

Post-exam Analyses.

Many of the exam questions I write are challenging because they ask you to integrate information (a) to analyze a situation and solve a problem--sometimes using, for example, mathematical methods of probability or formulas for biological events, (b) to recognize a specific genetic system from some critical clues, (c) to predict outcomes when I tell you that some part of a biological system was defective in a particular way (for example, a tRNA missing), (d) to link more than one concept to solve a problem, and (e) least frequently of all, to simply identify a definition or recognize a fact or principle.

Many problems on the exams are designed to reflect the kinds of tasks involving biological information in 'careers of the mind'. This includes careers in business, medicine (M.D., D.D.S., D.V.M), biological or biomedical research, and law. It is important to understand how to do this kind of problem solving with biological information. To do so, you need to memorize and understand biological systems, **and also** develop your skills to solve problems with them.

You can get better at these skills. Some of you will get **MUCH** better at these skills.

How can you use an exam to figure out how changing your study methods might help improve your skills? By doing your own **exam analysis**. Exam analysis is one of the best study skills you can learn. The six steps below offers one good approach you can use to analyze your own exam.

1. First, plan to analyze every question, and try to decide why you missed the questions you missed, **AND** for the questions you got right, why your answers were correct. Both matter just as much.
2. In this step, look at the questions you got wrong, and decide which of the following reasons explain why you missed it: (In some courses, you might want to modify these reasons or add to them.)
 - (a) You didn't recognize it was important to know/understand/work this kind of problem.
 - (b) You knew it was important, but you never did understand it, and hoped it wouldn't be on the exam.
 - (c) You knew this was an important topic or skill, you thought you understood it, but now realize that you didn't truly understand it.
 - (d) You knew it was an important, you understood it, but you didn't remember it (or remember how to do it) during the exam.
 - (e) You knew it was important, understood it, remembered it, but you made mistakes in applying it (or couldn't do it fast enough) during the exam.

(It is simplest to just mark these letters in the left margin next to each question.)

3. Next, examine the questions you got correct, and decide whether,
 - (a) You didn't know it was important, just guessed, and got it right.
 - (b) You knew it was important, but didn't really understand it (& hoped it wouldn't be on the exam), but guessed right.
 - (c) You knew it was important and thought you understood it but now realize you didn't, and just happened to guess right.
 - (d) You knew it was important, understood it, but didn't remember it (or didn't remember how to do it), but guessed right
 - (e) You knew it was important, understood it and remembered it, but actually made mistakes in applying it, and (luckily) happened to get it right anyway.
 - (f) You knew it was important, understood it, remembered it, and applied it correctly.
 - (g) (Also include: you didn't think it was important, but you happened to remember it anyway and apply it correctly.

4. Now for **ALL** answers, total up the (a), (b), (c), (d), (e), (f), and (g) answers. If you have many:
- (g) Answers -- you might save some study time if you could get better at identifying important topics.
 - (f) **Answers -- GREAT!** You're doing things well. Keep doing the same things. However, there might be things you could do to study more efficiently.
 - (e) Answers -- you need to spend more time on practice questions. You might do this by finding pre-prepared study questions (in the book or elsewhere), or you might work at trying to invent your own questions (can be a very useful exercise, but it takes some practice to do well) and/or trade questions with study partners who need the same skills.
 - (d) Answers -- you need to spend more time (and probably some different methods) memorizing the things you've identified as important. Use the kinds of memory exercises we've talked about or find memorization methods at the Study Skills Center or in books or elsewhere
 - (c) Answers -- you need to get better at knowing when you truly understand something. You might try testing your understanding by explaining things to study partners (but they **MUST** understand that point, or it won't help you), by trying to explain things to profs during review sessions or small group meetings, by trying to invent your own questions that would test these concepts (if you have trouble doing this, it suggests that you truly don't understand that topic well enough).
 - (b) Answers -- you need to realize that you need to devote more time to reading notes, attending review sessions (or class, if you ever skip class), reading the book, and **thinking** through the material. Reading and re-reading notes or the book won't help unless you actually think through the logic.
 - (a) Answers -- you need more practice at identifying things that are important to understand a topic. You need to make lists of important concepts (and perhaps test them by asking us at review sessions or other meetings about whether we agree with your listing). You might want to rank things on your list in terms of such as, 'Essential and fundamental to the entire course' (if you don't know them, you can't understand major parts of the course), 'Essential and fundamental to one major topic', 'Essential for a major topic', 'Important for a major topic', 'Good example for a major topic', 'Important for a minor topic', 'Good example for a minor topic', 'Important only for itself', 'Unimportant'. Is the professor offering clues? How much time did you spend on a particular topic, and/or how much was it emphasized, and/or how often does the same concept crop up? Do previous exams (from the same semester, or from previous years) help you determine how tests are structured & what is important? Is the professor testing using an 'over-learning' approach, in which case fine details matter a great deal? Do exams focus more on particular skills? How important are definitions relative to synthesis or analysis? How important are particular problem solving skills?

Attending class can help with any of these, but notice that if you skip class, it's the a & b answers above you're most likely to have problems with!

5. As your next task, evaluate the **kinds** of questions you missed and got correct. Did you miss a higher proportion of any kind of problems? Mostly math-based questions? Meiosis and mitosis? These can suggest areas in which you need to focus more (or less) time.
6. Next, make a list of **ALL** the questions on which you made an 'informed guess'. These are questions for which you could rule out all but two answers, and you had to guess between those two. Then count up how many you got right and how many you got wrong.

- (a) If you got half right and half wrong, then that particular exam was an accurate measure of what you could do at the time of the exam.
- (b) If you got more right than wrong (you might be delighted), you actually should be nervous--it means that you didn't know this material as well as you thought. On the **NEXT** exam, if you're equally well prepared, you'll probably do worse.
- (c) If you got more wrong than right (you're probably annoyed), then you should actually feel a little better about the next exam. If you're equally well prepared, you'll probably do better.
- (d) Now that you know a little probability,
What are the odds that if you guessed between two choices on six questions, you'll get all of them right? [$1/64$, or 0.015 ; You might recognize that this is a binomial expansion problem.];
What are the odds that you'll get exactly half correct? [$3/16$, or 0.3125]
What are the odds that you'll get at least three of the six correct? [$1/64$ of getting all correct, $6/64$ of getting five correct, $15/64$ of getting four correct, and $20/64$ of getting three correct; they're mutually exclusive, so use the sum rule, and the probability is $42/64$, or 0.656]
[This applies to many other events in life as well--what is the probability that a 70% free-throw shooter who shoots 8 free throws in a game will have a game in which he/she hits all 8? What is the probability that they'll attribute their 8 straight baskets to skill rather than chance?]
7. Also evaluate the proportion of questions on which you guessed. A common principle of test design, and one I often use on questions, is that some of the questions are structured in such a way that if you understand the concept but can't apply it well, you would be guessing between two or sometimes three choices, while if you both understand it **AND** can apply it well, you would be fairly certain of the correct answer. As a result, someone who knows the material very well would get almost all questions correct. However, someone who understood and remembered the concepts but couldn't apply them as well would guess much more often, on average would miss about half of those, and get a lower score.
On most multiple choice exams, even the students who know the material the best still have to guess between two choices on **at least** a few answers. Students who know this material less well will need to guess between more questions.
8. Last, some questions on a particular exam may truly be too hard to answer. On exams that are designed to test your synthesis and analysis skills, this happens at least occasionally. As a professor, I can tell that it has happened, for example, when only 20% of students are correct on a multiple choice question that has five possible answer (if everyone guessed among all four answers, 20% should get it correct by chance). This suggests to me that few or no members of the class actually knew the answer, and the rest guessed. It also implies to me that I made a mistake in my teaching method somewhere. It may be that I didn't emphasize some part of that question strongly enough, or even taught the wrong thing. This has been very rare for me, but it has happened--if you didn't already realize this, I'm certainly not infallible! Alternatively, the wording of the question may have been unintentionally misleading. Perhaps most of the class read some key word and immediately leaped to a wrong assumption, without actually thinking through to the correct answer.