**Epithelial mechanobiology Lab**

Our aim is to understand the fundamental principles behind the origin of diseases in epithelial tissues. We study how changes in cellular mechanics switch epithelia from a healthy state to a diseased state. We are specifically focused on cancer initiation and wound healing.

**Tools we use**

We combine bioengineering with cell biology tools in order to make tractable epithelial organoids from various organs. We perform live imaging of these organoids to dynamically study changes in cellular mechanics in various physiological and pathological situations. We employ automated cell segmentation and tracking to obtain dynamic changes in the shape and movement of cells. Additionally, we use 4D traction force microscopy to compute the force that cells apply on their surroundings

**Ongoing research**

Chaos within the tissue

Cells within the tissue are genotypically similar but show a chaotic biochemical and physical landscape at any given instant. Why do our cells need this heterogeneity? Is heterogeneity just noise or does this have a physiological relevance? We study the crosstalk between biochemical and physical heterogeneity within epithelial monolayers to understand its role in tissue remodelling and cancer initiation.

**Images-** physical heterogeneity (MSM landscape), Biochemical heterogeneity (), automated segmentation- cell/force inference image

Breast cancer

Breast cancer majorly originates in the milk-producing lobules of the mammary breast. These lobules are of epithelial origin, spherical in shape and surrounded by a basement membrane. We ask, How does cancer originate in these lobules? Why does the incidence of breast cancer increase as we age?

To address these questions, we make organoids of breast acini in the lab mimicking aged Vs normal breast tissue. We then sporadically transform healthy tissue cells into oncogenic mutants to study the cellular mechanisms underlying cancer initiation.

Images-

1. Breast acini sketch, and one staining image

Later on we can add: Breast acini staining image in hydrogel mimicking aged person vs young person. And breast acini staining image with oncogenic cell

Oral cancer

The most common form of oral cancer, oral squamous cell carcinoma originates in the gingival epithelium of the oral mucosa. This gingival epithelium is packed as a stratified layer of epithelial cells over the submucosal layer made largely of collagen, and laminin. A pre-cancer condition called oral submucosal fibrosis greatly modifies this submucosal layer and appears in populations with a habit of chewing betel nuts and tobacco. How does this pre-cancer condition allow cancer cells to grow in the epithelial layer? We make organoids of oral mucosa to explore this problem at a cellular level.

Images: SHG images- collagen, oral keratinocyte+HRas oral keratinocyte competition image.

Later on: 3D image- collagen SHG along with fibroblast and keratinocyte on top

All Lab Members

Send your photo, your bio (background, interests, project in the lab, interest outside lab- if any;))

You can also link your name to a different webpage if you have any- blogs/ etc