BME341 Biomaterials

Lecture #10
Cell Interactions with Biomaterials-I

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Objectives of this course

- Basic components of an eukaryotic cell
- Types of receptor-ligand interactions
- Properties and major components of extracellular matrix
- Receptor signalling-gene expression-cellular functions
- 4 major cellular functions
- DLVO theory, non-spesific interactions between cells and surfaces
- Models of cell migration
- Components that affect biomaterial cytotoxicity

Cellular Structure

- Wide variety of cells in human tissues, each having different functions
- 4 basic types of tissues
  - Epithelial
  - Connective
  - Muscular
  - Nervous

Cellular Structure

2 types of cells:

- Differentiated (committed): perform specific tissue functions
- Undifferentiated: progenitors for many different cell types

Membrane Receptors and Cell Contacts

Interactions between a cell and its environment can result in cell spreading, migration, communication, differentiation and activation. This is called “outside-in” signaling.

Cells can be attached to ECM in various ways.
Hemidesmosomes
Focal adhesions

Cell-Environment Interactions that Affect Cellular Functions

Cell-Cell and Cell-ECM interactions can alter cell function and affect gene expression in the nucleus

Binding of ECM molecules to integrin receptors to form focal adhesions causes changes in the cytoskeleton that ultimately affect gene expression in the nucleus.

Cell Cycle

The cell cycle is divided into two phases: *Mitosis* (the M phase) and *interphase* (G_1,S,G_2)

Mitosis is divided into several characteristic periods:

Prophase
Metaphase
Anaphase
Telophase

Cell Differentiation

- When stem cells are required to differentiate, they undergo a controlled set of changes, usually involving alterations in gene expression and levels of protein syntesis

Mesenchymal stem cells (MSCs) can differentiate into bone, cartilage, muscle, tendon, ligament, and adipose tissue, etc.