

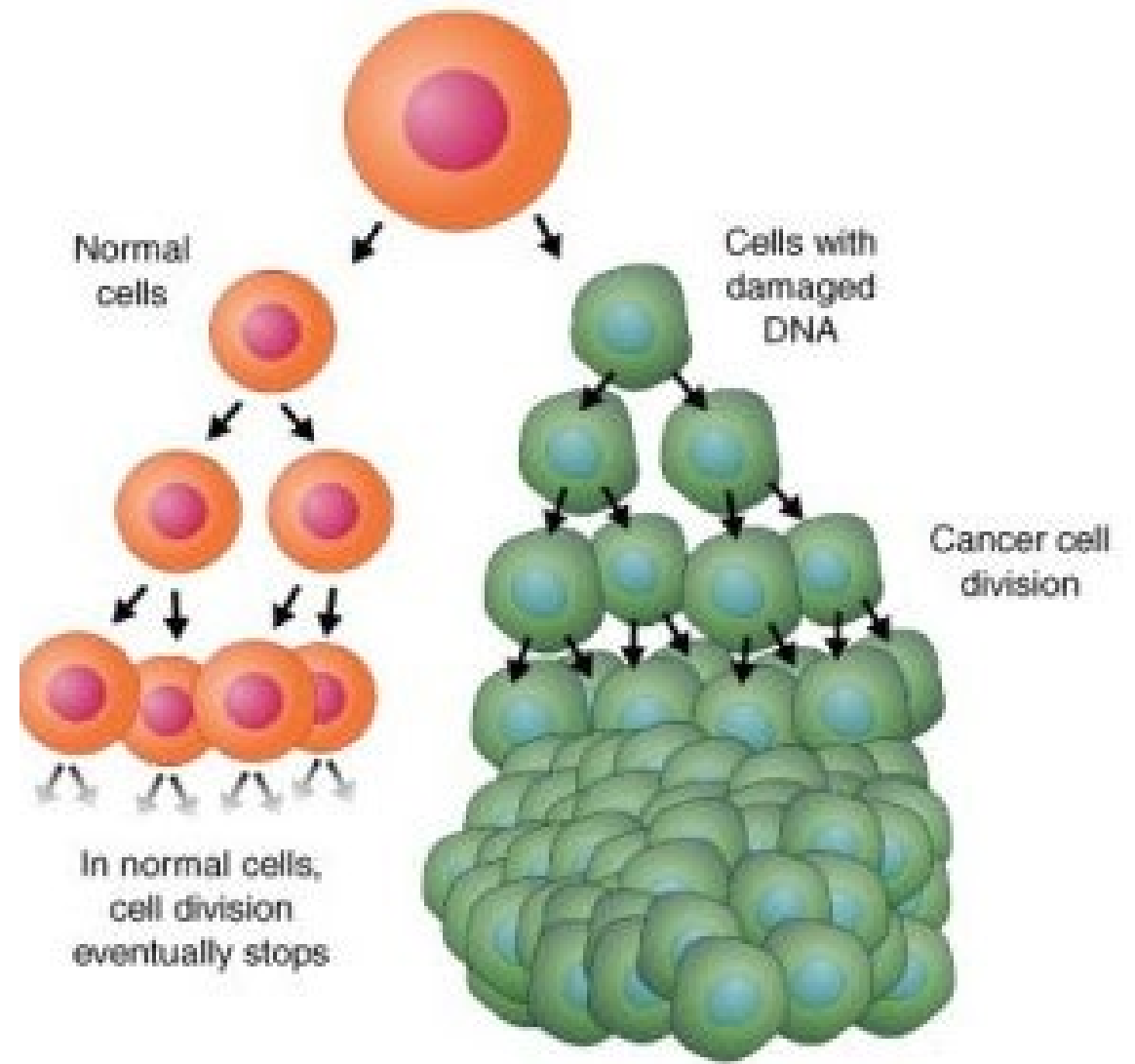
Chloe Shiff

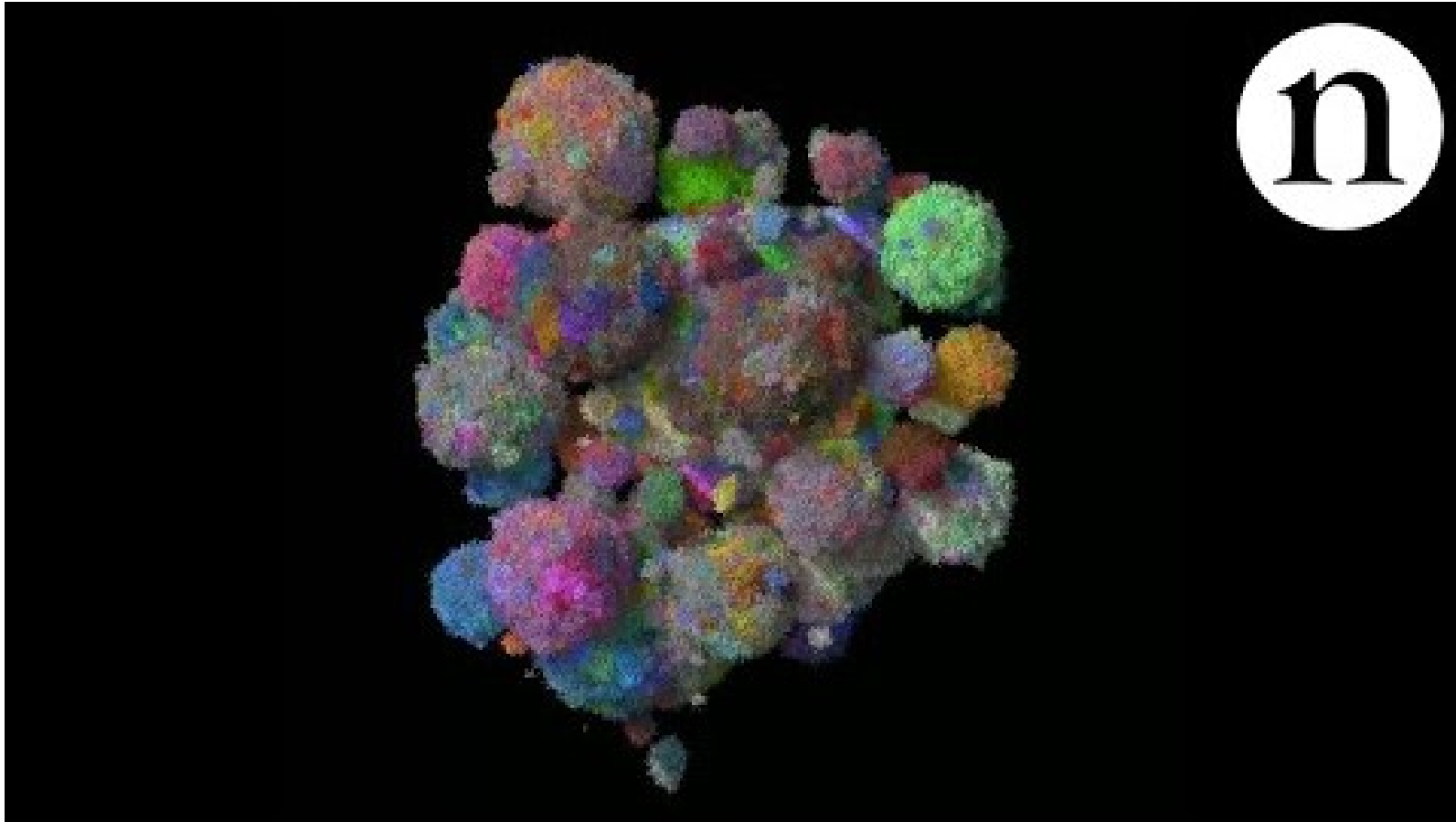
Mentor: Dr. Subhajyoti De

Genomic Data-Guided Mathematical Modeling of Cancer

Introduction- Cancer

- Cancer is caused by genetic and epigenetic mutations in a single cell which cause it to gain a selective advantage
- Uncontrolled, rapid exponential cell division creates a tumor
- Cancer is treated by killing all cancerous cells
 - Surgery
 - Chemotherapy
 - Radiation
 - Immunotherapy

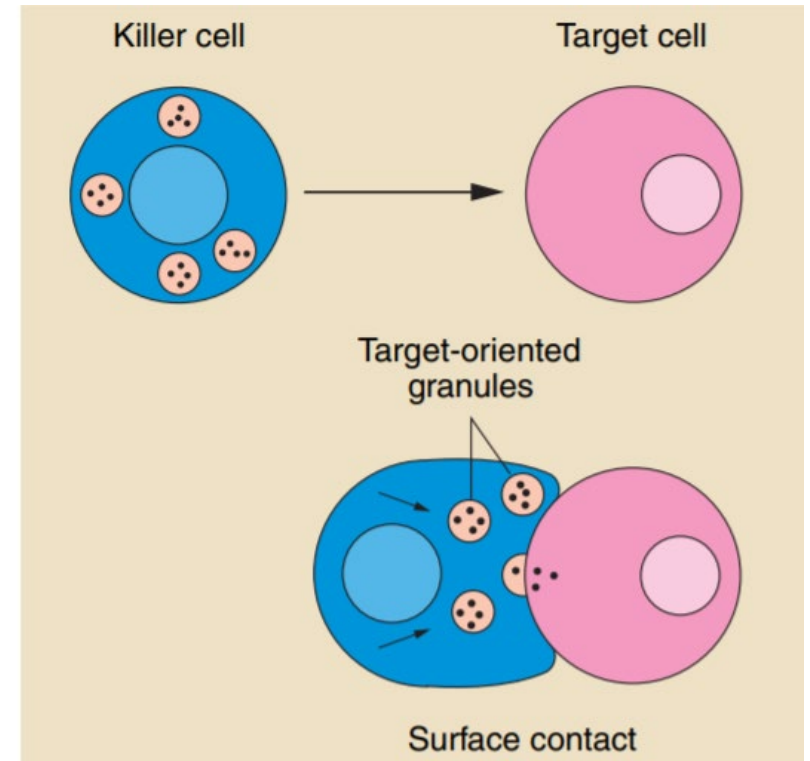




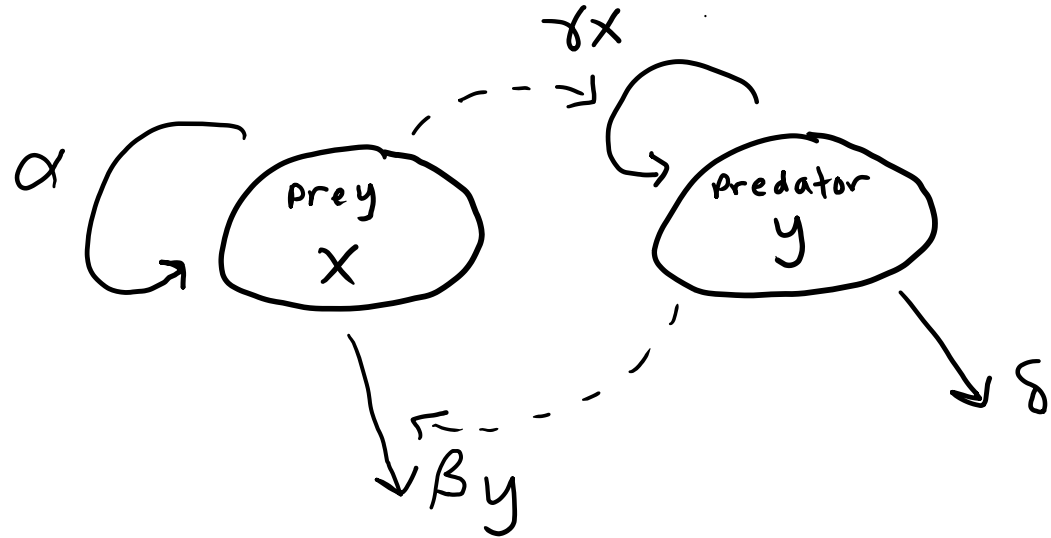
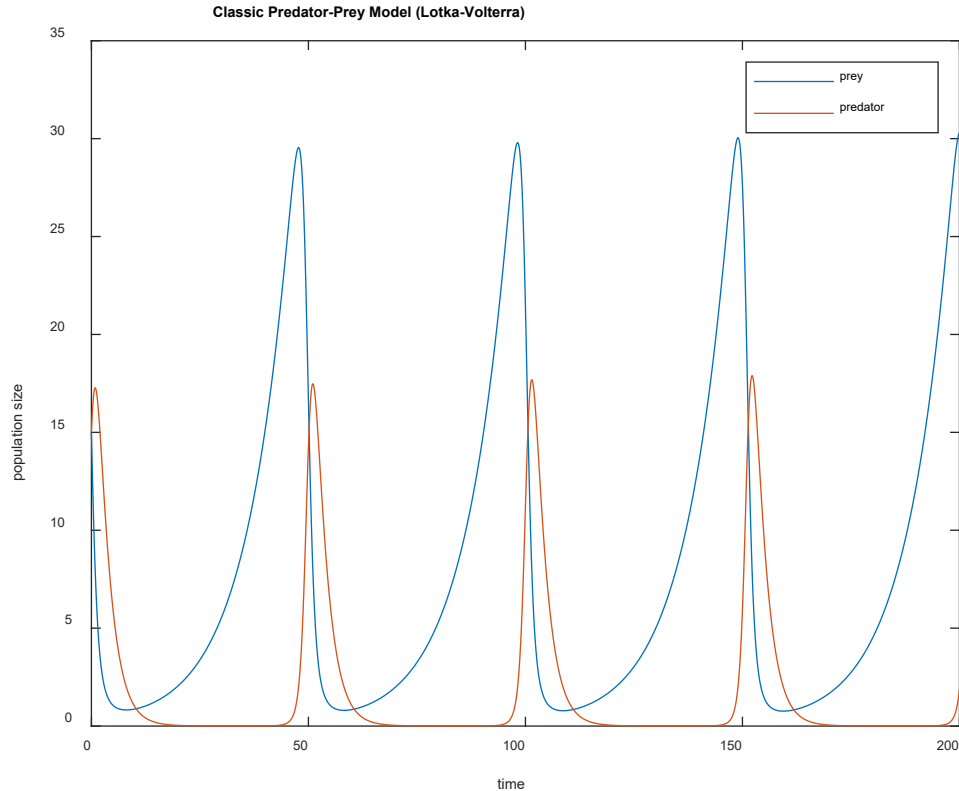
3d model
of tumor
growth

Immunotherapy

- Immunotherapy activates immune system
- Benefits
 - Cells within the human body kill cancer cells
 - better chance of killing ALL cancer cells
- Risks
 - Overly active immune system can kill healthy cells
 - Hard to predict body's response



Modeling Immune-Cancer Cell competition- Predator-Prey modeling



$$\frac{dx}{dt} = \alpha x - \beta xy$$
$$\frac{dy}{dt} = \delta xy - \gamma y$$

Immune cells are predators, Cancer cells are prey

Lotka-Volterra Equations

Project-Create a Mathematical Model of Tumor Growth

1. Create the Model Equations

- Begin with Lotka-Volterra (Predator-Prey modeling)
- Adapt equations to reflect immune response to cancer
 - Exponential cell growth
 - Additional species to represent additional populations with more mutations

2. Estimate Parameters from Experimental Data

3. Create MATLAB simulations to view results

- ## 4. Incorporate into existing models
- 3D spatial model

Goal:
Predict response to
Immunotherapy

Thank You

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