Inspiring Students to Study Successfully for the Sciences

Use with STUDY TIPS for SUCCESSFUL SCIENCE STUDENTS and
Studying for the Sciences: MISCONCEPTIONS & ANTIDOTES

Undo underperformance and stomp out science-oriented apathy stemming from inexperience, fears or misconceptions students have for learning science. Help your students develop effective interactive studying, exam savvy, and time management skills.

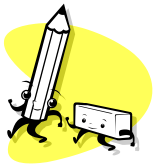
Set a goal to replace study skill insecurities with **curiosity** and **confidence** about content mastery by interacting with material and thinking critically while studying.

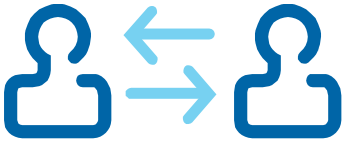
Stay Calm & Study On

Select 1-2 techniques that fit best with their learning style, your presentation methods, and scheduling realities. Do not try to use every technique for all classes.

A Note about NOTE TAKING: An ounce of prevention is worth a pound of cure. Before diving headfirst into heavy content, start your term with an upbeat, well-paced review of effective note taking.

1. Give a 3-5 minute mini lecture on an unfamiliar (but not utterly mind boggling) topic. Ask students to take their best notes. As in every lecture, keep a good pace, inject humor, and give meaty and relevant content. End by asking one question that requires applying details from the mini lecture. Can anyone answer it by using their notes? If so, what elements of their notes support the answer?
2. Ask the class (use clickers or similar): How long are your notes: ¼, ½, 1, or 1+ page? The average student takes ¼ to ½ a page of notes for every minute of lecture. Yet, in most introductory science lectures, the rate should be 1+ page for every minute. Do not deliver this message with the voice of doom or criticism. Convey hope; a bump up in note taking can boost understanding (and the GPA).
3. Dissect a sample of quality notes (yours or a past student's) with the group. Point out how successful note takers:
    - Preserve the lecture's outline structure.
    - Use lots of abbreviations (real or created by the student).
    - Sketch the diagrams! Don't just rely on transcribing words.
    - Write down sample questions that seem test-worthy.
    - Don't filter as they listen but sketch or write down EVERYTHING.





Share the handout **STUDY TIPS for SUCCESSFUL SCIENCE STUDENTS** with your classes. Specific tips include effective ideas on Rewriting Notes, Flash Cards, Table of Contents, Concept Maps, Blank Paper, and Office Hours.

Review **STUDYING for the SCIENCES - MISCONCEPTIONS & ANTIDOTES** sometime in the first week of class. Refer back to it often.

Professional Input - These tips are based on a presentation at the Introductory Biology Project 2012 Summer Meeting (Washington, DC) by Doug Gaffin and Marielle Hoefnagels of the University of Oklahoma (UO) http://ibp.ou.edu/hidden/ibp-summer-conference-implementing-vision-and-change-at-the-introductory-biology-level. See other tips and techniques from Marielle at http://faculty-staff.ou.edu/H/Marielle.H.Hoefnagels-1/index.html.

Professional Action - More professional development inspiration is available from the Action Centers http://uc.ou.edu/action at UO. Action Centers are faculty-directed, out-of-class sessions designed to "help students take action think deeply and critically. To learn how to set up Action Centers on your campus contact studentlearning@ou.edu.

American Society of Plant Biologists

Study Tips for Successful Science Students

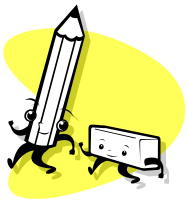
Stay Calm & Study On

Set a goal to replace study skill insecurities with **curiosity** and **confidence** about content mastery by interacting with material and thinking critically while studying.

Select 1-2 techniques that fit best with your learning style, instructor's presentation methods, and scheduling realities. Do not try to use every technique for all classes.

NOTE TAKING - The average student takes ¼ to ½ a page of notes for every minute of lecture. Yet in most introductory science lectures, the rate should be 1+ page for every minute. A bump up in note taking can boost understanding (and GPAs). Successful note takers:

- Preserve the lecture's outline structure.
- Use lots of abbreviations (real or created by the student).
- Sketch the diagrams! Don't just rely on transcribing words.
- Write down sample questions that seem test-worthy.
- Don't filter as they listen but sketch or write down EVERYTHING.



REWRITING NOTES - Simple can be effective. Rewrite the information clearly and in familiar, correct terms before the next class. This critical step moves new information to long term memory and links it to previously-mastered content. Successful note rewriters:

- Don't cram rewrites onto classroom notes pages. Use a new notebook or paper.
- Translate phrases into clear terms. Rewrite all abbreviations into full words.
- Use the textbook or slides to add any missing information to the notes.
- Add the textbook chapter and page numbers that relate to the notes, especially for diagrams.
- Redraw figures to match detailed images in the textbook or slides.
- Put question marks in the margin to show where help or additional clarity is needed (from further reading or a teacher meeting)
- Color code to help organize. Use colors consistently.

Short on time this week? Write one sentence at the bottom of each page of notes to summarize the page's content. *This should only occasionally replace full re-writing*.

Rewriting by hand fosters a deep connection to content. Plus, it's easier to add/update diagram sketches on paper. Rewriting with the computer facilitates searching back for specific terms or linking to online information. Do what works best for you. Change it up, as needed.

TABLE of CONTENTS - Use textbook organization to review for exams later in the term.

- Copy the Table of Contents to reaffirm the course's structure & major concepts.
- Cross out titles and headings referencing any topic that was NOT covered in the course. Do not be overzealous! Verify with the class syllabus, your notes, or during office hours.
- Rephrase all the subheadings into your own words.

FLASH CARDS

It's fine to use them to master basic vocabulary. Also use them for these effective techniques:

- Use your notes to create a process-oriented question (e.g. 'How does xyz occur?' or 'If this occurs, then what happens?'). Write questions on the front of cards and answers on the back. The act of asking and answering alone is effective studying.
- When self-testing with the cards, write the answer on a different piece of paper to make sure you RECALL (not just recognize) all information. Then you can peek at the answer.
- Create more cards as your understanding deepens. Add cards that have follow-up questions based on what thoughts get triggered when you review notes or answer existing flash card questions.
- Take a stack of cards and lay out a map to connect them all (see Concept Maps, below).

CONCEPT MAPS

Your brain masters new information by linking together and organizing increasingly complex bits of data, experience, and skill sets. Concept maps mimic this network-building by drawing lines to link terms with phrases that explain connections. Concept maps represent deep thinking; they can be hard to do at first. Start small and bulk up as the term progresses. Build concept maps with the information in reading notes or rewritten lecture notes. To build a concept map:

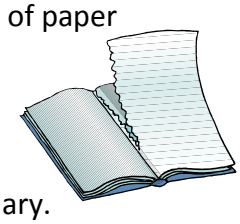
- Identify key words from a lecture or segment of information. First try ~5 words for a chapter section. Soon try to map an entire chapter on one page (~50 words). Write small and aim to build tight links.
- Write term one on a clean sheet of paper.
    a. Place a 2nd term nearby. Link the terms with a line and a phrase explaining their connection. Consolidate multiple connections or select the most prominent connection to explain the relationship between the terms.
    b. Repeat for the next term. It could link to just one term or both.
    c. Stop halfway through the list of terms. Does your brain hurt? Good! You are studying effectively and learning.
    d. Use up all the terms.

- Create an entire poster for the class.
- For group study sessions, have each person place at least one word in the map and explain the connection. Usually, the terms placed last are the harder concepts and merit extra consideration. The group can work together to place the last terms.

Concept mapping on paper may be best if you are a hands-on learner. Digitally inclined learners could try CmapTools (very basic maps, easy, free); MindMapper (flexible, fee-based w/free 21-day trial); or SimpleMind (iPad app, easy, free basic version).

BLANK PAPER

Grazing over familiar terms and scanning diagrams may offer some benefits, but they are not the same as thinking critically and making connections. So before studying degrades to little more than a blank stare, put away the pile of notes and cards, get out a blank piece of paper and try this:



- Select one well-executed graph/figure. Analyze it for a few minutes.
- Put it away.
- Reproduce it on a white piece of paper and then write a 2-4 sentence summary.
- Keep doing it. Use a new blank sheet of paper with same graph/figure until you can put all the elements into place correctly.
- Repeat for other graphs/figures.

OFFICE HOURS

They exist for a reason. Even if confidence and grades are high, go at some point early in the term and:

- Review at least one of your concept maps with your teacher or TA. Adjust and expand connections per your interactions.
- Ditto for at least one set of flash cards.
- Analyze a test. After a test has been reviewed in class (if it is) and you still have questions, seek out individualized explanations. Not only do you want to learn where you went wrong, but perhaps more importantly, you want to ask how to use the old test to improve your studying for the next test.

Don't undermine all this effective studying!

Ask your instructor about:

STUDYING for the SCIENCES - MISCONCEPTIONS & ANTIDOTES

American Society of Plant Biologists
Cultivating a better future through plant biology research

15501 Monona Drive, Rockville, MD 20855 USA • Phone 301 251 0560 • Fax 301 279 2996 • www.aspb.org

STUDYING for the SCIENCES
MISCONCEPTIONS & ANTIDOTES

Misconception 1: One or two hours of study time per week is fine for introductory science classes.

Antidote: Guard study time! Intro science classes demand ~2 hours of study time for every ONE hour of class time. Study chunks of data or flash cards on bus rides, practice sidelines, lunch lines, etc.

Quality Time

The 1:2 class to study time ratio has become 'common knowledge' on many campuses. It also commonly triggers an automatic scoff or wail from many students. It may be best just to emphasize guarding quality study time over adhering to the ratio.

Misconception 2: Copying and saving PowerPoint slides is the same as taking notes.

Antidote: Yes, save the PPT slides but try to ignore them during class. Take notes as if you won't see the slides ever again (e.g. the teacher doesn't provide them anyway). Jot down the slide number in the notes to verify and clarify when you rewrite your notes or read the textbook.

Misconception 3: There's no such thing as too much reliance on PPT slides.

Antidotes: As the term passes, everyone gets tempted to race through a PPT presentation to 'cover everything.' And sometimes it's a practical necessity for larger classes. But it's not the best way for students to delve into content. If at all possible, use class time for interactive learning and pass out the PPT slides at the end of class. If students must rely on PPTs during class, then try these antidotes:

1. The 'cloze' method can open doors. Cloze-based PPT slides each have blank spots for key terms, phrases, and graphic models that students must fill in as you go. Using basic cloze formatting helps build memory networks or concept maps. You can increase the impact of cloze by using each blank as a cue to pause your lecture and ask a question or trigger a debate so the class can help supply the missing information. Your goal is to keep the meaty exchanges coming. Do not let cloze degrade to mindless copying.
2. Lectures with PPT should be laser-beam focused and end in ~15 minutes. The rest of class time can be spent on interactive learning (i.e. Process-Oriented Guided Interactive Learning (POGIL) http://www.pogil.org/) or techniques from UO's Action Centers http://uc.ou.edu/action.
3. Test questions will not come only from the lecture's PPT slides yet many students dismiss anything not on a slide as off-script. The 'extra bits' (e.g. application samples, current events, personal experiences) you share between slides should serve to deepen content mastery or critical thinking. So give these 'bits' pride of place in your PPT presentation. This will train students to understand how and why application, current events, and person matter.
4. See ASPB's *Teaching Tools* for other PPT-based interactive learning options – http://www.plantcell.org/site/teachingtools/teaching.xhtml.

Many of these tips are based on a presentation at the Introductory Biology Project 2012 Summer Meeting (Washington, DC) by Doug Gaffin and Marielle Hoefnagels of the University of Oklahoma (UO) http://ibp.ou.edu/hidden/ibp-summer-conference-implementing-vision-and-change-at-the-introductory-biology-level.