**BB / BCB 3010 Simulation in Biology 2018 – Individual Simulation Project**

**Choosing an individual project to simulate**

You could either start with a research paper about something that interests you, and see if you could think about a way to model it, or you could start with a review paper on some topic of interest, or even a textbook, to get you started. As you read about the biology, try to come up with questions about the system, or hypotheses you could test.

For example, suppose you are interested in a signaling pathway involved in cancer. You could model the pathway, with the molecules involved as agents, and then test a hypothesis involving the effect of drug treatment on that pathway. If you are interested in epidemiology, you could model the malaria parasite infecting a mosquito, say, and then the mosquito biting a host, and then test what sort of insect control strategies might or might not work well. A hypothesis might be that spraying at a particular point in the season, or just after a rain, or at a particular time of day, might work best. Note that in order to test these hypotheses, your model needs to include the mosquito life cycle, and how it is affected by rain; or how active mosquitos are during the day vs. night.

You need to find something you are interested in. Choose the most important agents that define the system to start with, and then gradually add on to your system once you have a basic system working. Ideally, you will be able to compare your model with what happens experimentally, typically by looking at results in research papers.

Remember to Remix or save versions frequently, so that you always have a working simulation to go back to if things stop working when you add new code.

**Example simulation topic: nerve regeneration**

For instance, I am interested in nerve regeneration. I could model the system in the attached article on how Schwann cells and fibroblasts interact to influence nerve regeneration. I would define agents as Schwann cells, fibroblasts, and regenerating neurons, and give them rules that would be based on the results in the article. To validate that the simulation is working as I expected, I would compare simulation results on Schwann cell clustering to data in the paper; if the simulation is a good model, then it should produce data similar to what was observed in the lab.

The question I am interested in is whether the cellular interactions described by the authors are really enough to produce regeneration, or whether there are important factors missing. In addition, I can ask questions about the mechanism that were not addressed in the paper; for instance, is there an optimal ratio of cell types required to produce the most robust regeneration? I could run the simulation with various ratios of fibroblasts and Schwann cells, to see if regeneration does occur with cells following the rules described in the paper; and which cellular ratio produces the most regeneration.

Your project abstract should follow the format of the example project abstract attached. here.  The abstract describes the biology, an initial version of the agents and rules, model validation, a hypothesis to test, and some evaluation and user interactions.  The abstract is likely to grow and change as you develop your project. You may find that you will need to do additional research in the biology literature as you develop the simulation.