13.1: Introduction to Extracellular Matrix and Cell Adhesion

Interactions between a cell and its environment or with other cells are governed by cell-surface proteins. This chapter examines a subset of those interactions: direct cell contact with either other cells or extracellular matrix (ECM).

Extracellular matrix is a general term for the extremely large proteins and polysaccharides that are secreted by some cells in a multicellular organism, and which acts as connective material to hold cells in a defined space. Cell density can vary greatly between different tissues of an animal, from tightly-packed muscle cells with many direct cell-to-cell contacts to liver tissue, in which some of the cells are only loosely organized, suspended in a web of extracellular matrix.

Figure 1. Extracellular matrix (ECM). Typical components include collagen, proteoglycans (with hydration shell depicted around sugars), bronectin, and laminin. The cellular receptors for a number of these ECM components are integrins, although the exact integrin αβ pair may differ.

ECM is a generic term encompassing mixtures of polysaccharides and proteins, including collagens, bronectins, laminins, and proteoglycans, all secreted by the cell. The proportions of these components can vary greatly depending...
on tissue type. Two, quite different, examples of ECM are the basement membrane underlying the epidermis of the skin, a thin, almost two-dimensional layer that helps to organize the skin cells into a nearly-impenetrable barrier to most simple biological insults, and the massive three-dimensional matrix surrounding each chondrocyte in cartilaginous tissue. The ability of the cartilage in your knee to withstand the repeated shock of your footsteps is due to the ECM proteins in which the cells are embedded, not to the cells that are actually rather few in number and sparsely distributed. Although both types of ECM share some components in common, they are clearly distinguishable not just in function or appearance, but in the proportions and identity of the constituent molecules.

The “basal lamina” and “basement membrane” are frequently confused by students and professionals alike. The basement membrane was discovered first as a very thin layer of connective proteins just beneath an epithelial cell layer. The basal lamina was not discovered until later because it is not visible by light microscopy (normally only ~50 nm thick). Technically, the basal lamina, which consists of multiple layers itself, is a layer of ECM proteins secreted by the epithelial layer. The basal lamina and a thick reticular lamina (ECM secreted by other cell types) together form what is considered the basement membrane.

The basal lamina around glomerular blood vessels in the kidneys is twice as thick (up to 100 nm) as usual, accomplishing part of the kidneys’ physiological role in blood filtration.