Tissue Model of the Epithelial Mesenchymal Trophic Unit

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Problem Statement

- Chronic lung diseases can cause damage to epithelial tissues of the lungs
  - Pulmonary fibrosis, asthma, and COPD
  - Damage causes the sub-epithelial fibroblasts to increase production
- Currently no scaffolds that accurately model the lung extracellular matrix and its changes due to cell injury
  - Varying mechanical stiffness, porosity, incorporation of collagen and fibronectin, cell adhesive properties
- Dr. Brasier of the UW School of Medicine and Public Health requires such a scaffold that allows for lung epithelial cell culture in an ALI
  - Aim is to study cells in normal and fibrotic ECM conditions

Background: Lung Extracellular Matrix

- Lung ECM
  - Collagen, elastin, laminin, and fibronectin
- Function
  - Physical support, cell migration tract
  - Presents and stores growth factors
- Fibroblasts
  - ECM protein production
  - Effector cell for injury repair
- Collagen(I-IV and XVIII)
  - Provides tensile strength, regulates cell adhesion and directs tissue development

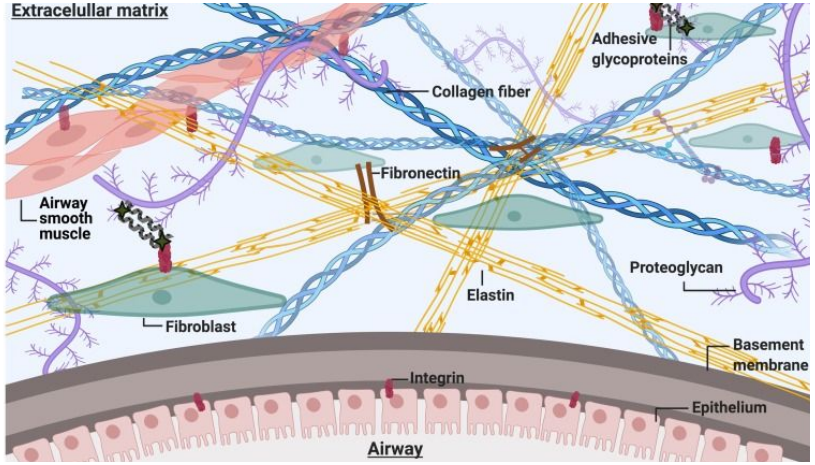

Figure 2: Lung ECM Diagram

Key Design Criteria

- Biochemical Properties
  - Supports cell adhesion and capable of fibroblast encapsulation
  - Porosity
    - Transportation of media through hydrogel
  - Degradation to allow for ECM remodeling
- Mechanical Properties
  - Two types of hydrogels produced: healthy and fibrotic tissue states
    - Healthy Young's Modulus: 2-5 kPa
    - Fibrotic Young's Modulus: ≥16.5 kPa
- Replicability/Ease of fabrication
  - Simple protocol that is easy to follow
  - Accessible materials
    - Pre-characterized CELLINK GelMA for easier fabrication

Current Status

- Bioprinting
  - Streamlining UV crosslinking method
  - Troubleshooting Printing Issues
    - Order GelMA cartridges
  - Establish a structure design that allows for rheometric testing
- Cell Viability
  - LIVE/DEAD Staining
    - Calcein Stain
  - Trypan Blue Staining
    - Cell Count