Lecture Notes For: Pacific Instituted for the Mathematical Science

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1 2023-Feb-16 Meeting: Mathematical Biology: Understanding Form and Function in Vascular Tumors

1.1 Biology Background

Tumor vessels in tumors and

Grow rapidly - Leaky - Prone to Colapse - The architecture is highly irregular : So the blood supply is different

Research Question: How to quantify this irregularity? put some numbers to it? How does the treatment alters the blood flow?

Low oxygen level: disrupts the cell cycle so alter chemotherapy and radiotherapy responses and enhances metastasis

Types of Hypoxia: Chronic Hypoxia - Cycling Hypoxia. What is the mechanism behind that? Can any of these types of hypoxia be used to our advantage?

Characterising vascular networks: Statistical Metrics (vessle length, diameters, branching angles). Down-Side: It focus on a single spatial scale. The question is can we quantify the form in a multiscalse sense?

1.2 Topological data analysis

The hiddens shapes in the data. Like a cloud of data points that resembles a torus. Persistent Homology –> the idea of inlating the disks centered on the data points.

1.3 Relating "Form" to "Function"

How does the architecture influence the blood flow in the network?