mentor. Each student will submit a summary of five hundred words on any aspect of the topic and the group will present their e-poster in front of the class on 7th August 2017. Both these activities are graded and will be incorporated in their final assessment score.

2. **Summative assessment:**

   Final Exam. **50%**, Examination at the end of the PreMed Bridging Block will consist of MCQs and OSPE. The OSPE will be based on prosections/dissection, plastinated specimens, models, histology photographs and will also be integrated with subjects including embryology and physiology.
   The block final grades:
   End of Block Exam:
   MCQ: 60%
   OSPE: 40%

Resource Material

Resource Material (Recommended Books)
1. Clinically Oriented Anatomy, Seventh Edition Keith L. Moore; Arthur F. Dalley; Anne M.R. Agur 2. Gray's Anatomy for Students Second Edition. Richard L. Drake, Churchill Livingstone 3. Clinical Anatomy by Regions-Richard Snell 4. Histology: Ross, Pawlina and Kaye, Lippincott Williams and Wilkins, 2003. 5. Wheaters Functional Histology. 6. Textbook of Medical Physiology, Guyton & Hall, 13th Edition, Published by Elsevier Saunders. 7. Langman's Medical Embryology-Sadler, Lippincott Williams and Wilkins, 2012 8. Lippincott's Illustrated Reviews: Biochemistry. 12th edition; by; P.C. Champe, R.A. Harvey, D.R. Ferrier, Lippincott Williams & Wilkins, 2017.