Advice for aspiring Biology students:

Tried everything and nothing is working?

Question: I was wondering if you could give me any advice, beyond the advice page on the biology website, on how to improve my performance in biology. I have read everything, I do the problem sets multiple times prior to each exam, review the lecture notes multiple times prior to each test ... and yet I am receiving scores quite below the mean. Short of getting a tutor, I can't think of anything else to do to prepare myself for these exams. If you could please help, I would really appreciate it.
Answer: Most of the standard advice is on the advice page. (If you read it at the start of the term, or before the first exam, you might take another look at it. The advice sounds entirely different after you've taken an exam.) But I'll give it another try. It sounds to me as if you are spending a lot of time but not doing the right things, at least not entirely. Some suggestions:

1. Go over the notes of the previous lecture before the next. That way the current lecture makes more sense and you get more out of the class time.

2. Go over the notes right after each lecture, preferably with a friend. (If you wait too long, all you have is what you wrote down. If you do it right away, you can recall the parts you didn't get down completely.) Ask each other (or yourself) -- if I get the point, did I get the supporting details straight? If I got the details down, so what was the point? I do not recommend recopying notes, although some people find it helpful. I think either recopying or transcribing tapes is much too time consuming to be worth it. HOWEVER, going over your notes carefully is well worth it. Fill in the holes, add notes, etc. (Listening to a tape for this purpose may be worth it for some. Doing it with a friend is probably faster and more efficient, especially with the aid of the web notes.) Some people recommend deliberately leaving the left third or so of the page blank and using it to supplement, annotate, or summarize your actual notes afterwards.

3. Don't spend hours reading the books wholesale. Skim one before hand if it helps you follow the lecture. Read sections that cover material you didn't get in lecture or find lacking when you try the problems. Go over the diagrams -- these are often more helpful than the text. They often summarize a lot of stuff in one concise picture and are much nicer than our handouts. (Note: Some people learn better from books than from lectures, and/or need the book to get the big picture. If you are one of these people, careful reading of the texts may

be well worth the time invested. But many other people do not get much benefit from reading the texts and just do it because "you're supposed to."

4. Try to organize the material in some way that suits you. Make diagrams, charts, tables, figures, etc. Ours are good, but ones you make yourself are often better. Be sure you know where the details of any particular topic fit into the big picture. Then be sure you know the details of any particular piece. There are experts who swear that organizing the material is the key to success. If it isn't organized in your head, you can't retrieve and use the pieces you need at the right time.

5. Some people have trouble because the material doesn't seem "real." It seems very philosophical and non concrete. The processes are memorized, but not understood. If you don't have a "feel" for the situation, you can't extrapolate and figure out what will happen if you add this inhibitor, continue longer, get a mutant, etc. Do your best using analogies, diagrams, etc. to get a better sense of what a process or situation represents. (Is it like cooking? Running a factory assembly line? Operating a thermostat?) Break the process down and build it back up. Ask yourself, as a way of testing understanding, "What will happen if I change some component? Block some step??" In other words, make up your own exam questions and answer them! What this comes down to is be sure to understand the material, not just repeat it. (See #8 below.)

6. When you explain things to yourself, or to others, try not to use pronouns. Use nouns instead. This may sound silly, but it really helps you to be sure that you understand what you are saying. If you use pronouns or vague terms you can fool yourself into thinking you understand when you really don't. An example: Suppose you say "The gene is transcribed and ***it*** goes to the cytoplasm and is translated, ***which*** uses tRNA and mRNA." What do you mean by ***it*** and/or ***which***? Is ***it*** the gene or the mRNA? Does ***which*** refer to translation or transcription? Sometimes you know, and you are just using shorthand. But sometimes you don't know, and you don't even realize it until you are forced to pick the right terms to replace "it" and "which." So try to be as specific as possible instead of as vague and as general as possible. Being specific has multiple advantages. It helps you to learn, it helps listeners understand what you are saying, and it helps graders on exams know that you really understand what you are talking about.

7. There are problems listed in the lecture notes after each major topic. Try to do at least some of these problems as you go along. Trying to do a whole problem set at one sitting can be intimidating and overwhelming. You may find

it easier to do the selected problems after you review each section of the lecture. Of course this will work the best if you review the lectures regularly, after each class, or at least once a week. (See tips #1 & #2.) You'll want to do all or most of the problems in every problem set, including the ones not mentioned in the lecture notes, but it may be easier if you spread the job out.

8. Be selective about memorization. Memorize the vocabulary you need, as soon as possible, but don't memorize wholesale. You do not have to memorize most pathways, mathematical formulas, molecular structures, etc. You have to recognize and use many of these formulas, structures and pathways in context, but you don't have to reproduce them from memory. If you find yourself memorizing large chunks of material, you should think twice before continuing. You are probably memorizing too much, because you are afraid of leaving out something important. It may be an indication that you do not understand the material well enough to recognize what is important and what is not. You do need to *understand* everything, but you only need to memorize a little of it.

Too much emphasis on memorization tends to correlate with a low level of understanding (and a low grade in the course). There are several possible explanations for this. It may be that it takes so long to memorize the material that there is not enough time left to learn how things work. However, it seems more likely to me that memorization can be easily mistaken for understanding. Once you memorize a pathway you think you understand it, so you don't bother to learn enough about how it works. It is more important (in this course) to learn the underlying mechanisms than to memorize the details. It may sometimes be necessary to do both, but don't stop at the memorization step. It's probably better to start from the other end and try to understand how things work first. Once you understand, you may find that there isn't much that has to be memorized, and what must be memorized now 'sticks' relatively easily because you can put it in context. (See #5 above.)