

**Project definition Due: Thursday, March 1<sup>st</sup> (via email)**

**Final Paper Due: Thursday, March 15<sup>th</sup> (via email, by start of class)**

**Purpose:**

- 1) To apply the modeling principles learned in class to a real-world problem
- 2) To develop deeper understanding of how modeling can provide insights into a neuroscience problem.

**Project description**

In this project you will go through the exercise of developing a model to answer a neuroscience question, by replicating and extending a previously-published modeling effort. You will be required to research a problem; define the hypothesis in the context of previous work; download, modify, and interpret an appropriate model; and explain the model findings and what you learned beyond what was presented in the original research.

The choice of problem to model can come from ModelDB (<http://senselab.med.yale.edu/senselab/ModelDB/default.asp>), or you may identify a problem from your own research.

**Deliverables:**

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**March 1<sup>st</sup>    Project definition**

For a model taken from the ModelDB database:

- 1) The citation of the original paper for which the model was built;
- 2) Citations for at least 2 additional papers which you have read to better understand the problem being modeled, or the interpretations of the results of the model presented in the original paper. We will expect you to discuss the relevance of the findings in these (and other) additional papers to the original problem, in your report; and
- 3) The URL for the model web page in ModelDB.

For a model developed from your own research:

- 1) The introduction for your report (see below), outlining the problem to be investigated;
  - 2) Citations for at least 3 papers which helped you to define the problem being modeled; and
  - 3) A brief (2-3 sentences) description of the approach to be taken
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## March 15<sup>th</sup> Project report

A 3000-word paper, with at least 2 figures derived from your simulations, which reviews your modeling effort. The paper must have the following sections:

- 1) Abstract (150 words)
- 2) Introduction: Why is this problem important? Provide background, with references, to answer why.
- 3) Methods: Describe what techniques were used and why. How were the parameters chosen for the model? Were the values used appropriate? How did you vary the parameters of the model? Why did you use those values?
- 4) Results: Provide replication of a key result in the paper. For models downloaded from ModelDB, test the robustness of the model's results by varying the parameters in the code provided. You may also extend the model to further explore the modeled system.
- 5) Discussion: Explain why the chosen result is important. Provide a critique of the original modeling approach - was there a better way to model this problem? What else could be learned from this model? How would you extend this model to learn something new? What new work has been done that contradicts or confirms the model's findings?
- 6) Citations (what papers you read for this report, **more than 3**). You must have clearly incorporated the results of those papers into your background, methods, or discussion.

You must include at least 2 figures in your results showing the output of your simulations. *It is insufficient to simply hand in figures generated from the existing code in the ModelDB database.* Please choose your figures carefully – your figures must clearly demonstrate a result described in your report, which is also incorporated in the discussion. Please ensure that the figures have properly labeled axes and an appropriate figure legend.

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### Project ideas:

Any and all of the models in ModelDB are fair game. To find models implemented in Matlab, click on “Find Models for.... Simulators”. (But, you don't need to do a Matlab model – many others are available.) There are many types of models in the database, ranging from ion channel simulations to networks of simplified neurons.

Here are some nice examples using Matlab:

[Fernandez05] <http://senselab.med.yale.edu/senselab/modeldb/ShowModel.asp?model=59480>

[Molineux05] <http://senselab.med.yale.edu/senselab/modeldb/ShowModel.asp?model=59479>

[Bose04] <http://senselab.med.yale.edu/senselab/modeldb/ShowModel.asp?model=45513>

[Heinz01] <http://senselab.med.yale.edu/senselab/ModelDB/ShowModel.asp?model=36834>  
(requires Matlab compiler, not available in the student version)