WEEK 1

Unit 1: Cell	Where? How long?	*Explanations /Questions*
Introduction Cells are the smallest unit of life. This unit will help you to understand the characteristics, components, and functions of a cell. By learning the structures of the cells, you can see that cells vary in size, shape and functions. Generally, living things are grouped into two categories: ***prokaryotes*** and ***eukaryotes.*** ***Expectations*** This is an exciting opportunity to discover how cell are interact, divide and how cells are studied. In addition, you will have a brief introduction on how uncontrolled cell growth can lead to cancer cells. ***Unit outline*** Cell types and structure Sub cellular structures and their functions The Cytoskeleton Cell division: Mitosis and Meiosis Cell Cycle regulation	10 minutes	The **cell** (from Latin *cella*, meaning "small room") is the basic structural, functional, and biological unit of all known living organisms (https://en.wikipedia.org/wiki/Cell_(biology). As medical students, you need to know, understand, recognize and describe the fantastic biological machinery that makes human bodies in control and how a disorder of the division of this smallest unit of the organism leads to diseases and in particular cancer.
Learning outcomes At the end of this unit, you will be able to • Describe the characteristics of a cell, and classify the cells as a prokaryotes and eukaryotes; • List the structural components of the cell and their function; • Describe the cell cycle and how it is controlled; • Define and explain the major cellular events involved in cell division and cell regulation; • Describe the components of the cell's cytoskeleton, explain how the cytoskeleton is formed and how it directs the cell movements.		

Unit 1.1_CELL TYPES AND STRUCTURE	**Where? How long?**	***Explanations /Questions***
Introduction The cell is a basic and fundamental unit of life as it fulfils all requirements for living things. It can grow, die, reproduce, process information, respond to stimuli, and interact with its environment and so on. Living things exist in different sizes from a single cell for example bacteria to trillions of cells for higher plants and animals. Cells which have a nucleus are called eukaryotes while those which do not have a nucleus are called prokaryotes. While prokaryotes are simple, eukaryote cells contain a variety of internal structures called organelles that perform a specific function to maintain the cell order.	10 minutes	Hundreds types of cells are present in the body and depending on the role a cell has to perform, its structure suits for that. Most of the diseases or human body disorders such as diabetes or malaria are the results of problems at cell level while human fertility is also about cell reproduction. Therefore, as future medical professionals, you need to be aware of the types of cells and their structure.
Expectations This is an exciting opportunity to know what the small unit of life is well structured and well organized. In addition, you will get information on different approaches used by scientists to discover the cells.		
Section outline Cellular concept Microscope Cell theory Prokaryotes Eukaryotes		
Learning outcomes		
By the end of this section, you will be able to: - Define what a cell is. - Explain the cell theory and its scientific discovery. - Distinguish between prokaryotic and eukaryotic cells.		

<table>
<tr><th colspan="2">ACTIVITY AHEAD OF LESSON: Cellular concept; Cell theory; Prokaryotes ;Eukaryotes</th><td rowspan="4">40 minutes</td><td rowspan="4">This Textbook of Biology is an OpenStax resource that you can download for free.</td></tr>
<tr><td>Purpose:</td><td>In this activity you are going to develop your understanding of what is a cell, how cells are studied, and understand the concept of cell theory.</td></tr>
<tr><td>Over to you:</td><td>Follow this link and read this open resource: Chapter 4: Cell Structure form section 4.1 to 4.4.
Be certain to note anything that you don't understand.</td></tr>
<tr><td>Activity:</td><td>After reading , make notes of what you understand by:
Cell and cell structures
Microscopes
Prokaryotes
Eukaryotes
Then
State the Cell theory
Give an example for each type of cell.
Bring your notes to class so that you can participate in the conversation about cell structures.</td></tr>
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Welcome to the cell theory. You will discover the cell types and the structure of the cell. **IN CLASS ACTIVITY: CELL TYPES AND STRUCTURE** **Purpose:** To compare and contrast prokaryotes and eukaryotes To explore internal structure of prokaryotes and eukaryotes **Over to you:** Using your laptop, go to internet and find open resource images of prokaryotes and eukaryotes and compare them. **Activity** In your constituted groups, draw up a table with 2 columns, headed "Prokaryotes", "Eukaryotes". Using the answers (see suggestions for including as many as possible) as a starting point, and add any important aspects that have not been covered, and move them into your learning about the ***Cell theory***	10 minutes for search, 15 minutes for feedback	**Instruction to students** Constitute groups of four students each. Choose a leader and a spokespeople per group. You should stay in the same group during laboratory practicals and all other group assignments

CELL THEORY The cell theory is a widely accepted as the relationship between cells and living things. It states that: • All living things are composed of one or more cells. • Cells are the basic structural and functional units in living things. • New cells are produced from existing cells**.**	20 minutes	Individually, state the cell theory, explain in which year, by who and how each theory has been developed. Post your answers on the LMS

MAIN TYPES OF CELLS		
- **Prokaryotes** Prokaryotes are single-celled organisms without a distinct nucleus and they are relatively small (1-10µm). They have a genetic material but that material is not enclosed within a membrane. Prokaryotes (Monera Kingdom) include ***Eubacteria*** (true bacteria) and ***Archaebacteria***. The genetic material is a single circular DNA strand and is located within the cytoplasm. Recombination happens through transfers of plasmids. - **Eukaryotes** Eukaryotes are advanced cells. They may be single-celled like the kingdom of **Protista** and **fungi** or may have billions of cells like the **plant** and **anima**l kingdoms. The most significant difference between the two groups is that the former has a nucleus. This means that the genetic material is enclosed within the nucleus-bound by the nuclear membrane. .	10 minutes	Questions to students: a) How cells are classified? b) What is the difference between Prokaryote and Eukaryote? Discuss with students the mains characteristics of the different kingdoms

PROKARYOTES

The classic prokaryote is Escherichia-coli (or E-coli), which is a bacterium inhabiting the human intestinal flora through a rigid cell wall.

Cell wall

Most bacterial cells are encased by a strong cell wall. This cell wall is composed of ***peptidoglycan***, which consists of a carbohydrate matrix that is cross-linked by short polypeptide units.
Cell walls protect the cell, maintain its shape, and prevent excessive uptake or loss of water.
Bacterial cells are divided into two groups depending on their responses to the Gram test. The property depends on the composition of the cell wall.

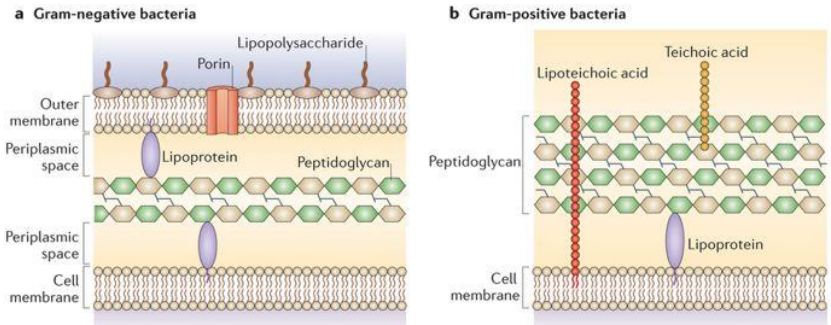

Figure 1.1: Cell wall of gram-negative bacteria (a) and Gram positive bacteria: by Lisa Brown, 2015 Sept 1,Cell wall structure of Gram-negative bacteria, Gram-positive bacteria, mycobacteria and fungi [illustration], Nature Review Microbiology, accessed on February 17, 2019, at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4860279/

The structure of gram-positive bacteria and gram-negative bacteria cell walls

The gram-positive cell wall is much simpler, composed of a thick layer of cross-linked peptidoglycan chains. Molecules of lipoteichoic acid and teichoic acid are also embedded in the wall and exposed on the surface of the cell. The gram-negative cell wall is composed of multiple layers. The peptidoglycan layer is thinner than in gram- positive bacteria and is surrounded by an additional membrane composed of lipopolysaccharide. Porin proteins form aqueous pores in the outer membrane. The space between the outer membrane and peptidoglycan is called the periplasmic space.

20 minutes

Note to tutors

You have to explain to students that prokaryotes have few structures: single chromosome, cytoplasm, ribosomes,

Project **Figure 1.1**onto the screen and EXPLAIN the diagram by mentioning the different compositions of the cell wall.

Define :

a) What is a peptidoglycan?

b) What are lipoteichoic acid and teichoic

*Notes for tutor: A really helpful way to help students to focus: explain them how*the susceptibility of bacteria to antibiotics often depends on the structure of their cell walls. The drugs penicillin and vancomycin drugs, for example, interfere with the ability of bacteria to cross-link the peptides in their peptidoglycan cell wall. Like removing all the nails from a wooden house, this destroys the integrity of the structural matrix, which can no

longer prevent water from rushing in and swelling the cell to bursting. ...)

Gram stain Two types of bacteria can be identified using a staining process called the **Gram stain,** hence their names. **Gram-positive** bacteria have a thicker peptidoglycan wall and stain a purple color, whereas the more common **gram-negative** bacteria contain less peptidoglycan and do not retain the purple-colored dye. These gram negative bacteria can be stained with a red counterstain and then appear dark pink	20 minutes	Note to tutors Project this Video about gram stain bacteria. Ask questions about what is staining, why it is important to stain a specimen.

EUKARYOTES Eukaryotic cells have three major components: 1. The cell membranes 2. The cytoplasm 3. The nucleus.	10 minutes	These structures will be studied in the next section in details

ASSESSMENT UNIT1.a		15 minutes	This test is being delivered electronically(on the LMS)
Purpose:	Take this assessment to check student understanding of the materials presented in this unit		
Over to you:	There is no minimum required score to pass this assessment, and your score on this assessment will not affect your overall module grade. This assessment is designed to prepare you for the Final Exam that will determine your module grade. Upon submission of your assessment you will be provided with the correct answers and/or other feedback meant to help in your understanding of the topics being assessed. You may attempt this assessment as many times as needed, whenever you would like.		
Activity:	Multiple choice questions (you have to upload them here)		

LABORATORY PRACTICALS :Laboratory safety measures and how to write a lab report		120 minutes	Before this laboratory exercise takes place, make sure the materials specified in the SOPs are available and the laboratory is prepared. Conduct a supervised visit of the laboratory
Purpose:	To familiarize with laboratory environment and how to write a lab report		
Over to you:	You will learn safety measures needed in the laboratory and how to write a lab report.		
Activity	Read the safety laboratory manual available in the laboratory. In groups of 4, design your lab report format and submit it to the tutors for evaluation,		

Anticipated time required for Unit 1.1 activities :

Theory : 2h all activities + 2h self-learning

Practical : 2h