**WEEK 3**

<table>
<tr><th>Unit 1_4: CELLULAR JUNCTION</th><th>Where? How long?</th><th>Explanations /Questions</th></tr>
<tr><td>Introduction<br>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.</td><td rowspan="4">10 minutes</td><td rowspan="4">A cellular junction is an intercellular bridge or intercellular connections.<br><br>As future medical practi tioners 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</td></tr>
<tr><td>Expectations<br><br>In multi-cellular organisms, cells are organized into tissues. In this unit, we will examine some of the most important methods by which cells communicate between them: the cell junctions that link cells together .</td></tr>
<tr><th>Learning outcomes</th></tr>
<tr><td>At the end of this unit, you will be able to<br>• Define cellular junction<br>• Describe the characteristics of gap junctions, tight junctions and adherens junctions</td></tr>
</table>

## ACTIVITY AHEAD OF LESSON: CELLULAR JUNCTION

30 minutes

**Purpose:** How do you communicate with your neighbors? Do you have a nice, open channel of communication? Are you strongly bonded together? Do you try to keep yourselves apart by blocking each others' view?

Neighboring cells must also interact in one way or another. Sometimes they have open channels of communication, and other times they simply hold each other tightly. Aw, how sweet! This lesson covers three types of cell junctions in animal cells.

**Over to you:** Using your laptop or tablet, follow the link on cellular junction

***Be certain to note anything that you don't understand***

**Activity:** File the table below to compare the different types of cellular junction and print a copy.

| Junction | Adhesion type | CAM * associated | Cytoskeletal filaments | Function |
|---|---|---|---|---|
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| | | | | |
| | | | | |

CAM : Cell adhesion molecules

Bring the copy in class.

| CELLULAR JUNCTIONS | | Note to tutors |
|---|---|---|
| Cell junctions anchor cells to each other, seal boundaries between cells, and form channels for direct transport and communication between cells. Each of the three types of junctional complexes has characteristic ultrastructure designed to perform a specific function.<br>Cell junctions are classified into three functionally distinct groups:<br>- **Anchoring junctions;**<br>- **Occluding junctions**<br>- **Communicating junctions.**<br><br>**Anchoring junctions**<br>Cells bind to one another and are attached to components of the ECM. There are three major types of anchoring junctions, based on the type of cytoskeleton involved:<br>- **adherens junctions,**<br>- **desmosomes**<br>- **hemidesmosomes**.<br>In every type of anchoring junctions**,** anchoring proteins extend (**intracellular attachment proteins)** through the plasma membrane to link cytoskeletal proteins (**transmembrane linker glycoproteins)** in one cell to cytoskeletal proteins in neighboring cells as well as to proteins in the ECM**.**<br><br>**1. Adherens junctions** can couple cells with other cells or with a component of the extracellular matrix. The transmembrane linker glycoproteins is called **cadherins.**<br>a. **Cell-cell adhesion junctions** form an "adhesion belt"(also known as the **zonula adherens**) that encircles each of the interacting cells (Figure.1.13). These junctions are found between apical regions of the cells. The adhesion belt contains contractile actin filaments.<br>b. **Cell-matrix junctions** connect cells and their actin filaments to the extracellular matrix. These junctions are also known **as adhesion plaques**.<br><br>**2. Hemidesmosomes** anchor the basal surface of epithelial cells to the extracellular matrix. As their name indicates, they appear as half-desmosomes under the EM (Figure1.13). | 20 minutes | Explain students what is :<br>**intracellular attachment proteins** and **transmembrane linker glycoproteins**<br><br>Project this video about cell junctions. |

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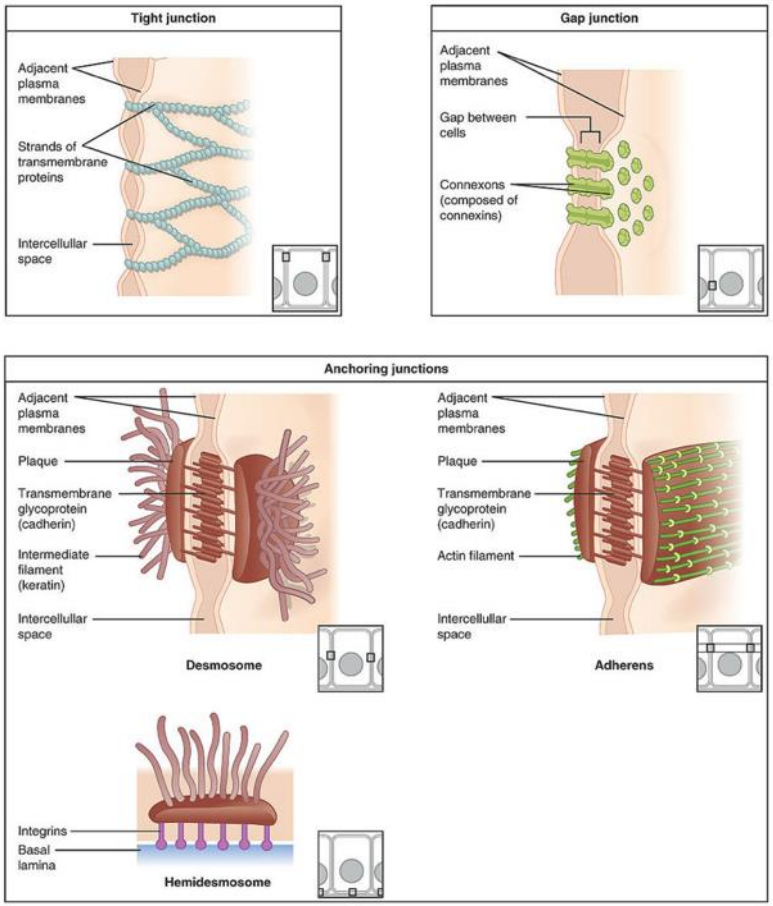
|---|---|---|---|
| **3. Desmosomes** are button-like structures that bind to intermediate filaments, anchoring them in place. The type of intermediate filaments attached to the desmosome depends on the cell type. For example, epithelial cell desmosomes are attached to keratin filaments, brain desmosomes are attached to desmin filaments. |  <br>**Figure1.13: The three basic types of cell-to-cell junctions are tight junctions, gap junctions, and anchoring junctions**.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 | 10 minutes | |

## Tight junctions

Tight junctions or occluding junctions form a physical barrier between adjacent cells whose plasma membranes come in direct contact with one another, they prevent the movement of small molecules between the two cells, and also block the exchange of lipid molecules between the outer region of the two plasma membranes that are in direct contact .

Tight junctions are composed of network of membrane proteins that form a belt-like structure that encircles epithelial cells along their apical surface (Figure 1.13). The junction between cells is so tight that no extracellular space can be seen.

## Gap junctions

Gap junctionsknown as communication junctions, attach adjacent cells in a way that allows transfer of chemical and electrical signals. The key structural component of gap junctions is the **connexon,** a hollow cylinder made up of transmembrane proteins (Figure1.13). Connexonsof adjacent cells interact with one another to form continuous channels that are open to the interior of both cells. Although connexons of neighboring cells are in direct contact, the plasma membranes of the two cells are separated by a slight gap of 2-4nm. Gap junctions permit communication between cells by allowing small ions or water-soluble molecules to pass between cells.

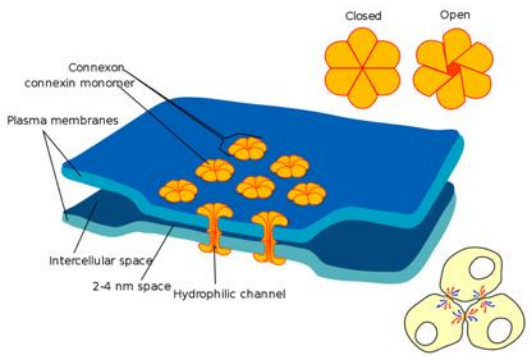



**Figure 1.14: A model of a gap junction.** The drawing shows two adjacent plasma membranes. Connexons (in orange) are formed each of six identical connexins. By Mariana Ruiz Villarreal, June 6, 2006. Accessed September 27, 2018.https://commons.wikimedia.org/wiki/File:Gap_cell_junction-en.svg#/media/File:Gap_cell_junction-en.svg

10 minutes

Notes to tutor

| IN CLASS ACTIVITY: CELL JUNCTIONS | | | |
|---|---|---|---|
| **Purpose:** | We have reviewed the three types of cell junction in animal cells. | 20 minutes | Use the previous groups.<br><br>Every student has brought the copy of the filled table form activity ahead of lesson. |
| **Over to you:** | In the previous existing group, review the table to be filled to compare the different types of cellular junction | | |
| **Activity:** | Each one in the group will correct the print copy of his/her colleagues,<br>Discuss among yourselves the provided answers.<br>Then make a correction. | | |

| LABORATORY PRACTICALS :CELL COUNTING AND VIABILITY | | 120 minutes | For lab this exercises make sure materials in the lab manual are available and the lab prepared. |
|---|---|---|---|
| **Purpose:** | To identify the number of cells present in the given 1ml sample | | |
| **Over to you:** | You will count Cells directly under the microscope. | | |
| **Activity** | During this lesson , students will learn how to count cell using the hemocytometer, therefore they will obtain more practice in serial dilutions and calculations. | | |

**Anticipated time required for Unit 1.4 activities :**

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

Practical : 2h