STUDY GUIDE—CHAPTER 7
Reading Assignment: Sections 7.3-7.5
Human Perspective: Cell adhesion in inflammation and metastasis

Concepts:
How do cells answer the questions of: Where to go? Who to associate with? How to communicate?
What are the major tissues, what are their functions, what are their general structures?
What is the Extracellular matrix? What are some examples, what is the structure primarily?
What are the important families of components of the ECM?
What is the general structure of all collagens, what is their function? How does type IV differ from type I and type II. What happens if there is a mutation in the helical portion of the protein?
What are the components of proteoglycans, what are their characteristics, what is their function?
What is significant about fibronectin structure, what does it interact with, where is it found, what is its function?
What is the structure of laminin, what does it interact with, where is it found, what is its function?
What is the basal lamina, where is it found, what does it do, what is it made of? Compare and contrast to tendon. How can related proteins give different structures.
What are the membrane proteins that interact with the ECM and with other cells?
Know the construction of junctions: tight junction, belt junction (adherens junction), focal adhesion, desmosome, hemidesmosome, gap junction. Where are they found on polarized cells and how do they function? What are the connections made by each type?
What is the effect of Ca++ on gap junctions?
How do cells get through the barriers made by the basal lamina? How does extravasation work, what are the cell surface interactions involved?

Terms:
- Basal lamina, basement membrane
- Apical, basal surface of a cell
- Extracellular matrix (ECM)
- Proteoglycan
- Hyaluronic acid
- GAG
- RGD structure

Proteins:
- Collagen
- Fibronectin
- Laminin
- Matrix metalloproteinases
- Cell adhesion molecules (CAM)
- Integrin
- Selectin
- Cadherin
- IgG superfamily
- Occludin, claudin
Sample questions:
Which of the following is true about tight junctions?
1. They allow passage of small molecules and ions from cell to cell
2. They connect the basal surface of the cell to the basement membrane
3. They block the passage of molecules between cells in epithelial sheets
4. They are composed of integrins attached to intermediate filaments
5. They are composed of cadherins linked to keratin filaments
6. They are composed of selectins attached to carbohydrates on the cell surface

Problem solving
Fertilized mouse eggs divide very slowly at first. They reach two cells after about 24 hours and eight cells by 48 hours. At the eight-cell stage they undergo a process known as compaction, as illustrated in Fig. 1. Although the mechanism is not clear, the cells appear to adhere to one another more strongly; consequently, they change from being a clump of loosely associated cells to a tightly sealed ball. You wish to know what kinds of intercellular junctions are present before and after this change in adhesion.

To study this question, you use very fine glass micropipettes, which allow you to measure electrical events and at the same time to microinject either the enzyme horseradish peroxidase (HRP), 40,000 daltons, or the fluorescent dye fluorescein, 330 daltons. Fluorescein glows bright yellow under UV illumination, while HRP can be detected by fixing the cells and incubating them with appropriate substrates. You inject embryos at various stages of development with the two marker substances. At both the two-cell and eight-cell stages, different results are obtained, depending on whether the injections are made immediately after cell division or later (Fig. 2). Some of this difference can be attributed to the cytoplasmic bridges that linger for a while before cytokinesis is truly completed.

1. Why can HRP and fluorescein enter only one cell adjacent to the injected cell before compaction?
   a. Because cytoplasmic bridges are present only between a mother and daughter cell pair.
   b. Because there are still adherens junctions between pairs of cells at that point.
   c. Because there are tight junctions left over from the previous 4-cell stage.
   d. Because it leaks into the EMC and is transported to the adjacent cell

2. What would you predict would happen if high levels of Ca^{2+} were injected into the cell along with the fluorescein at the compact cell stage?
   a. Fluorescein would be seen in all cells of the 8-cell compact embryo
   b. Fluorescein would be seen only in the cell that received the injection
   c. The entire embryo would fall apart into single cells
   d. The embryo would revert to the non-compact stage

Figure 2: