Introduction

In many animal tissues (e.g., connective tissue), each cell is separated from the next by an extracellular coating or matrix.

However, in some tissues (e.g., epithelia), the plasma membranes of adjacent cells are pressed together. In vertebrates, there are three major classification of cell junctions:

- Adherens junctions, desmosomes and hemidesmosomes(anchoring junctions)
- Gap junctions (or communicating junction)
- Tight junctions (occluding junctions)

Invertebrates have several other types of specific junctions, for example septate junctions or the *C.* elegans apical junction.

In multicellular plants, the structural functions of cell junctions are instead provided for by cell walls. The analogues of communicative cell junctions in plants are called plasmodesmata.

2. ANCHORING JUNCTION

Cells within tissues and organs must be anchored to one another and attached to components of the extracellular matrix. Cells have developed several types of junctional complexes to serve these functions, and in each case, anchoring proteins extend through the plasma membrane to link cytoskeletal proteins in one cell to cytoskeletal proteins in neighboring cells as well as to proteins in the extracellular matrix. (Table: Types of anchoring junction)

Three types of anchoring junctions are observed, and differ from one another in the cytoskeletal protein anchor as well as the transmembrane linker protein that extends through the membrane:

Junction	Cytoskeletal Anchor	Transmembrane Linker	Ties Cell To:
Desmosomes	Intermediate filaments	Cadherin	Other Cells
Hemidesmosomes	Intermediate Filaments	Integrins	EC Matrix
Adherens junctions	Actin Filaments	Cadherin/Integrins	Other Cells / the EC Matrix

Table: Types of anchoring junctions

Anchoring-type junctions not only hold cells together but provide tissues with structural cohesion. These junctions are most abundant in tissues that are subject to constant mechanical stress such as skin and heart.

3. DESMOSOMES

Desmosomes connect two cells together. A desmosome is also known as a spot desmosome or macula adherens (macula = latin for spot), because it is circular or spot like in outline, and not belt- or band shaped like adherens junctions. Desmosomes are intercellular junctions of epithelia and also are found in cardiac muscle. But the intermediate filament in this case is desmin, not keratin (which is found in epithelial cells).

They resist mechanical stress because they adopt a strongly adhesive state in which they are said to be hyper-adhesive and which distinguishes them from other intercellular junctions; desmosomes are specialised for strong adhesion and their failure can result in diseases of the skin and heart. They are also dynamic structures whose adhesiveness can switch between high and low affinity adhesive states during processes such as embryonic development and wound healing, the switching being signalled by protein kinase C. Desmosomes may also act as signalling centres, regulating the availability of signalling molecules and thereby participating in fundamental processes such as cell proliferation, differentiation and morphogenesis. Here we consider the structure, composition and function of desmosomes, and their role in embryonic development and disease.

Desmosomes are intercellular junctions that provide strong adhesion between cells. Because they also link intracellularly to the intermediate filament cytoskeleton they form the adhesive bonds in a network that gives mechanical strength to tissues. Thus desmosomes are particularly abundant in tissues such as epidermis and myocardium that are continually assailed by mechanical forces. When desmosomal adhesion fails, as in certain genetic and autoimmune diseases, tissues that are subjected to mechanical stress may fall apart. The desmosome–intermediate filament complex (DIFC) is a network or scaffolding that maintains the integrity of such tissues. The picture shows an EM of a desmosome formed between two cells (Figure 3.1). Notice the phase dense material between the two cell membranes, which is made up of transmembrane linker glycoproteins (e.g. demosgleins and