Session 5 CELLADHESIONS (CELL-CELL & CELL-MATRIX)

Integrating Cells into Tissues

- Cells differentiate into distinct "types"
 - Phenotypes: morphology, biochemical, mechanical, physiological, development
 - Mechanoconnections by cell-cell and matrix contacts



Cell-Cell and Cell-ECM interactions



Homotypic Cell-Cell Adhesions Cadherins : Ca²⁺ adhering Transmembrane proteins Types: E-, N-, P-, VE-, and T-cadherin.



Cadherin-CSK connection

 Adaptor proteins (e.g. β-catenin) connect adherens junctions to actin filaments



Heterotypic Cell Adhesions Leukocyte rolling and transmigration



Extracellular Matrix

- Proteoglycans
 - Glycans
 - Protein core
- Water
- Fibrous ECM proteins
 - Collagen (20 types)
 - Elastin
 - Fibronectin
 - and others...





Integrins and the ECM



Integrin Ligands at a Glance

Jonathan D. Humphries, Adam Byron and Martin J. Humphries



Integrin Activation

 Cells not always sticky



- Extracellular signals induce conformational changes in integrins that increase binding affinity ("inside-out")
- Important for platelets and leukocytes



Focal Adhesions

> 50 integrin associated proteins



Actin Filaments



Nature Reviews | Molecular Cell Biology

2D vs 3D Adhesions



Focal Adhesion Kinetics

Growth at protrusions and diminish at retractions



Tissue Remodeling

- Secretion
- Degradation
 - Matrix metalloproteases
- Contraction







Major Themes from Introductory

- Bio-Chemo-Mechanical Themes
 - Fundamental building blocks
 - Chemical-mechanical relationships in biology
 - Structure-function relationships
- Architectural Themes
 - Whole is great than the sum of the parts
 - Versatile and multifunctional components
 - Emergent properties
 - Connectivity is intra- and intercellular
- System Dynamics Themes
 - Flux within stable structures
 - Multi-input, multi-output behaviors
 - Feedback loops lead to homeostasis or commitment to cell function