WEEK 3

Unit 1_5: THE EXTRACELLULAR MATRIX (ECM)	**Where? How long?**	***Explanations /Questions***
Introduction The relationship between the cell and its environment is controlled by specialized macromolecules complexes that bind cells together to form tissues and organs. The plasma membrane of mammalian cells has specialized junctional complexes that allow cells to bind to neighboring cells or to the extracellular matrix, which provides a structural framework for the association of cells.	10 minutes	The extracellular matrix constitutes a three-dimensional network of macromolecules.
Expectations In multi-cellular organisms, cells are organized into tissues. In this unit, we will discuss about the extracellular matrix, a network of macromolecules secreted by cells; that support tissues such as bone or wood their strength. The matrix provides one way to bind cells together.		As future medical practitioners with an interest in normal human development and health, ,it is fundamental that you know how cells adhere to, to communicate between them and to each other and with the extracellular environment in order to understand why dysregulation of cells junctions cause diseases
Learning outcomes		
At the end of this unit, you will be able to • Describe extracellular matrix		

ACTIVITY AHEAD OF LESSON: ECM			
Purpose:	The extracellular matrix is a dynamic, physiologically active component of all living tissues. In addition to providing structural support for the cells embedded within a tissue, the extracellular matrix guides their division, growth, and development. In other words, the extracellular matrix largely determines how a tissue looks and functions. This lesson describes the structure and function of the extracellular matrix, which fills the space between the cells of your tissues.	30 minutes	
Over to you:	Read the following link ***Be certain to note anything that you don't understand***		
Activity:	Attempt the MCQ		

EXTRACELLULAR MATRIX

The ECM is a network of proteins and carbohydrates thatprovide structural and biochemical supportof adjacent cells. The proteins provide tensile strength and elasticity while the polysaccharides form a hydrated gel that expands to fill the extracellular space.

Three major types of macromolecules make up extracellular matrix:

- **Structural proteins**
- **Adhesive proteins**
- **Proteoglycans**

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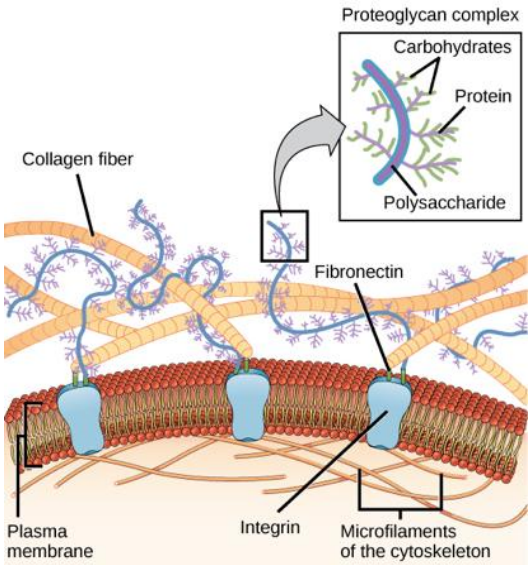

Figure 1.15: The extracellular matrix consists of a network of proteins and carbohydrates.OpenStax, Anatomy and Physiology. OpenStax CNX. Feb 12, 2019.Accessed February 21,2019. https://cnx.org/contents/FPtK1zmh@15.1:oWqVExrJ@10/4-2-Epithelial-Tissue

30 minutes

Note to tutors

Students have learned cellular junctions, now move to the ECM.

Collagen and elastin are fibrous proteins.

IN CLASS ACTIVITY: ASSIGNMENT			
Purpose:	This is an opportunity to relate disorders of ECM to diseases.	10 minutes for research 20 minutes for feedback.	
Over to you:	Using a laptop and in your respective group, go to the internet and make a research about the assigned topics: Group 1: Proteoglycan Group 2: Collagen Group3: Elastin Group 4: Fibronectin Group 5: Basement membrane Group 6: laminin		
Activity:	Students will discuss and make a PPT presentation of no more than 3 slides. The presentation will last 5 min, followed by questions and answers. Then each group will prepare a project composed of not more than two pages (follow the template on the right-hand column). ***! Use open resources materials, avoid plagiarism and reference your image.*** ***The deadline to submit the project report is the end of week 3***		**Use this template** Template of the Project: Introduction History Structure Function Related Disease Glossary Reference

EXTRACELLULAR MATRIX: **Structural proteins** The two matrix protein are collagen and elastin, both of which are fibrous proteins. ***Collagen*** are the main proteins of the extracellular matrix. They account for 25% of total protein content in a human organism. Collagen is composed of three polypeptide chains wound around one another to form a triple helical structure. Gly-X-Y is the primary amino acid sequence, whereby X is often proline. There are at least 30 different collagen peptide chains. Types I-IV are of primary significance. The most abundant type is collagen type I and is one of the fibril forming collagens that are the basic structural components of connective tissues .The major function of collagen is to strengthen and organize the ECM. ***Elastin*** is another matrix protein, is the main component of elastic fibers. An elastin molecule consists of flexible polypeptide chains and has an ability to be reversibly unrolled under the action of mechanical stretching forces. These fibers provide elasticity to blood vessels, the lungs, in skin, and the ligaments. **Adhesive proteins** Matrix adhesives proteins like fibronectin and laminin mediate the connection between the components of the matrix to one another and to the surfaces of cells. *Fibronectin* is one of the adhesive glycoproteins providing the attachment of cells to the extracellular matrix. *Laminins* mediate the attachment of parenchymal cells to type IV collagen thereby providing the interaction between cells and basement membranes. Other extracellular matrix glycoproteins are *nidogens, tenascins, and fibulins*. **Proteoglycans.** are composed of proteins covalently attached to long nonbranched chains of polysaccharides, ***glycosaminoglycans***. The polysaccharide content is more than 95% in the proteoglycans. These polysaccharides are highly negative in charge and bind positively charged ions and water molecules to form hydrated gels; that controls diffusion of small molecules and resists compressive forces. Glycosaminoglycans occupy large volumes in tissues, forming strongly hydrated gels that cause tissue turgor. The turgor gives the tissue an ability to resist compression forces. For example, an articular cartilage can resist mechanical pressures of a hundred atmospheres. Proteoglycans can form huge polymeric complexes in the extracellular matrix. Besides providing tissue turgor, proteoglycans can also be connected to other extracellular matrix proteins forming complex structures, e.g., basement membranes.	30 minutes	Note to tutor Collagen and elastin are fibrous proteins. Students have to reads about other ECM Glycoproteins. ! structure of *glycosaminoglycans*

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DISEASE OF ECM. Mutations in gene coding for components of ECM. Eg Mutation in genes coding for collagen I cause **Osteogenesis imperfecta** or “brittle bone disease”. **Figure 1.16:** Osteogenesis Imperfecta Type V in Adult. By ShakataGaNai, February 1, 2017. Accessed on February 21, 2019. https://commons.wikimedia.org/wiki/File:Osteogenesis_Imperfecta_Type_V.jpg/ Other diseases : Mutations in collagen V account for some types of **Ehlers–Danlos syndrome** . .	30 minutes	Note to tutor

Anticipated time required for Unit 1.5 activities :

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