**Active Learning Resources**

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*These resources were compiled for a June 2017 talk on Active Learning to Stanford Postdocs*

**Papers Discussed in the Talk**

Freeman, Scott, et al. "Active learning increases student performance in science, engineering, and mathematics." *Proceedings of the National Academy of Sciences* 111.23 (2014): 8410-8415.

<http://www.pnas.org/content/111/23/8410.full>

Marrs, Kathleen A., and Gregor Novak. "Just-in-time teaching in biology: creating an active learner classroom using the internet." *Cell Biology Education* 3.1 (2004): 49-61.

<http://www.lifescied.org/content/3/1/49.short>

Smith, Michelle K., et al. "Why peer discussion improves student performance on in-class concept questions." *Science* 323.5910 (2009): 122-124.

<http://mcdb.colorado.edu/files/pubs/19119232.pdf>

Vision and Change in Undergraduate Biology Education.

<http://visionandchange.org/>

Integrating Concepts in Biology. Campbell, Hyer, & Paradise. Trunity.

<http://www.trunity.com/trubook-integrating-concepts-in-biology-by-campbell-heyer-paradise.html>

Learn more about how we’re redesigning Intro Biology at SJSU: <http://www.sjsu.edu/biology/assessment/introductory-core-redesign/index.html>

**Digital Resources I Use in Neurophysiology:**

**My Flipped Lecture Videos:**

<https://www.youtube.com/playlist?list=PL7HSA1eDpu-HNpokXx6mhP1QtRCZw3Qy5>

**Swimmy:**

Free virtual lab where students elucidate a central pattern generator circuit. You can sign up for a faculty account and get solutions, teaching tips, etc.

<https://mdcune.psych.ucla.edu/modules/swimmy>

**Neurons in Action 2:**

Simulations using Neuron software, $50 for book, or $25/site license. Many people have used this software and share lesson plans, questions, etc. Also has a history section and classic papers.

http://neuronsinaction.com/home/main

**Dancing Cockroach Leg (great 1st day activity):**

http://www.lifescitrc.org/resource.cfm?submissionID=7750

**Two examples of Neuroscience and Society Activity I use:**

Contact me if you want to see the lesson plans for Alzheimer’s Drug Trial and Concussions and the NFL

Correlation vs. Causation: <http://www.lifescitrc.org/resource.cfm?submissionID=9954>

How reliable is eyewitness testimony: <http://www.lifescitrc.org/resource.cfm?submissionID=9955>

**Mouse Party:**

Animation about the effects of drugs on the brain. Developed for high schoolers, but you can make it more advanced.

<http://learn.genetics.utah.edu/content/addiction/drugs/mouse.html>

**Digital Libraries**

**Biosciednet:**

Collections of peer-reviewed teaching resources run by AAAS. Includes many archives, including the APS archive.

<http://www.biosciednet.org/portal/>

**Life Science Teaching Resource Community (formerly American Physiological Society Archive of Teaching Resources):**

Peer reviewed teaching resources – I strongly suggest you submit any great teaching resources you generate.

<http://www.lifescitrc.org/index.cfm>

**Educational Resources in Neuroscience (ERIN). Run by Society for Neuroscience:**

<http://erin.sfn.org/>

**Brain Facts.org**

<http://www.brainfacts.org/educators/>

**National Science Digital Library:**

<http://nsdl.org/>

**Med Ed Portal**

Lots of peer reviewed materials, some non-peer reviewed, lots of cases, videos, etc. Targeted to medical education, but some look useful at the undergraduate level. You can even request videos and other material for free.

<https://www.mededportal.org/>

**Other Resources:**

**University of Buffalo Case Study Collection**

Great collection of peer reviewed case studies, includes teaching notes, handouts and slides that you can access with a nominal membership fee. Many of these have clicker-type questions built

<http://sciencecases.lib.buffalo.edu/cs/>

**Learn Genetics from University of Utah**

Other resources from the makers of mouse party. Info sheets, animations, worksheets, etc.

<http://learn.genetics.utah.edu>

<http://teach.genetics.utah.edu/>

**UCLA Modular Digital Course in Undergraduate Neuroscience Education at UCLA:**

Other virtual labs including a Gel Scramble

<https://mdcune.psych.ucla.edu/>

**DNA Learning Center:**

[http://dnalc.org](http://dnalc.org/)

<http://bioinformatics.dnalc.org/alu/animation/pdf/pv92.pdf>

**Howard Hughes Medical Institute’s Virtual Lab Site**

<http://www.hhmi.org/biointeractive/vlabs/index.html>

**Chem Collective for virtual chemistry labs**

<http://www.chemcollective.org/>

**iLab Central**

<http://ilabcentral.org/index.php>

**Virtual Labs in Chemistry and Physics (supported by NSF)**

<http://matdl.org/virtuallabs/index.php/Virtuallabs>

**NCBI Databases for Protein, Genomic, Bioinformatic labs**

<http://www.ncbi.nlm.nih.gov/>

**Phet Simulations (University of Colorado):**

<http://phet.colorado.edu/en/simulations/category/new>

**Education Research Journals (often have lesson plans, etc):**

**CBE Life Sciences Education:**

<http://www.lifescied.org/>

**Journal for Undergraduate Neuroscience Education (JUNE):**

<http://www.funjournal.org/>

**Advances in Physiology Education:**

<http://advan.physiology.org/>

**Guide to BIOL 136**

Welcome to Neurophysiology. This course is taught using active learning strategies that you may not have encountered in your classes before. You will not be getting a lecture for the full class period. Typically we will spend the first half of class going over the reading that you did the night before and the remaining time working in groups on problems, case studies or discussing journal articles. I have designed this class structure based on evidence from the cognitive and education sciences into how people learn most effectively. There is a strong base of evidence that the more actively you work with the material you are trying to learn, especially by teaching it to others, the more long-lasting learning you will gain. This means that you will have to be an active participant in all course and homework assignments to get the most out of this class. ***Attendance in this and any class is an investment of both time and money and it is my job to structure this course so you can get the most out of your investment if you put in the proper effort.*** For this to happen, you will need to take control of your learning and give your best effort to all course assignments. Below are some tips for maximizing your learning and therefore your performance in this class. I have also explained WHY we do certain things in this course. Please feel free to ask me any questions in office hours or through Canvas.

Since you may not be as familiar with my style of teaching, I’ve compiled a FAQ for you based on questions/comments about my courses I have gotten in the past.

***I’ve done fine so far learning by sitting in lectures, what is the evidence that active learning strategies actually work?***

First off, I want to be clear that lecturing is not all bad—at some point you do want an expert to explain new content and in most classes I will spend time explaining the topics of the day. That being said, there is overwhelming evidence that you learn more when you have to actively struggle with new material, explain it to others and test yourself on it. Think about it this way, if you were trying to learn how to play basketball would you only want to listen to someone tell you about how to play basketball or would you want to get out there and actually practice? As Biology majors, though, you should want more proof than anecdotal data. There are hundreds if not thousands of papers showing that active learning strategies are more effective than lecture alone. If you only want to read one paper on this, I suggest Freeman, et al.’s 2014 meta-analysis in PNAS. In it they combined the results for 225 studies that compared active learning classrooms vs. straight lecture classrooms and found that student performance on exams and standardized concepts inventories was significantly better in the active learning classrooms and that students in traditional lecture only classrooms were 1.5 times more likely to fail than students in classes with active learning. You can read it for yourself to see if you are convinced: http://www.pnas.org/content/111/23/8410.full

***Why do we have online quizzes after every video? That seems like a lot of busy work.***

In order to most efficiently use class time, you will need to come prepared for class. That means that I want you to have tried your best to learn the material beforehand. You are more likely to consolidate new information into memory if you test yourself on it than if you only read the book or passively watch the video (For an example of the evidence of this statement see this 2006 paper by Roediger & Karpike: http://learninglab.psych.purdue.edu/downloads/2006\_Roediger\_Karpicke\_PsychSci.pdf).

***Why are the online quizzes due 2 hours before class?***

Another purpose of the quizzes is to help me understand what you have learned from the assignments and what you are still struggling with. This will help me to tailor what we cover during class so that we spend time on the most challenging material. This means we will spend our class time together more effectively.

***How are the online quizzes graded?***

Since I am using the quizzes to understand what challenges you are having with the material you get full credit for completing the quiz on time, regardless of your grade (with the caveat that if I feel the class is not taking them seriously I withhold the right to count them for credit). This means even if you receive a 3/5 on a quiz you will receive a 5/5 in your final grade if you have completed the quiz by 1pm the day it is due. If you complete the quiz within 1 week late, you can receive half of the credit. If you do not do the quiz you get 0 points.

***Why do we spend so much time working in groups?***

There is a saying that you only really learn something once you have taught it to others (also supported by lots of studies. See this short 2012 review article by Laal & Ghodsi: http://www.sciencedirect.com/science/article/pii/S1877042811030205#). Working in groups forces you to quickly confront what you do not know and helps you reinforce what you do know by explaining it to your other group members. Additionally, no matter what career path you decide to follow, you will have to work in groups at some point. It is important to get experience navigating group dynamics now and is in fact a learning goal of the Biological Sciences Department (i.e. one of the things we really want our majors to know when they leave us for the real world). If you are encountering interpersonal problems in your group, please come to talk with me about it.

***What tips do you have for using the videos?***

1. Focus on the learning goals for each video--determine whether you can do/understand the 2-4 learning goals per reading. If you cannot, make sure to note that on the last question on the online quiz and/or ask questions on the discussion board.
2. Do not just passively watch the videos--take notes like you would during an in-class lecture.
3. Take advantage of the fact that you can watch the videos or parts of the videos multiple times--Some people may want to watch it once to get a feel for the material and then watch while taking notes. The videos can also be used to watch specific portions again while preparing for the test.
4. Do not assume that watching the videos 10 times will make you an expert in the material--while you have the ability to watch the videos multiple times, that alone will not help you to learn the material. You must actively engage with the material by taking notes, answering problems based on the material, and testing yourself.
5. Take advantage of the captions and transcript--if you have trouble understanding what I am saying or prefer to read the explanation you have the tools to do so.
6. Take advantage of the ability to slow down or speed up the videos--You can set the optimal speaking speed for you.

***Why do so many of your exam questions ask us to design, evaluate or interpret experiments?***

If all you can do is memorize biology information you will not succeed in a biology career. Most information these days is easily available. It is more important for you to be able to critically evaluate evidence, interpret results and design ways to test new hypotheses. That being said, you need to have a base of knowledge before you can start applying your skills. I try to design exams such that 1/3 of the points test your knowledge and comprehension of the material and the rest on your ability to analyze and apply that knowledge to new situations. If you are struggling with experimental design questions the best advice I have is to keep practicing. Alter the experimental design questions in your problem sets or on previous exams slightly and use those new questions to practice.

**Biol 136**

Swimmy Lab Group Contract San Jose State University

Due April 11, 2013

**Turn in this contract by April 11th. If the contract is not received by then, your group will lose 5% points on the Swimmy Lab Report.**

***If you are having interpersonal problems working together this should also be addressed as soon as possible.*** If any member of the group is not fulfilling their portion of the assignment as mapped out in this Groupwork Contract, it should be brought to Dr. Wilkinson’s attention as soon as possible. After the lab report is turned in, nothing can be done to address the fact that all students did not contribute equally. One of the learning goals of this assignment is to teach you how to work together to create a product, in this case a lab report. Group work can be challenging, but in practically any career you choose this is an important skill.

**Group Member Names**

**How is Responsibility for the Swimmy Lab Going to Be Divided Among Group Members? (i.e. what tasks will each group member take primary responsibility for?)**

**When will a first draft of all items be shared between group members?**

**By what date will revisions made to this first draft be accomplished by?**

**What competing deadlines does each group member have? Make sure to discuss how these will be worked around.**

By signing below, you are agreeing to participate fully in the group, complete your tasks for this assignment on time, and participate professionally (i.e. trying to work out differences civilly and adhering to academic honesty standards).

|  |
| --- |
| Group Member #1 |
| Group Member #2 |
| Group Member #3 (if applicable) |