Chapter 05:

Cell adhesion and extracellular matrix: Adhesion and intercellular junctions

1- **Cell adhesion**

1-1-Definition

Cell adhesion is the set of cellular and molecular mechanisms implemented to bind cells together or with the environment that surrounds them. This cell adhesion is essential for the integrity of cells, their growth and communication with other cells.

1-2-Adhesion molecules [Figure 1]

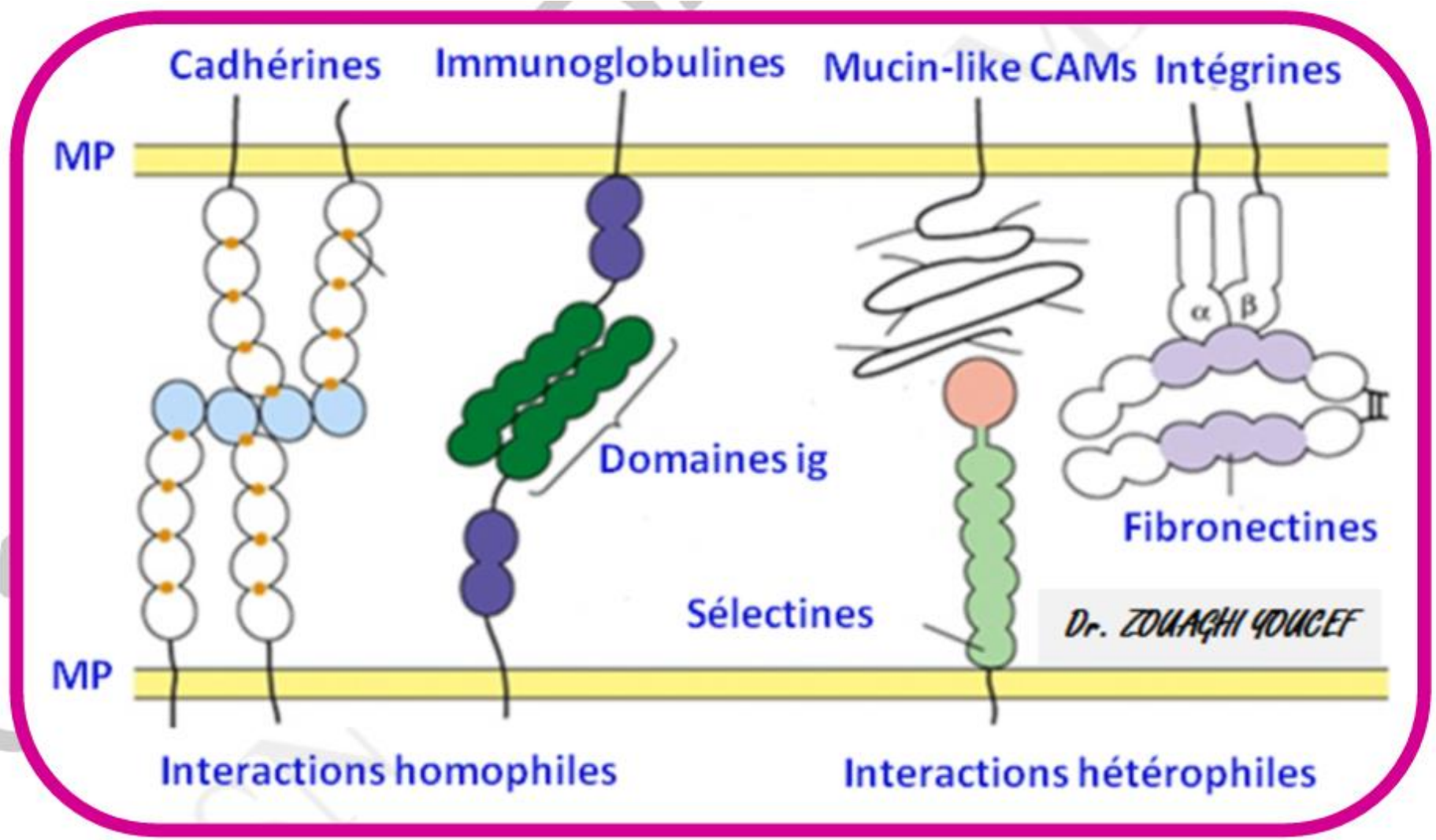
These are membrane glycoproteins expressed on the surface of cells where they intervene in intercellular contact and in interactions between the cell and the extracellular matrix.

Adhesion molecules are classified into 2 large families:

- CAMs (Cell Adhesion Molecules): Allow adhesion between two cells.

They are divided into 4 families: Cadherins, selectins, immunoglobulins and integrins.

- SAMs (Substrate Adhesion Molecules): Ensure the adhesion of cells with a substrate; most often the extracellular matrix (ECM). Integrins are involved in the adhesion of cells with the ECM.



ıre 1 : Représentation schématique des différentes classes de molécules d'adhérence

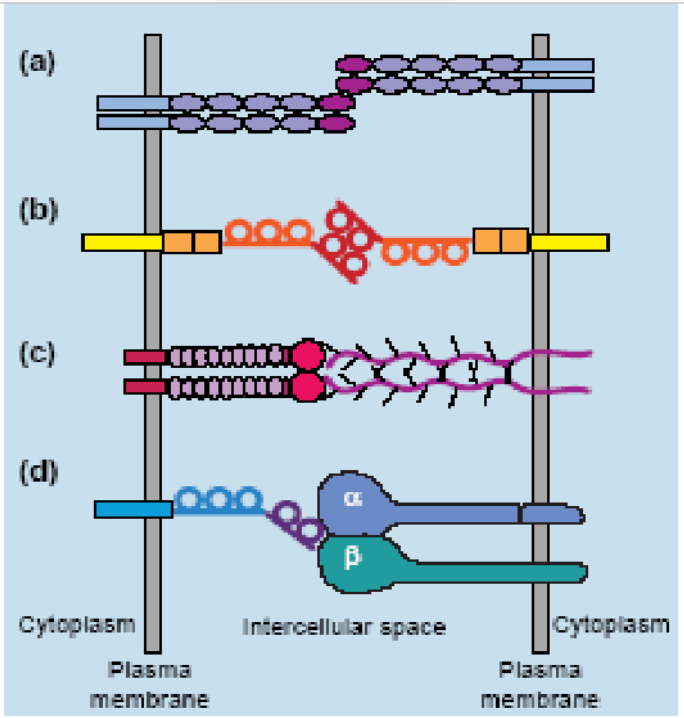


Figure 2.2 : Représentation schématique des différentes classes de molécules d'adhésion [1] ; (a) les cadhérines, (b) la superfamille des immunoglobulines, (c) les sélectines et (d) les intégrines.

Figure 1: Schematic representation of the different classes of adhesion molecules

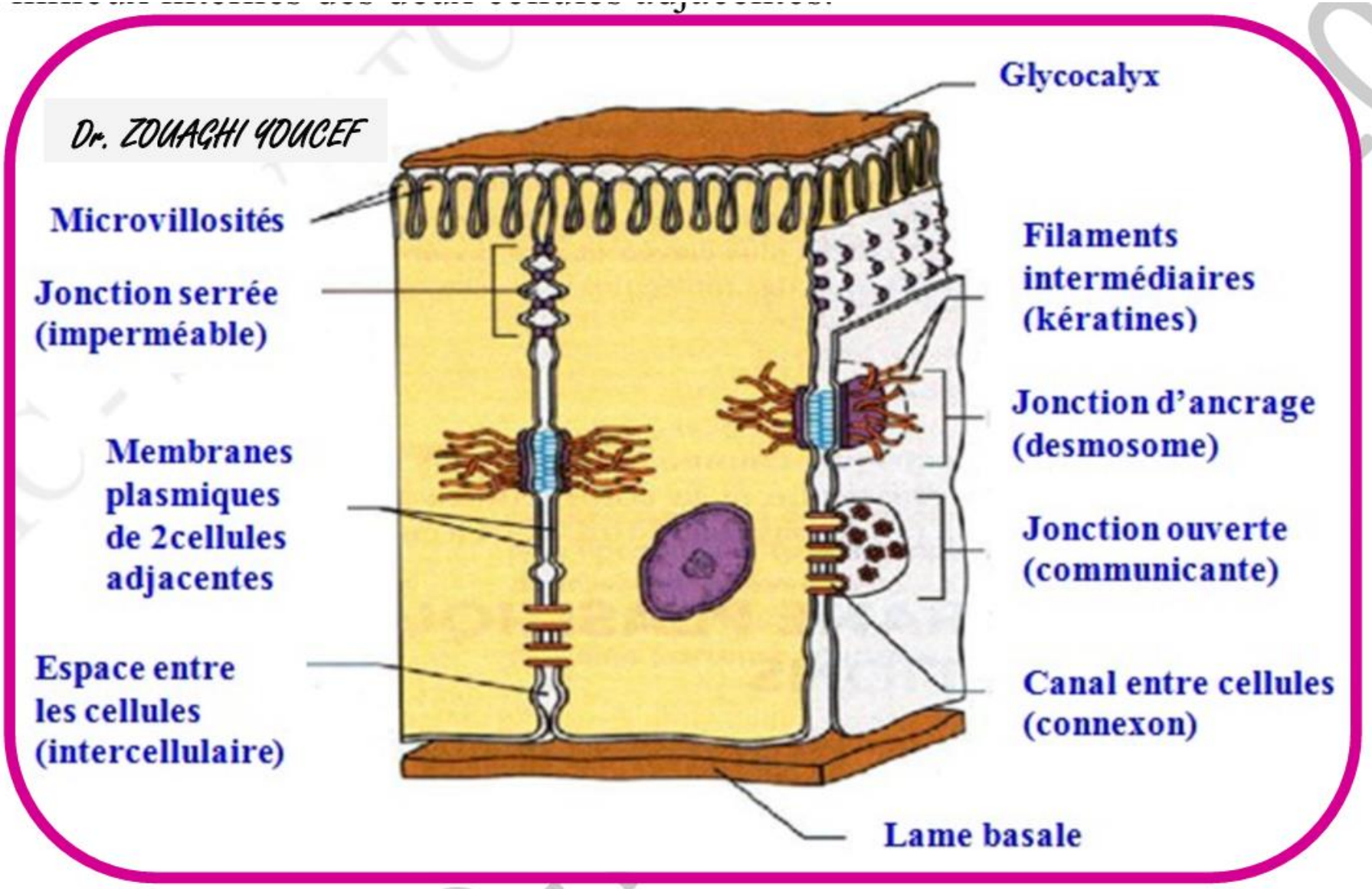
2- **Intercellular junctions [Figure 2 & 3]**

2-1-Definition

Intercellular junctions are specialized regions of the plasma membrane that allow the attachment of cells to each other and the extracellular matrix (the basal lamina). They allow tissues to form and give them a function.

2-2-Classification of intercellular junctions

Intercellular junctions differ according to their shape, their function and the width of the intercellular space.



re2 : Représentation d'une cellule épithéliale reliée aux cellules adjacentes par les trois types de jonctions : jonction serrée, jonction d'ancrage et jonction communicante.

2-2-1-According to their shape There are three types:

- **Macula:** this is a circular or oval junction.
- **Fascia:** it is a large spot with an irregular outline.
- **Zonula:** it is a junction in the form of a belt that surrounds the apical part of the epithelial cell (intestinal epithelium).

2-2-2-According to their function They are of three types:

- **Occludens:** if they close the intercellular space.
- **Adherens:** if they intervene mainly in cohesion.
- **Communicans:** if they allow communication from one cell to another.

2-2-3-According to the width of the intercellular space

We use the terms:

A-Tight junctions (or tight junction or zonula occludens) [Figure 3]

- Zonular-type junctions of 0.1 µm width surrounding the apical pole of the epithelial cells.
- **Tight and impermeable junctions:** The external layers of the two membranes are joined, which prevents the passage of any substance.
- The adhesion molecules involved in tight junctions are claudins and occludins.

B- Adherent junctions (desmosomes) [Figure 3]

- At the level of desmosomes, the intercellular space widens.
- The opposing cytoplasmic surfaces have plate-like densifications on which convergent cytoplasmic filaments are anchored.
- Desmosomes are widely distributed in tissues subjected to sudden mechanical tension, such as cardiac muscles, dermal epithelium and the cervix.
- Desmosomes exist in three different forms:

 Macula-type punctate desmosomes (macula adherens):

the most common. The adhesion proteins involved are cadherins and desmoplakins.

 Zonula-type encircling desmosomes (zonula adherens): surround the apical pole of epithelial cells.

The adhesion molecules involved are cadherins.

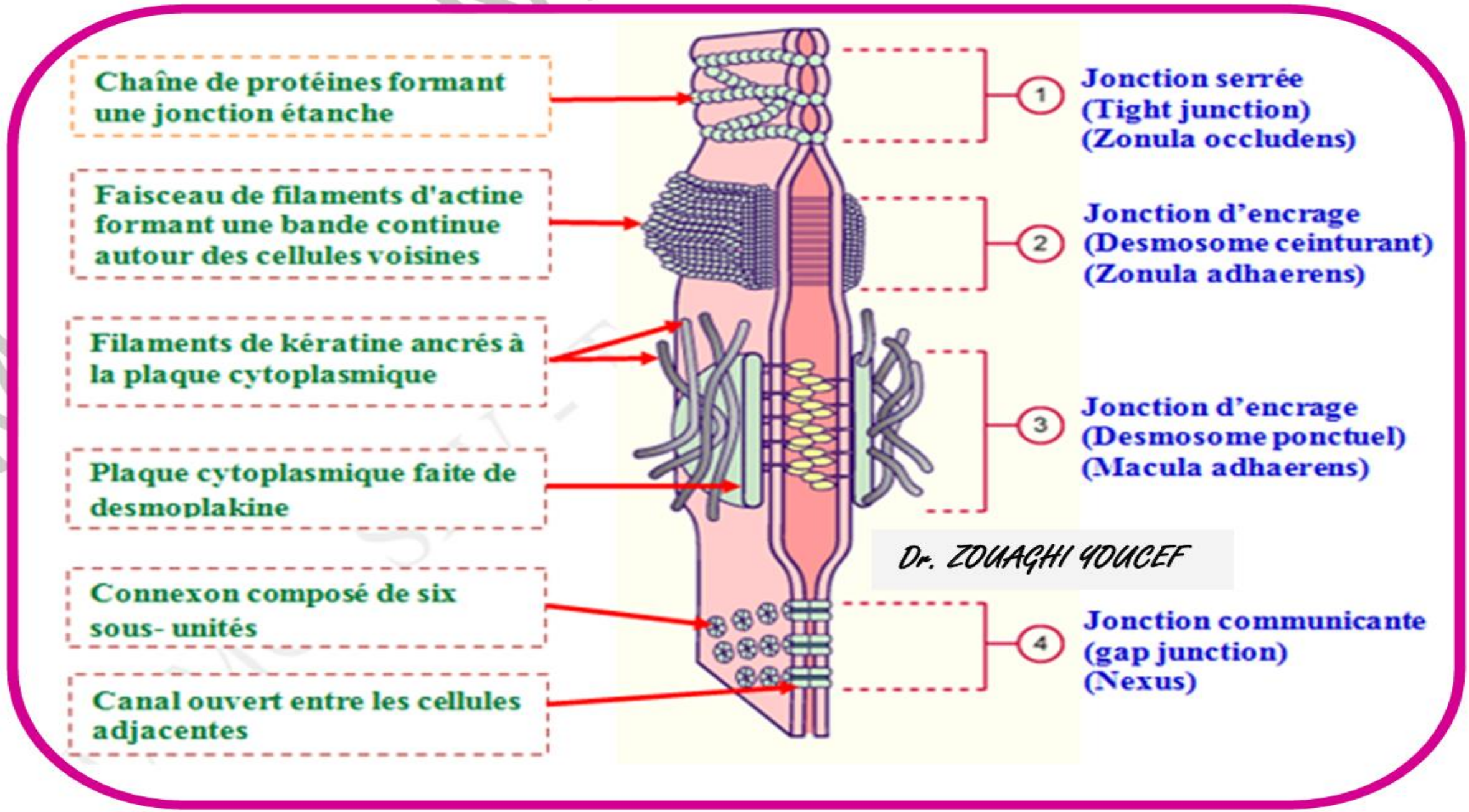


Figure 3 : Les trois types des jonctions cellulaires

Hemidesmosomes [Figure 4]:

provide the cell-extracellular matrix (basal lamina) connection, located only at the basal pole. They resemble punctate desmosomes. The adhesion molecules involved are integrins that bind to certain components of the extracellular matrix: fibronectin or laminin. C-Communicating junctions (gap junction or macula occludens) [Figure 3]

- These are maculas 0.5 µm in diameter.
- These junctions allow small molecules (vitamins, amino acids, oses, etc.) to pass from one cell to another.
- Each of the two cell membranes that are part of the gap junction, has proteins called connexins that associate into a connexon (hexamer of connexins)
- Each connexon of a membrane is connected in the extracellular space to a connexon of the second junctional membrane, forming a central channel thus connecting the internal environments of the two adjacent cells.