BME341 Biomaterials

Lecture #8
Surface Properties of Biomaterials

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Objectives of this course

- To understand basic protein adsorption to biomaterial surfaces
- To understand how physical and chemical properties of the biomaterial surface affect protein adsorption and why protein adsorption is important to biological response
- To distinguish between physicochemical and biological surface modification techniques.
- To understand the theory behind and possible limitations to the characterization techniques.

Interface

- The environment inside the body is chemically, electrically and mechanically active
- The interface between an implanted biomaterial and the body, is the location of a variety of dynamic biochemical processes and reactions.

Systems move toward lowering their free energy

Surfaces do so by:

- Geometric changes
- Bonding (strong and weak interactions)
- Dynamic rearrangement

Surface properties

Chemical makeup of a surface will determine the types of intermolecular forces governing interaction with proteins

Nonuniformity of surface characteristics results in domains that can interact differently with proteins

Surface Properties Governing Protein Adsorption

- Hydrophobicity
- Charge
- Steric hindrance
- Roughness

Physicochemical Surface Modification Techniques

Covalent Coatings

- Plasma Treatment
- Chemical Vapor Deposition (CVD)
- Physical Vapor Deposition (PVD)
- Photografting
- Self-assembled monolayers (SAMs)

Physicochemical Surface Modification Techniques

Non-Covalent Coatings

- Solution Coating
- Langmuir-Blodgett Films

Surface Characterization Techniques

- General surface analysis:
  - Contact angle analysis
  - Light microscopy
- Surface spectroscopic techniques:
  - involve absorption of electromagnetic radiation by the material
    - ESCA
    - ATR-FTIR
- SIMS
- SEM, SPM