

BME341 Biomaterials



Lecture #11

Cell Interactions with Biomaterials-II

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Cell Proliferation

Presence of proper extracellular environment is an important factor for cell proliferation.

Depending on their tendency for proliferation, cells can be classified as:

- Labile: replicate continuously
- Stable: don't change once differentiated but can be induced to proliferate
- Permanent: terminally differentiated, have lost the ability to divide

Cell Differentiation

Stem cells can differentiate

and

Stem cells can replicate themselves to replenish the stem cell pool.

Cell Spreading

Cell spreading: After attachment, cells extend *pseudopodia* along surface. The integrin receptors in the cell membrane interact with ligands on the material surface to firmly anchor the cell in place.

Cell spreading includes cytoskeleton rearrangement and production/adsorption of adhesive proteins on surface

Assays to Determine Effects of Cell-Material Interactions

- Measurement of cytotoxicity (cell death)
- Measurement of cell adhesion and spreading
- Changes in gene expression
- Changes in protein production
 - Presence/location of various proteins in the ECM

Cytotoxicity Assays

- In vitro assays for cytotoxicity are often a required first step in biocompatibility testing
- ASTM and ISO standards for cytotoxicity experiments
- Anything present in a biomaterial that interferes with cellular metabolism or protein synthesis machinery is considered cytotoxic.

Cytotoxicity Assays

- Direct contact assay
- Agar diffusion assay
- Elution assay
- Adhesion/Spreading assays

MTT Assay: Mitochondrial Activity

MTT is a colorimetric method that measures the reduction of yellow 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide into an insoluble purple formazan product by mitochondrial succinate dehydrogenase.