D. Cell adhesion molecules

I. Introduction

Most cells in multicellular animals are organized into cooperative groups called tissues, which in turn combine in various ways to form larger functional units: organs. Tissue cells are usually in contact with a complex network of secreted extracellular macromolecules: the extracellular matrix (ECM). This matrix helps to ensure cell and tissue cohesion and provides a structured framework within which cells can migrate and interact with each other. The cells of a tissue are also held in place by direct adhesion between cells. All these interactions are due to specialized membrane proteins: adhesion molecules. They play a very important role in both the development and anatomical integrity of tissues.

Cell adhesion plays a role in several areas: tissue cohesion; cell migration; cell proliferation; cell differentiation; apoptosis; embryonic development; physiological or pathophysiological tissue remodeling; and inflammatory response.

II. Classification

Adhesion molecules have been grouped into four main families based on their structure:

II.1. The immunoglobulin superfamily

The immunoglobulin superfamily is a family of glycoproteins that are mainly membrane-bound but also soluble, involved in cell recognition, binding, and adhesion. These proteins share several characteristic “immunoglobulin” domains in their tertiary structure. Note that a disulfide bridge closes the characteristic loop of immunoglobulins.

This family contains proteins such as antigen-binding molecules (antibodies and major histocompatibility complex molecules), co-stimulatory molecules, co-receptors, binding molecules, and certain cytokine receptors. These molecules play a crucial role in interactions between cells involved in the immune system.

II.2. Selectins

These are transmembrane glycoproteins. Their ligands are osidic: glycoproteins, glycolipids. They are Ca-dependent molecules. They play an essential role in cell adhesion to the vascular endothelium and control inflammatory processes. There are three main types of selectins:

L-selectin: all circulating leukocytes;
P-selectin: platelets and endothelial cells;
E-selectin: activated endothelial cells;

II.3. Integrins

Integrins are heterodimers composed of two alpha and beta subunits. They constitute a superfamily of receptors for various ECM molecules, particularly at the PM level. Their main extracellular ligands are collagens I and IV, laminin, fibronectin, and fibrinogen. Integrins are linked to the cytoskeleton and are one of the major pathways for transducing signals from the ECM to epithelial cells (regulation of their gene expression). Integrins play an essential role in regulating many cellular functions: shape, polarity, proliferation, migration, survival, differentiation, etc.

II.4. Cadherins

These adhesion molecules, which play a key role in cell junctions, are calcium-dependent. The presence of calcium is essential for maintaining the structural and functional integrity of these molecules.

Cadherins have been classified into four subfamilies, named using a capital letter corresponding to the initial letter of the cell type in which they were first identified and in which they are generally most abundant: E-cadherin (epithelium), N-cadherin (neurons), P-cadherin (placenta), and V-cadherin (vascular).

Cadherins play a key role in cell recognition during embryogenesis and in the complex cascade of events that enable tissue cohesion.

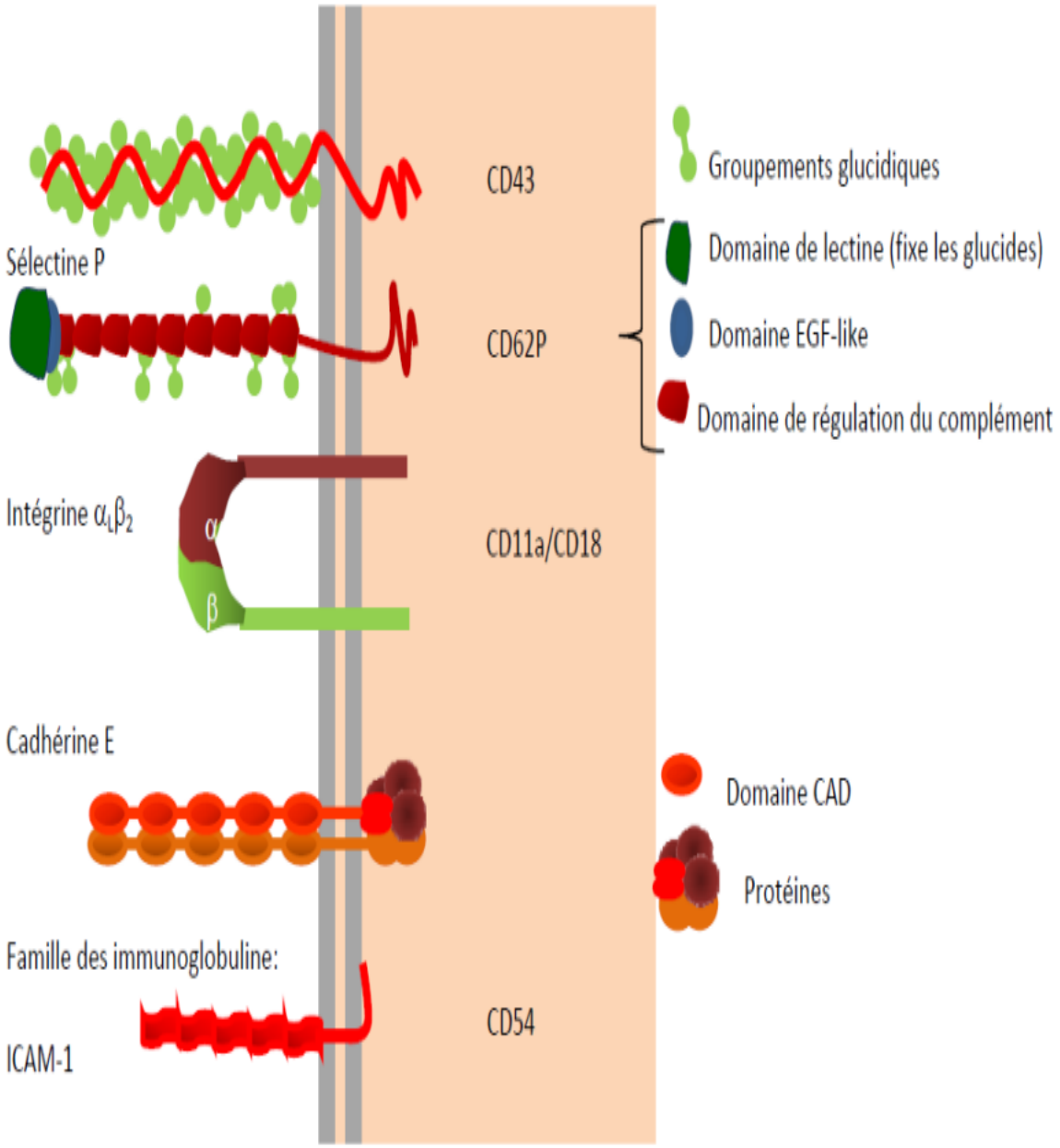

Figure. Adhesion molecules.