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George Plopper, Associate Professor

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General Areas of Research:

· Extracellular Matrix and Tissue Engineering
· Biotechnology
· Biomaterials
· Biomedical Engineering
· Tissue Engineering

Research Activities:

Dr. Plopper's research laboratory is primarily concerned with determining how cellular adhesion to extracellular matrix (ECM) molecules elicits specific cellular responses, including growth, differentiation, and migration. We work with two model systems: human mesenchymal stem cells adhering to purified ECM proteins, and human breast cancer cells interacting with bovine lung endothelial cells plated on purified ECM proteins. Our general hypothesis is that adhesion to ECM molecules activates a subset of intracellular signaling pathways associated with integrin receptors, and that this signaling controls cell behaviors by modulating the organization of the cytoskeleton. Our research has both basic and applied elements, and is organized into three major projects:

- Functional dissection of laminin domains: This project aims to identify how cell adhesion receptors and signaling molecules control the growth, migration and differentiation of cells plated on domains of the ECM protein laminin-1. Our hypothesis is that distinct populations of ECM receptors (e.g., integrins ?1?1, ?3?1, and ?6?1) bind to distinct regions of laminin-1 and control signaling pathways independently, but that they act in concert to modulate growth and differentiation of stem cells and endothelial cells. We are using an E. coli expression system to generate fragments of laminin-1 and are testing the signaling that results from binding to these fragments.
- Modulation of breast cell migration by lung endothelium: Breast tumors preferentially metastasize to the lung, through an unidentified mechanism. The hypothesis we are testing is that endothelial cells affect metastasis of breast tumor cells by altering pro-migratory signal pathways in breast tumor cells. Our goal is to define the specific cell-cell and cell-ECM interactions that

stimulate transendothelial migration in breast tumors. This project is being conducted in collaboration with Dr. Charles Keese at Applied BioPhysics, Inc.

- Differentiation of mesenchymal stem cells plated on defined ECM proteins: We are defining the effect of ECM contact on human mesenchymal stem cell differentiation. Our hypothesis is that contact with distinct ECM proteins stimulates specific integrin-associated signaling pathways that ultimately control the differentiation of these cells into bone-, cartilage-, or fat-producing cells. We are working with the Molecular Genetics Core Facility at the Wadsworth Center/New York State Health Laboratories to analyze gene expression profiles in these cells, using Affymetrix DNA microarrays.