

How Real-world Problems Enhance Motivation in Students and Teachers



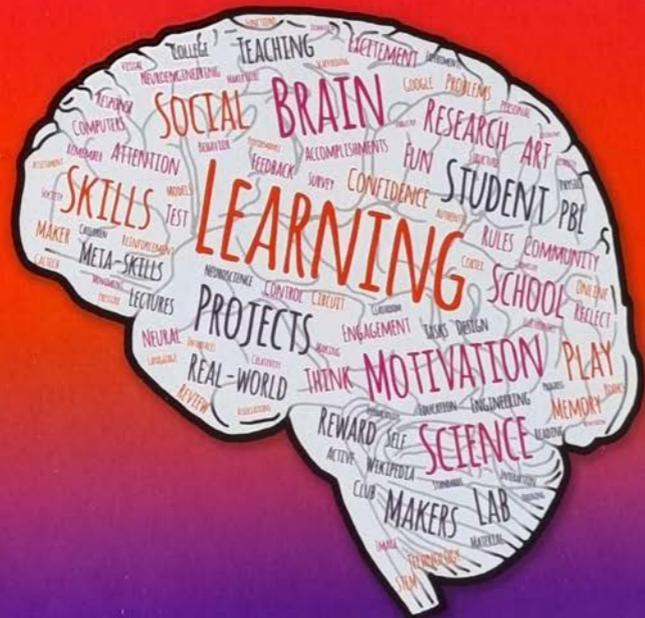
Steve M. Potter, PhD
Adjunct Associate Professor
Coulter Department of Biomedical Engineering
Georgia Institute of Technology
and Emory University School of Medicine

Outline of my talk:

- **PROJECT-BASED** learning motivates students.
- **Visible** and **enduring** projects from two of my courses.
- Student testimonials about my Real-World curriculum.
- Ideas for how you can make **your** courses real and highly motivating.

My new book

How to Motivate Your Students to Love Learning



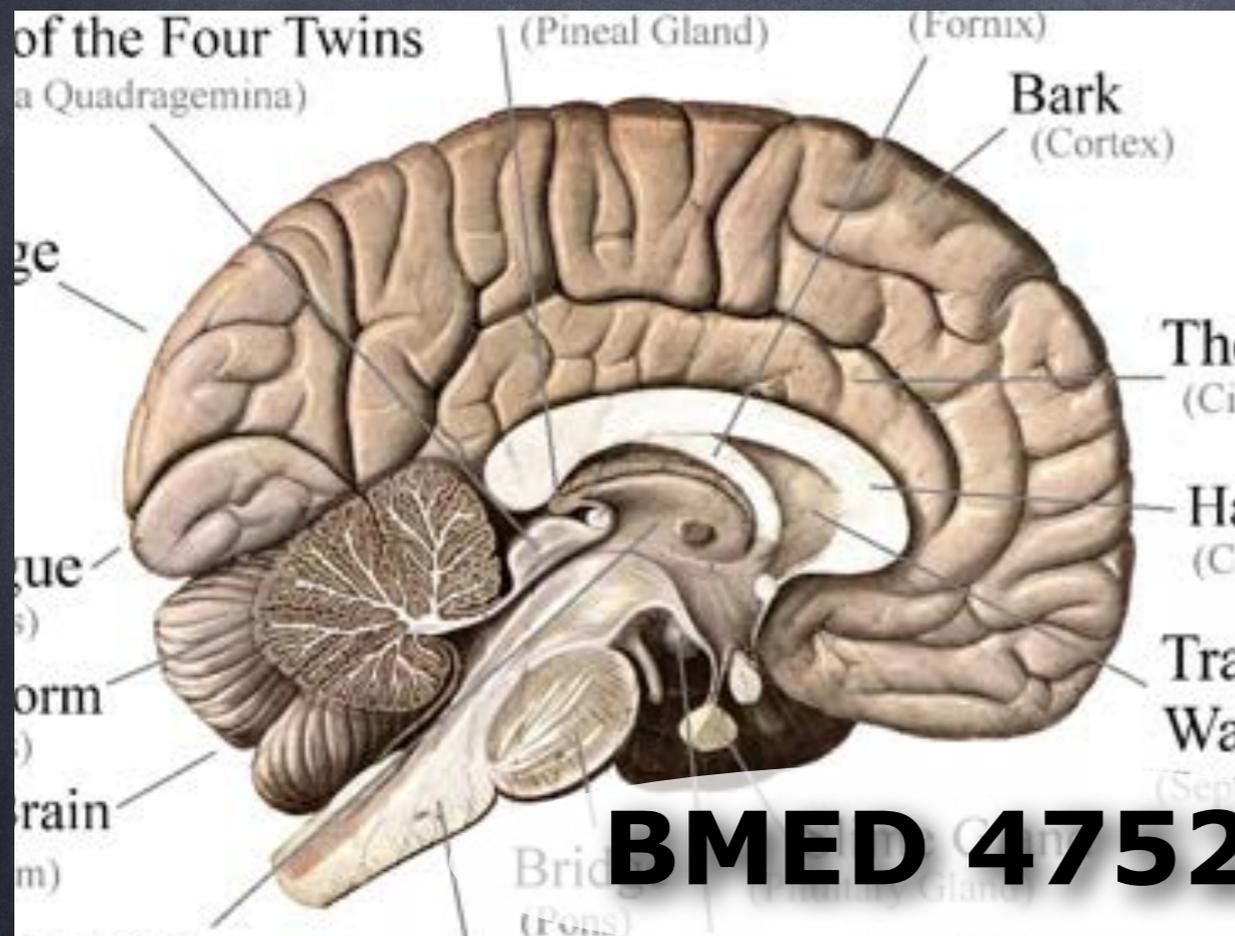
Steve M. Potter

Specific advice for
teachers at all levels,
mixed with
my personal story

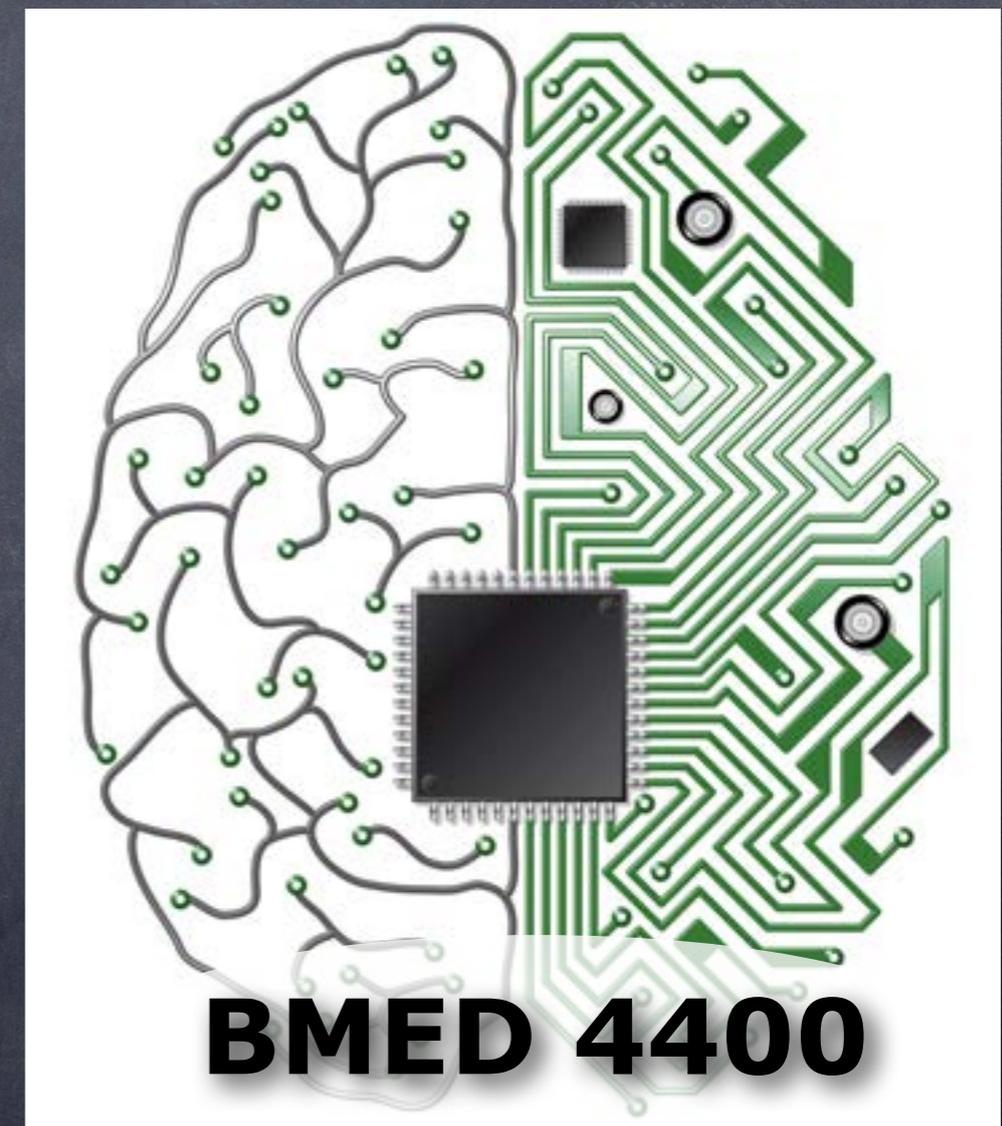
[- Amazon link -](#)

My Real-world courses at Georgia Tech: Introduction to Neuroscience and Neuroengineering Fundamentals

Neuroscience...

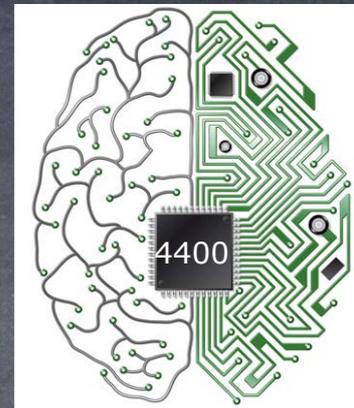


...Applied neuroscience

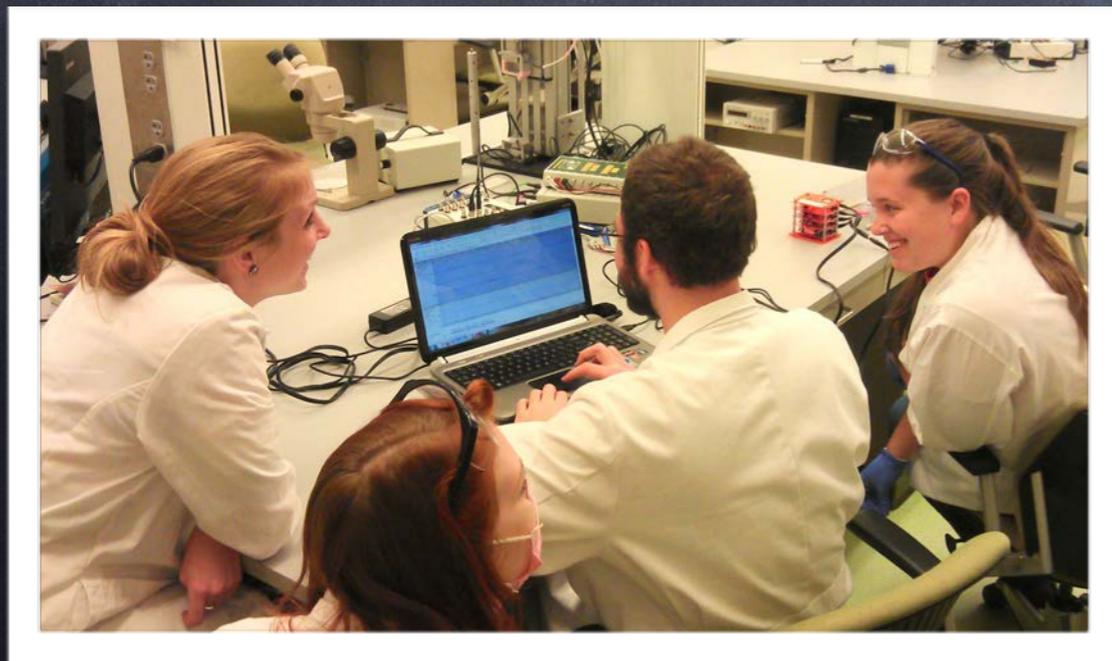


Neuroengineering Fundamentals

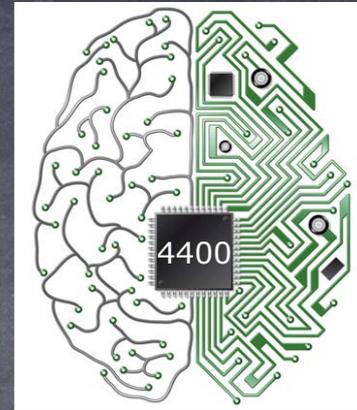
BMED4400 Lab + lecture



- Goal: to be a microcosm of the grad school experience, jammed into one semester.
- **Project-based** lab class: students researched the literature to come up with a real, semester-long project they can do with the equipment available. (Multi-electrode array neural cultures).

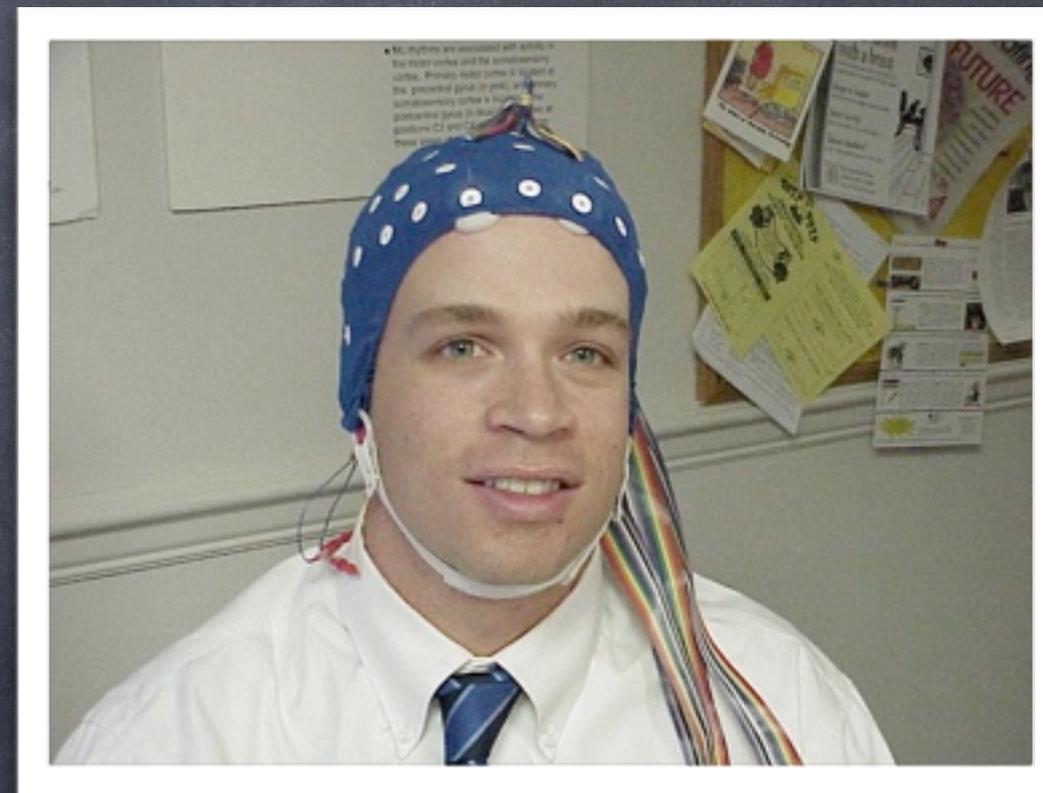
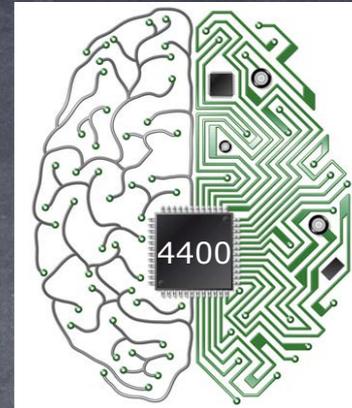


Neuroeng. Fun.: Real-world aspects

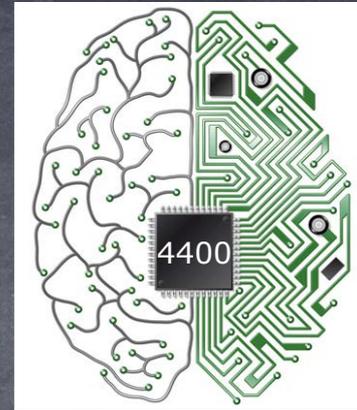


- Guest lectures from local and distant experts in neuroengineering. (e.g. Michael Chorost on cochlear implants)
- Plan and execute complex group project with lots of iteration, failures, and class discussion.
- Design and build equipment, write software, analyze data.
- Highly motivating: potentially publishable research projects on the most cutting-edge equipment. Give useful feedback to manufacturers, e.g., Axion Biosystems.
- Prototyping for Backyard Brains.
- Field trips...

Field trips to the Center for Advanced Brain Imaging to do their fMRI experiments and to Melody Moore-Jackson's lab for their EEG experiments



Important course goal: How to learn from failure



Grades were based on how much
effort and learning

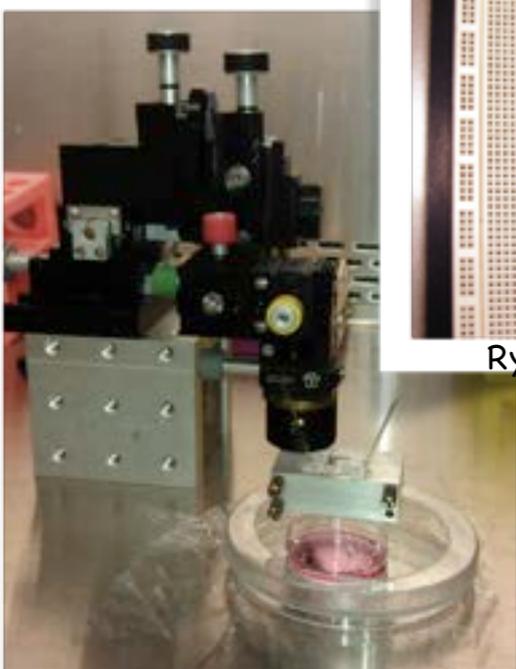
their lab notebook reflected, regardless of
whether their projects and experiments
worked or not.

Real world aspect: Their notebooks were put in our
library and used by later students to
anticipate failures and learn from past mistakes.

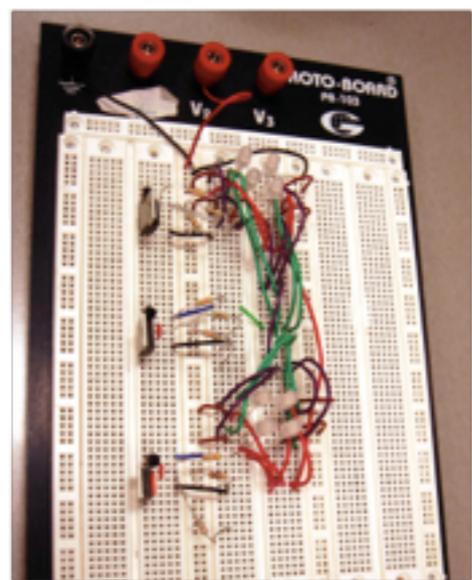


open source
hardware

Now we move from
making physical objects in lab class...



Michael McKinnon



Ryan Hooper



WIKIPEDIA
The Free Encyclopedia

You Tube

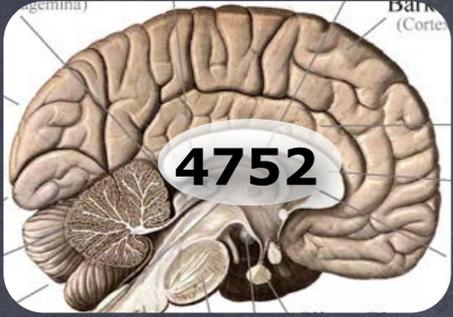


instructables

share what you make

amazon.com

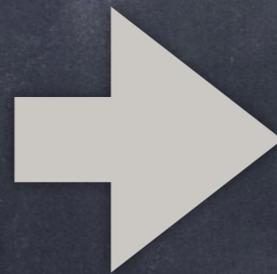
...to making enduring digital
artifacts on the web.

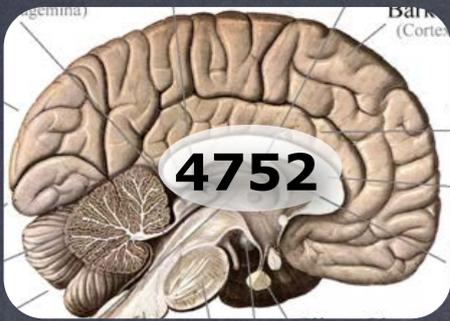


Introductory Neuroscience

BMED/BIOLOG 4752

- 60–100 biology and BMED seniors.
- Difficult for an elective – students must be motivated.
- Semester-long assignment: Become an expert in a chosen neuro topic that is not yet on Wikipedia, and write a real Wikipedia article about it.



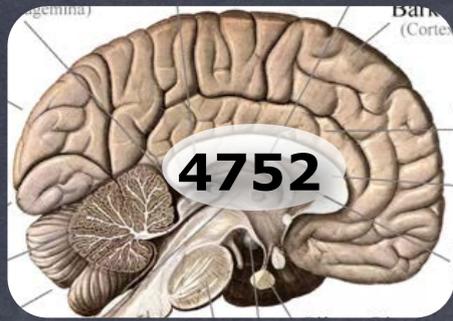


Wikipedia Article Assignment



- Since 2006, my students wrote over 250 **new** neuro articles for Wikipedia, and expanded many stubs.
- The fact that this was for the Real World was a fantastic motivator for students!
- Many sub-assignments helped build enough expertise to write a good article.
- The all-volunteer community of Wikipedia editors was very helpful.
- Wikimedia.org has a Wikipedia Education Program to help teachers incorporate Wiki article editing into their curricula.

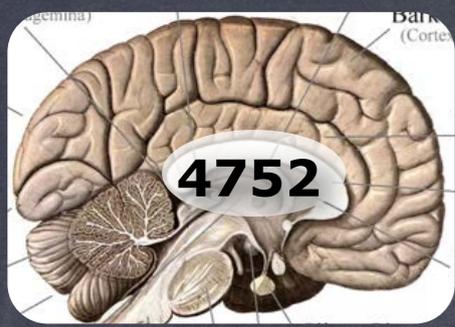
I polled my alumni a few years after they graduated



Alumna Christa Caesar



“Intro to Neuroscience was completely different from all my other courses because of its real world approach. This approach made the material relevant, interesting, and useful at the same time, therefore making learning a fun process. In addition to learning some great neuroscience, I also picked up on some very practical skills that I greatly value today – such as creating a Wikipedia article, directing, recording, and uploading a Youtube video, interviewing an expert in a neuroscience sub-topic, and writing an Amazon review article based on a book out in the market. I never did any of this in any other course and this made Intro to Neuroscience extremely refreshing and novel.”



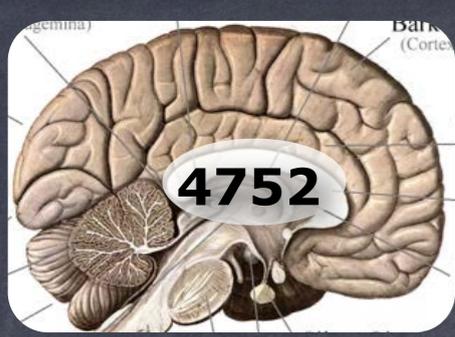
Alumni comments on IntroNeuro...



Alumnus Mike Weiler

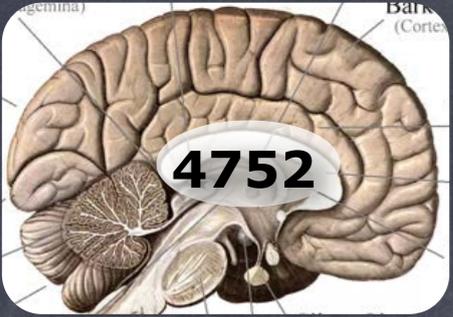
“...The real world assignments made a significant impact on me, both at the time of completion and to this day. The process of gathering information, publishing it in a public venue and taking credit/responsibility for the content of the writing was almost an entirely unique concept to me as an undergraduate. To that point my classes had required a significant writing component, however, there was never a requirement to put my name on the line and make my writing available to the public. To my surprise, that actually significantly altered the way I approached the writing and substantially improved the quality of my final product. The assignments motivated me to become engaged in the topic and do an excellent job because I wanted to represent myself well. This is the same process that I am now going through as a graduate student because all my work will be published, thus representing myself, my lab and my school.

In addition to publicly displaying my work, the assignments helped to expose me to the types of activities I now find myself doing on a regular basis in graduate school. The amazon book review assignment helped me to think critically about the writing of others and be able to compose a thorough and thoughtful review of the main points. This skill has become invaluable as I assess journal articles for my research. The wikipedia article was also extremely unique and was actually my favorite element of the class. That was my first exposure to truly "publishing" scientific information. I still read the wikipedia entry occasionally to this day, and I'm very proud of the work I put into that article. The experience has helped me to write journal articles of my research and I now have two published papers.”

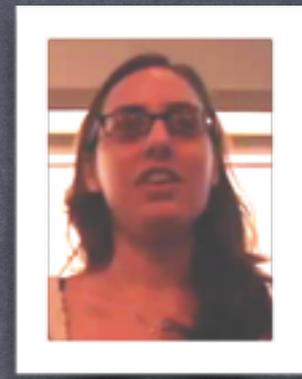


Other Real-world aspects of IntroNeuro

- Learned about real lab research from other neuroscientists.
- Read a neuro book of their choice and wrote a detailed review on Amazon.com using their Real Name.
- Read and ranked other students' book reviews.



Case study: Amazon neuro book reviews



Jennifer Carlson read and reviewed "Rewire Your Brain"

7 people commented on it!

Initial post: Jan 24, 2011 2:12:56 PM PST

Comments

[Track comments by e-mail](#)

Tracked by 1 customer

Sort: **Oldest first** | [Newest first](#)
Showing 1-7 of 7 posts in this discussion

[Alison Poulsen](#) says:

Thanks for your effort in writing this long review!

[D. CURRY](#) says:

Ditto!

Thank you SO much for a thorough review! It was interesting, well written, and compelling. I now know about the book and why I must own it! Excellent work on your part!

[miami7424](#) says:

thank you for your good works!i appreciate your information

[Daniel D. Phillips](#) says:

Jennifer- Wonderful review :) I wish more books had reviews like yours. Thank you please!

[Meg](#) says:

Thank you for your detailed and informative analysis. Because of your review, I bought the book.

[Thomasina](#) says:

excellent review of this book. Thanks so much!

[Late bloomer](#) says:

Extremely comprehensive review! Thank you.

Although this book was mostly easy to read, there were parts of the book that were a bit overwhelming. While reading, I kept thinking that it would be more rewarding would be to jot it down with its basic function, what the list. This way you have a sort of cheat sheet for quick reference while reading this book while taking my own advice of making notes called the list. This way you have a sort of cheat sheet for quick reference while reading this book while taking my own advice of making notes called the list. I wrote this review, I used Dr. Arden's method of FEED. As he tells you in my heart this advice and tried my best to focus by turning off my TV and cl

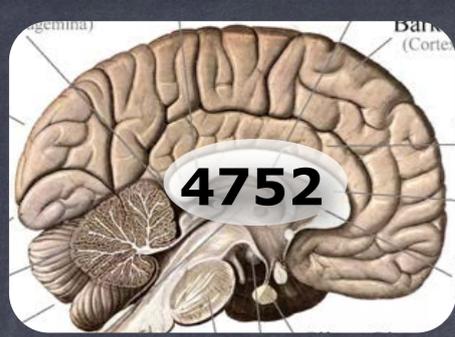
Years later, it remains the most helpful review!

335 people found this helpful

Amazon.com: Customer Review
File Edit View History Bookmarks
Facebook Tumblr Twitter
T-Square: BIOL/BMED-4752-
★★★★★ "Very interesting"
By [Jennifer Carlson](#)
REAL NAME
Edit review Delete review
Amazon Verified Purchase
This review is from: Rewire Your Brain
"Rewire your brain" by Dr. Arden
book while encouraging
my favorite sections, find
I chose this book to read
cover review, written from
and was able to give me
this changeability to bet
had neuroscience conce
self-help book. Now afte
mental issue they are en
in classes about neurons
have heard all throughou
book does this beautiful
long or complicated wor
patient he had worked w
advantage. There were 9 chapters in this book covering basic neuroplasticity, anxiety, and sleep, the benefits of social interactions, resiliency, and attention. I will go into more detail below.

CH 1: Firing the right cells together
This section is essentially the meat of the whole book. Here the author introduces the concept of neuroplasticity and what it means to us. He describes how the different parts of the brain function, how neurons work, and how neuroplasticity occurs. Due to the content of this section, you may think that this part of the book would be more of a textbook type read, however that is not the case whatsoever. Dr. Arden manages to keep this section simple and interesting. He even throws in some fun facts that I really enjoyed about how a woman's brain and a man's brain differ. Here is one example: "Since woman's brains have a better connection between the two hemispheres ... words often carry more emotional meaning for women than they do for men." I definitely see this amongst the couples that I know. The most important part of this chapter is where the author introduces his method of how to

HowViewpoints=18 ☆ relatable
CookingLight Flickr UO VS RS Reader Post
31 used & new from \$25.94
LOOK INSIDE
The Winner's Brain: 8 Strategies Great Minds Use to Achieve Success



Other Real-world aspects to IntroNeuro

- Attended and wrote up neuro lectures around Atlanta and at the Society for Neuroscience conference.
- Interviewed an Expert orally and presented what they learned.
- Did benefit walks to learn about neuro diseases.
- Created YouTube videos about research articles.



From: "Kermit and friends explain the basal ganglia" by Austin Bennett

[Link to videos](#)



Do your students make stuff?

Do they work with
real-world clients and customers?

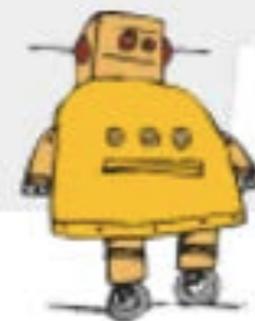
Design, modeling
and problem solving
in the classroom are important,
but they have less impact if they are "toy"
problems
or cookbook lessons.

Get your students involved in a

Atlanta Mini-Maker Faire 2012



Have your students create Instructables of their creations



instructables

share what you make

LONG line of kids eager to learn soldering



Thanks to Dale Dougherty and Mitch Altman

How to make it REAL

- Encourage group efforts that help others.
- Have students share what they make with the world.
- Iteratively improve complex projects, with external input from outsiders.
- Keep project results online after the semester. Students can build their maker portfolios.
- Use evaluation by fellow students and the whole world.

Teach *agency* with Real-world projects

Students acquire a deep sense of **agency** by tackling real-world problems. They no longer fear failure or having to learn new things to get the job done.



"Whether you think you can,
or you think you can't--you're right."
-Henry Ford

From my book:

My Websites

- Research & Teaching: [https://
potterlab.gatech.edu](https://potterlab.gatech.edu)
- Maker Workshops: [https://
steveMpotter.tech](https://steveMpotter.tech)

email me: [stevepwork at
gmail.com](mailto:stevepwork@gmail.com)

TAKE-HOME MESSAGES

- *Motivation is at the root of all learning.*
- *To learn is intrinsically rewarding and should be fun.*
- *Understanding some of the brain mechanisms of motivation and learning is helpful for teachers.*
- *Student excitement in the medium-to-high range optimizes attention and learning.*
- *Social interactions are the strongest motivators.*
- *Real-world impact greatly enhances motivation.*
- *Children can and should be active contributors to society.*
- *Know your students. Let them know you.*
- *Control and ownership by the students are powerful motivators.*
- *Any difficult task can be made easier by breaking it down into sub-tasks.*
- *Make your rules and boundaries clear to your students and stick to them.*
- *Keep getting feedback and keep adjusting your methods and curricula.*
- *Keep giving feedback to students and let them help each other.*
- *Every single student is smart in some ways and can learn and improve the world if they are motivated.*