

**BioQUEST 2012: Pharmacokinetics Models Lab**  
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Objectives:

1. Familiarize yourself with the pharmacokinetics model with the Using Drugs2CoPE ESTEEM Modules.
2. Read and understand an original research article that uses models.
3. Recreate the results from an original research model.
4. Describe the dynamics of a continuous model with a discrete pulse function.
5. Explore how to apply the models to a real world scenario.

Problems (**be sure to read the Additional Directions and Hints before proceeding**):

1. Go to the ESTEEM website and download the four Using Drugs2CoPE ESTEEM Modules.
2. Set the dosing function to zero. Determine the values for  $\alpha$  and  $\beta$  that give a stable node and a stable spiral, if possible. Be sure to include copies of the graphs with your lab write-up.
3. Read Spitznagel's "Two-Compartment Pharmacokinetics Models" (posted on Blackboard.)
  - a. Replicate the results for the usual dosing of PPA and CPM. Describe what happens to the patient.
  - b. Change the dosing to be less frequent and more frequent without skipping doses for both PPA and CPM. Describe what happens to the patient, and compare/contrast to results from 2(a).
  - c. Using the "Missed Doses" worksheet, create the model where the patient takes the drug as prescribed (i.e. for PPA every 6 hours), but skips every third dose. Describe what happens to the patient, and compare/contrast the results from 3(a) and 3(b).
4. Using your research skills, find some real-world drug data. For each drug, repeat the steps of 3(a)-3(c). Use caution in choosing which module goes with which drug.
  - a. Lithium
  - b. Caffeine
  - c. Synthetic thyroid hormone (brand name is Synthroid®)
  - d. Aygestin ®
  - e. Depo-Provera™
  - f. A drug from the grab-bag of drug inserts. (Provided in the next class)
  - g. A drug of your choice.

### **Additional Directions and Hints:**

The FDA requires all drug manufacturers to publish the half-life information for any medication prior to receiving approval. This information can be found at <http://www.accessdata.fda.gov/scripts/cder/drugsatfda/index.cfm>

Enter in the name of the drug and select the “Label Information” link. You want to look for the pharmacokinetics section.

It is important to note that, in general, only the half-life of the drug in the bloodstream is published. To determine the half-life of the drug in the gastrointestinal tract, one must infer the half-life from the dosing directions. One must also infer how long it takes the drug to dissolve.

For example, consider Synthroid®. Based on the information on page 3 at Drugs@FDA ([http://www.accessdata.fda.gov/drugsatfda\\_docs/label/2008/021402s017lbl.pdf](http://www.accessdata.fda.gov/drugsatfda_docs/label/2008/021402s017lbl.pdf)), the drug has a half-life of 6-7 hours. Based on the prescribing information, the drug is mostly absorbed in the stomach in one hour and completely absorbed within four hours. Use that information to infer a half-life for the gut.

To input all of the known information into the module, the user need only type in the half-lives; all other parameters can be adjusted using sliders, allowing one to see the model change dynamically as the parameters change.

Once you enter the half-life in the first page of each module, it will automatically update throughout the “Single Dose” and “Missed Doses” pages.