

## **BIOLOGY STRATEGIES**

### **Make learning a daily routine.**

1. Repeat study over several shorter periods over different days. Study the material weekly, not just before tests. Leave plenty of time between study and self-testing so you're not just testing short-term memory and repeat until you know that you can always get them right.

Well before an exam, take a subset of the material and study it as if the exam on that topic was tomorrow. Finally, whatever you do, whether alone, with the peer study partner, or in groups, don't put it off until the night before the exam.

2. If your professor provides materials ahead of class (e.g., lecture outline, PowerPoint) get them and use them to guide your note-taking.
3. Flesh out notes in 24-48 hour cycle. "Note Massage"
  - After lecture add to, or rewrite, your notes while the scribbles still make sense. Do it regularly as a part of a formal schedule or you won't do it at all. Use complete sentences; add labels and notes to diagrams even if you think they're quite clear already; try to organize things into categories to show relationships.
  - Get all the missing holes filled. Use other students, your text, and your professor.
  - For topics which you do not fully understand, get explanations. Don't wait until close to the exam to fill in this understanding. Get it now. Before the test you need to be studying with a higher level of understanding.

### **Study to understand, not just to memorize words.**

1. Don't just read over your notes and PowerPoints. If all you do is read your notes, the text, and the PowerPoint, then you'll gain only a passive familiarity with the material. You want to be able to recognize elements of what you know when you see them in new situations and be able to explain it to others.
2. When trying to learn the material, focus on the right stuff. The things that your professor considers most important to the subject and which are most likely to appear on quizzes and exams are the things that have been emphasized in lecture and in specifically assigned readings. Learn these things first and best.
3. You should practice explaining the material and applying it to new situations. Why should you this? Questions sometimes pose entirely new situations, which you need to analyze – even though you've never seen that situation before.

Suppose, for instance, you've learned a lot about a certain forest ecosystem in class. And then on the exam, the professor doesn't ask a thing about the forest, but instead puts you in the middle of the desert, acquaints you briefly with certain of its inhabitants, and asks you complicated questions about their relationships to one another. If you really know your way around the ecosystem you were given (the forest) – know about its energy and nutrient flow, its inhabitants' adaptive strategies, etc. – then you will be better prepared to see familiar patterns in this strange new situation (the desert). You know in advance that there's a food network of

some sort – that it will be like that in the forest in some ways, etc. You end up understanding a bit about the desert ecosystem not because you memorized it (indeed you've never encountered it before at all), but rather because you know the forest ecosystem so well that you now can think beyond just that.

But the only way to be sure in advance that you really know the given system well (the forest) is to practice explaining what you know.

4. Learn individual concepts before integrating it together.
  - You need to have content learned and understood before you can go to the next level of understanding by integrating the information.
  - This is one reason it is so important to turn around your notes quickly and answer any fact and detail questions right away.

#### **Use active study methods.**

1. Map out all connected material. Try to see how disparate lecture topics are connected. How does a concept or process tie to a larger picture? How does new material build off of prior course content? How could it be built on later?
2. When explaining causal connections, it's important to build a logical and adequate chain of connection between the initial cause and the final effect. For instance, if you were asked to explain why carbon monoxide kills, you might answer, "Because it stops respiration." That might be adequate in casual conversation, but it isn't normally enough on an exam.

There are too many questions left unanswered. "How does CO inhibit respiration?" "Why does the stopping of respiration lead to death?" Depending on the course and the level of detail normally employed in it, you might well be expected to offer an answer more along the lines of the following: "CO binds to hemoglobin, inhibiting its ability to carry oxygen from the lungs to the tissues. Oxygen is required as the terminal acceptor of electrons in the respiratory electron transport system, which then ceases because oxygen is absent. Without respiration, no ATP is generated. And since ATP is the form of energy needed by numerous energy-requiring processes essential to life, these processes cease, and death ensues."

Notice how many logical links between CO and death profitably can be employed. Some courses, depending on emphasis, may require fewer than these; some might require more. It's up to you, of course, to gauge what's appropriate for the course that you're in. To form the habits and instincts of offering "complete" answers, become more like the pestiferous child who replies to every statement with the question, "Why?" It will help your thinking immensely.

3. Practice coming up with questions that a professor could ask on course material as well as practicing and refining answers to those questions. Exams in college are the worst possible place to get feedback for the first time. You need to test yourself frequently to truly gauge how much you comprehend.
  - When testing your understanding, make yourself give clear, accurate, brief, but complete explanations, entirely from memory.

- If working in a group, start by agreeing upon representative questions, then take turns answering them, while others point out what answers are especially good and what answers need improvement.
- If studying alone, write out what seem to be good answers, based upon your notes, and then put those answers aside for a while and see how well you can reproduce them from memory.
- Do the same thing with any diagrams or figures covered in class to make sure you can recreate them from memory with all the key parts and steps labeled, and their function and significance stated. Even if you don't have to create a diagram or figure on a test, practicing it from scratch will help you to understand the material better.