**Simulation practice project guidelines, including Code Review explanation**

**Goal and Overview**

This exercise is designed to help you learn how to turn a biological system into a description of agents and rules, and then encode that description and use the model to test a simple hypothesis. You have a choice of three pre-defined projects, with agents being defined as molecules, cells, or organisms respectively. I will assign students to groups based on which type of simulation you would like to model. The biology behind each project is given in a textbook chapter, review article, summary, or journal article. The biology is much more complex than you will be able to implement in two weeks, so you need to pick out the most important components of the system to model.

**Abstract (due before class Monday, March 26th (30 points)**

You will each individually write an Abstract for your simulation, following the format of the example Abstract posted on the site, and upload the Abstract the course MyWPI site before class on Monday, March 26th (30 points). The Abstract should summarize the biology for your system, describe possible agents and rules, state some ways to validate that the model is working, and some evaluations (graphs, statistics) and user interactions you could implement, as well as a hypothesis you might test. Have your Abstract available in class on Monday for discussion with your group.

**Discussion and Group Abstract**

During class on Monday, March 26th, you will discuss the agents and rules you came up with in your groups, and the group will agree on agents and rules you will all work with. You also need to agree on the shapes and colors of all your agents, so that your simulations will be easy to compare. Someone in your group will upload your group agents and rules for me to approve.

**Implementing the Simulation**

Over the next two weeks, you will then each implement the agents and rules individually, so that you will all get practice designing your own implementation. All simulations that you turn in must work, and must include all the agents and rules you came up with as a group. They must also include all the basic features below, and at least two additional features that make sense biologically. You are encouraged to help each other out with ideas and code, but each implementation should have some unique features.

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| **Basic features (80 points)** | **Additional features (20 points)** |
|  | **Possibilities include:** |
| All agents and rules work as described in Abstract and are biologically plausible (50 points) | Additional agent(s) beyond the group’s list (5 points / appropriate agent) |
| Simulation well structured; good use of procedures; code clear (commented for Netlogo) (20 points) | More advanced rules beyond the group’s for an agent or agents (5 points/rule) |
| Good user input (e.g. sliders) and output (e.g. graphs) (10 points) | Appropriate use of z-axis (5 points) |
|  | Other (you describe) |

**Validation and Hypothesis testing**

When you construct a model, you need to show that it is working as described. In some cases, this can be a visual validation, such as checking that your various agents are interacting as you intended by watching your simulation. In some cases, a graph showing agent populations behaving as intended makes sense. Testing a hypothesis using your simulation is a little different, and should involve something you didn’t explicitly program into the baseline simulation. For example, for an ecological system, you might hypothesize about what would happen if you introduced an invasive species with certain properties into your stable simulation, and then test that hypothesis. For an infectious disease scenario, you might test several interventions, and hypothesize that one will be best; or that there will be a critical time by which an intervention must be administered to be effective. For a molecular simulation, you might hypothesize that a critical level of some molecular component is required for the entire process to proceed smoothly. These are all just examples. You’ll need to both validate your model, and use it to test a simple hypothesis.

**Code Review (due Tuesday, April 3rd) (20 points)**

You’ll have a Code Review session on Monday, April 2nd. The purpose of these is to think deeply enough about someone else’s code to understand it, and provide helpful feedback. I’ll assign you to a partner who is implementing a different simulation from you. You’ll each walk your partner through your code, also explaining the biology. The code does not need to be perfect – in fact, helping your partner to debug a problem is highly encouraged! Each of you will write a short review of an important piece of your partner’s code, documenting the code with screenshot(s). You’ll also write up any suggestions for your partner. You’ll post the Code Review on Tuesday, April 3rd, by 5 PM, and **also provide the Code Review to your partner**. There is an example Code Review posted on the Canvas site.

**What to turn in on Friday, April 6th (Simulation, 100 points; Report, 30 points)**

On Friday, April 5th, you’ll upload a link to your simulation, along with your updated Report. Your report is an update and amplification of your original Abstract. The Report summarizes the biology (a paragraph or so), lists the agents and rules, and briefly explains how the simulation works (a paragraph or so). In addition, the Report includes some validation that the simulation works as described, as well as data testing a simple hypothesis. The validation and hypothesis testing does not need to be elaborate; a paragraph or two for each, with graphs showing appropriate data, is fine.