Introduction to
Computer Modeling of Biological Systems

Bio 370 (2002)

Course Introduction / Guidelines

Being partly a question and answer session between student and teacher about the course.

a) "Say, what is this course about?!"

Well... welcome to a different and exciting enterprise, Computer Modeling of Biological Systems. While you have no doubt encountered models in many of your courses at Skidmore they have likely always been presented as aspects of that particular sub-discipline. This course, on the other hand, focuses on the modeling process itself and cuts across many biological sub-disciplines. It is one of very few such courses offered at a small liberal arts teaching college in this country.

b) "Don't I need to be a math and/or computer wizard to model biological systems?"

No, the watchword for this course is that you do not at all need to be either a computer wizard or a math buff to use computer modeling in biology. In fact, the course is explicitly designed on the assumption that you have little background in a computers or modeling math at all. I purposely selected the Visual BASIC as the course platform because people tend to find it to be quite 'familiar' and easy to use. As for the math involved in modeling even complex biosystems, you will very soon (i.e. lab #1 and lecture #1) see that exactly because you can use a computer to do it, the process becomes surprisingly simple and requires no more math background than elementary algebra.

c) The textbook, sources for models

The text for the course is Bob Keen and Jim Spain's Computer Simulation in Biology: A BASIC Introduction a revised 2nd edition of the original course text. This book is excellent and codifies some twenty plus years of experience they have had teaching a similar course at Michigan Tech. Keen & Spain are ecologists with some biochemical leanings and so, as opposed to my other courses, the bulk of the focus in this course is not particularly on vertebrate physiology (although we do a substantial number of physiological models also later in the course). Rather, the two major sub-areas are ecology/populations and molecular biology/cellular metabolism. Don't let the imposing appearance of certain small sections of Keen confound you; one major outcome of this course is that you will learn how really easy this stuff is to do using a computer as opposed to employing traditional math methods.

d) How does course run? What is a week in it like? When are the exams?

Well, the structure of the course is likely different from that of any other biology course you have taken. Look over the accompanying course topics outline. Notice in particular that 3/4 of our contact time is in lab and that there are no scheduled exams (although I have sometimes given an in-lab exam problem set). Rather, in keeping with the objective of the course (i.e. to learn to model biology), you are expected each week to hand in to me, for evaluation, criticism and feedback, a set of approximately 3 models (the exact number will vary from week to week and will be specified in the assignment handout for that week).

A typical one week cycle* in this course proceeds as follows:

Wednesday a.m.	'Lecture'	A) I introduce a new topic highlighting certain aspects of the reading &/or a technique I anticipate as critical. B) You receive an assigned list of models to work on for that week.
Wednesday p.m. and Monday a.m.	Labs	A) You have looked over the reading and developed preliminary ideas on how to do the models before you come to lab (ideally, you should have preliminary versions at least hand-written out.) B) You work in lab, one person to a machine, at the assigned time, towards getting a clean set of final models.
Wednesday a.m.	Lecture	A) You hand the models you have been working on & we begin the next topic.

* also see the course cycle diagram on the lecture topic outline

Note the following particulars with respect to this framework:

1) The lab periods take place in the Dana 181 PC lab each Wednesday and Monday at the assigned class times. There are a sufficient number of PC work stations to have one for each person in the class and a printer 'reserved' for class use only. Work outside scheduled lab hours may done at any other location where you can make a PC network connection (see me if you wish to arrange to work on your own machine locally).

2) The readings are listed on the accompanying course/topic outline. Almost uniformly, the models assigned as due the next week are embedded in sections of the readings (e.g. Keen Exercise 2-1). I will indicate to you each Wednesday, in writing, what particular models are due the next week (e.g Model Assignment #1, #2, etc. is handed out to you). Because the models are integrally linked with the associated reading in the book, you will find it to your advantage to read carefully those portions of the book associated most closely with the particular specific problems we are working on. There are, however, a few difficult (or even obscure) sections in the book. It is my job to guide you through those.

3) The 'lectures' occupy a relatively minor portion of this course. Unlike some of my other courses, in which I expect I lean too heavily on the lectures and too little on the readings, the main purpose of the lectures here is to orient you towards each new reading topic and to communicate to you new techniques by which to approach new modeling problems. Most of this course simply involves what it is about, actually sitting down at the computer and doing models.

4) When a model is 'due', the procedure to hand it in is as follows:

a) The due time is the *beginning* of the lecture period that Wednesday. Due times are always indicated clearly on each modeling assignment.

b) For each model, the following **4** pieces constitute a submission:

- 1 **diskette** (or ZIP disk) with the model stored on it. [No CD's please!]
- 1 printout showing the **output** (graph or table usually).
- 1 **printed LIST**ing of the bare model itself, stripped of any extras (graphing routines, etc.).
- a brief, written statement of the **biological significance** of the results.

This may be hand-written on the output or LIST if desired but typed text is preferred.

Sum: submission of a model entails handing in 4 things.

In addition, as also noted in assignment #1:

a) Since you are giving me your disk & will not have it back for a week (I return assignments no more than one week later), you must also make a second copy of your disk (just drag the old disk icon on to the new) which YOU will then work on during the second week. We then swap disks at the end of that week, a sort of musical disks.

b) All work is to be completed BEFORE the class or lab at which it is due. You come in, drop off your disk, Lists, graphs & reasonings into the collection box and then sit down to work on the new material. No old Lists should be printed out during the new work period as it takes time & resources away from the new topic.

5) Evaluation of your model is done as follows.

- Each model is worth an indicated fixed number points depending on its level of difficulty.
- If it works reasonably when I run it (and meets other relevant criteria), it receives the full number of points.
- If it does not, at my option, I may give it back to you for 'fixing' (=Redo), along with some helpful advice. If corrected and handed in by the second deadline set for the model (generally one more week), it can still receive full credit.
- Your grade for the course is essentially based on how many total points you actually achieve divided by the total number of possible points you could have achieved. There is therefore no reason, if you do your work steadily, why you could not obtain an A level grade with this arrangement.

The only additional factors are the final project, which will be a model in an area largely of your choice (but see below) & will be worth considerably more points than any of the individual course models and the possibility that I may assign you a new 'test' model during a fixed period (say an hour lab) as a form of on-the-spot exam. I have exercised the on-the-spot exam option only twice so far, by the way. More specifics on the final project* will be handed out towards the middle of the course.

6) What to do when your are 'stuck'. YOU WILL ALL BECOME STUCK at some point (indeed at many points!) during the modeling process; I will too. Having your model not behave the way you expect it to is the very core of the modeling process. It often means there is something you do not understand correctly about the system you are trying to model and when you finally resolve the 'problem' you have also arrived at a new, clearer level of understanding of the system itself. All of this is great philosophically but what do you do when you are stuck and have 3 models due in two days (if it's already Tuesday evening you have created your own problems!)?

*The only stricture on the final project is as follows. If you wish this course to count toward the cell & molecular concentration, the department requires 1) that your final models be from the cell & molec. area and 2)that in any optional model week (usually the next to last week) you pick molecular rather than ecological, physiological or genetic models.

What to do when your are 'stuck'. (continued)

First of all, leave yourself time so that you are not stuck at the last minute! Ah, but you did; now, what to do?

- You may consult among yourselves at any time to talk things over; just remember that the final model you hand me must be yours in the end, not a copy of someone else's! (This now goes by the fancy name of cooperative learning!).

- You may consult me. I have a PC hidden on my office desk (ext. 5079), am on email (rmeyers , the course mailing list is bi370-list) and within the constraints of my other commitments am ready and eager to help you. If I am not available email me your question (& the model code!) or leave a note on my door listing a telephone number (or better email address) and the times I can reach you by phone for the rest of that day. If all else fails, you may call me at home (587-6117) for help; I only ask that you exercise some reasonable restraint in employing this option.

In addition, as questions develop, I will *often* post sample outputs, hints, corrections, etc. on the wall outside my office. Make it a habit, when you go to other classes in Dana, to pass the Biomodeling Notices section of the wall outside my office and glance at them. Twelve times may yield nothing and the 13th may save you 2 hours of work!

Attached you will find a course outline that lists the topic and associated reading for each week of the course. After the initial tools section is completed, I will no doubt shuffle the order of some of the remaining topics depending on your own interests and capabilities. When I do this, I will hand you a revised course outline that reflects those schedule and reading changes. The list of required models for that week (including their point value) will be handed to you each Wednesday on a separate sheet(s) (i.e. a model assignment sheet). Preliminary work on the final project will begin before or just after the Fall break.

I continue to be excited by the prospect of teaching this course. Let us all put some hard, steady work into it and I am certain that we will profit greatly from it.

Remember, when in doubt....

Always check the posted Biomodeling notices outside my office door!
