Action Potential, Introducing a CURE into an established Neurobiology Laboratory course

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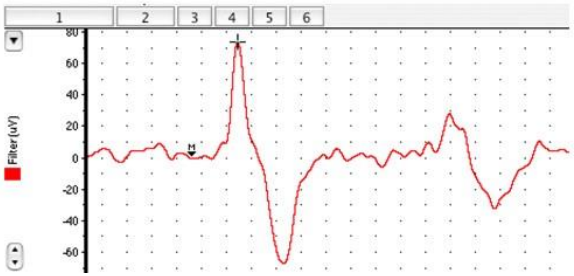

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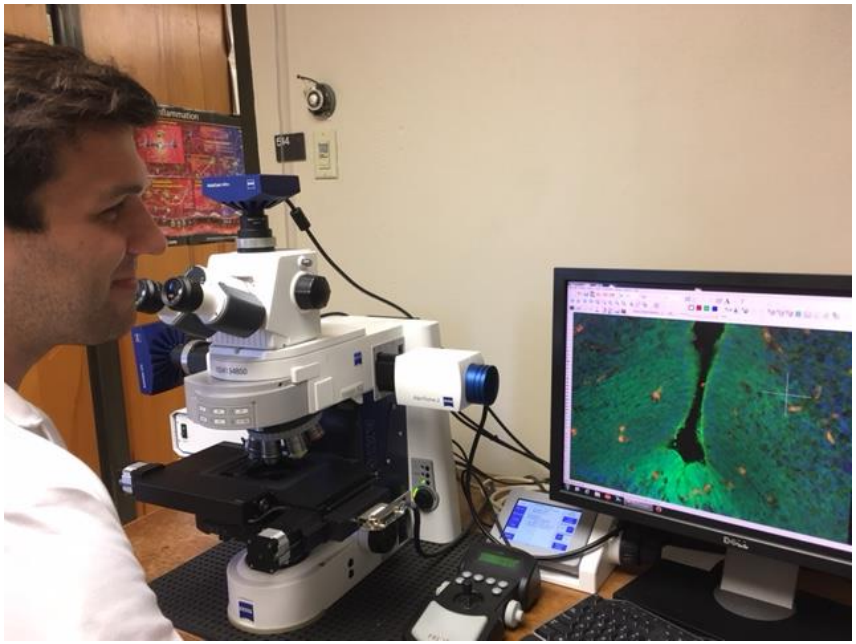
Ray P. Authement College of Sciences

What I *THOUGHT* Undergraduate Research should look like

- Student asks to do research with you in lab
  - Student has a lot of interest in the brain or neurological disorders
  - Looking for experiences that might introduce them to the science that they like learning about
  - Curiosity about the subject
  - Some students looking for experiences to make them more likely to get into graduate or Medical School.



Jantzen Collette, BS 2015, MS 2017

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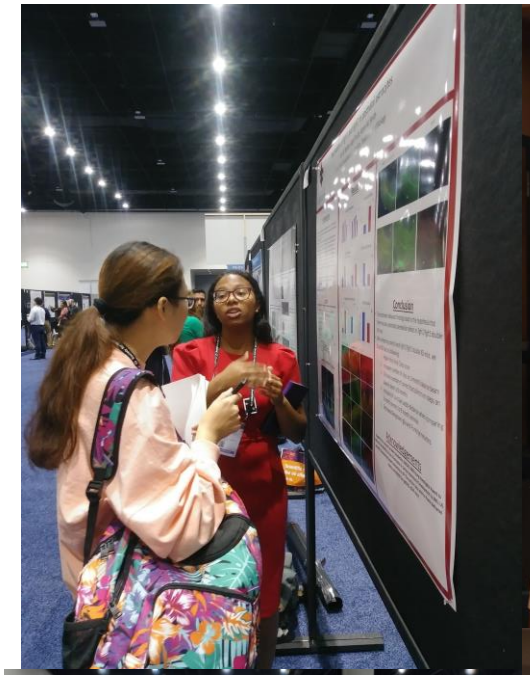
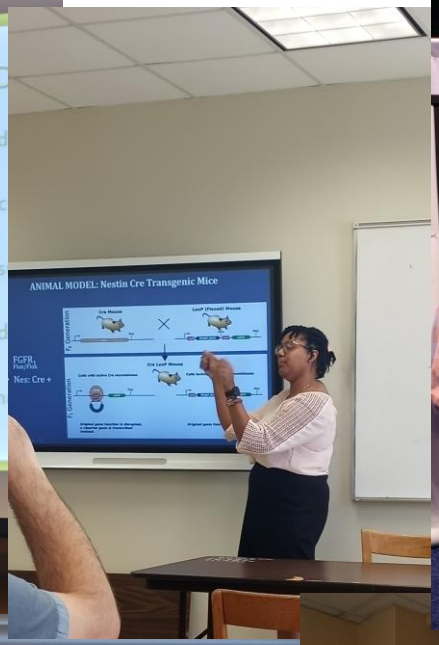
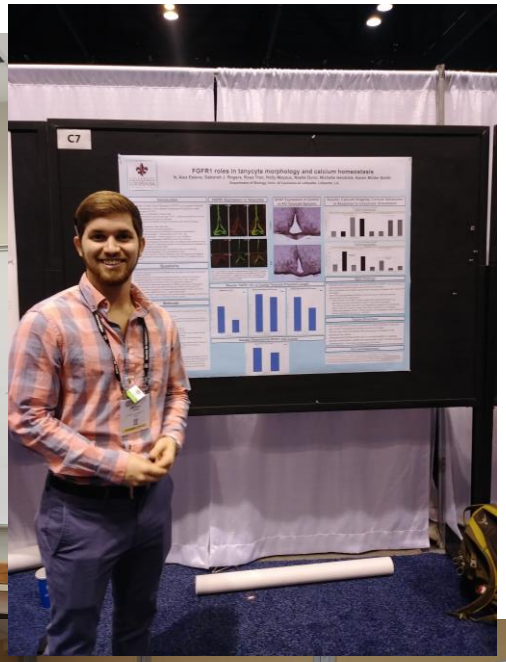
What I *THOUGHT* Undergraduate Research should look like

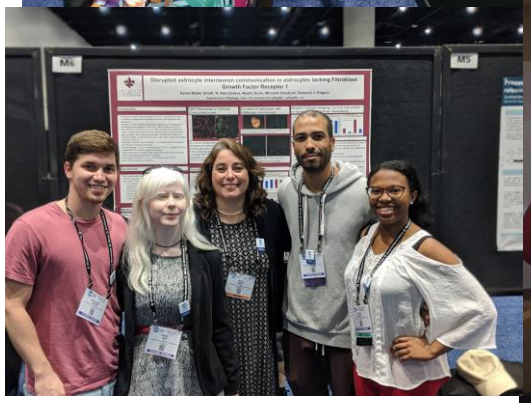
- MURE Mentorship Based Undergrad Research Experience
- You teach them basic techniques, they help out with experiments, pair them up with a post doctoral or graduate student researcher
- The student learns basic lab skills and is a helper on a project-an extra set of hands
  - Get real life skills
  - Learn what the lab culture is like (Research-ReDO!)
  - Problem Solving
  - learn from students and mentors about graduate school, get interested in doing more research
- Eventually, they can work independently and possibly help design and perform an experiment that is independent

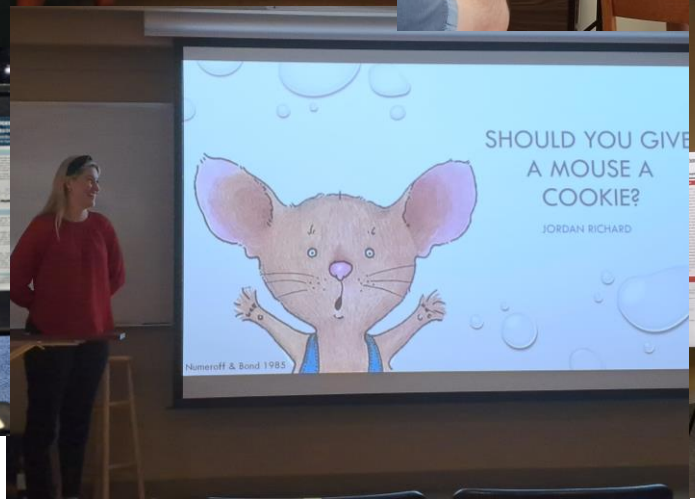
MUREs leading to Presentations











MUREs leading to publications

- Esteve NA, Rogers DG, Stagray J, **Mayeux H, Nora G, Huval, L,** Smith KM, Tanycyte radial morphology and proliferation is influenced by Fibroblast Growth Factor Receptor 1 and high fat diet. GLIA, submitted for Publication
- Rubin-Barton L, **Pruitt A, Lugo MS,** Smith KM. Deletion of Fibroblast Growth Factor Receptor Signaling in Postnatal Bergmann Glia results in Ataxia and Motor Deficits. *Manuscript under revision*
- Rogers DJ, **Bergeron B**, Watson G, Smith KM. 2022. 3D printed chamber for live cell imaging on an upright fluorescent microscope. Journal of Biological Education, Jan 31, doi: 10.1080/00219266.2022.2030389
- Choubey L, **Collette J,** Smith KM. 2017. Quantitative assessment of Fibroblast Growth Factor Receptor 1 expression in Neurons and Glia of the Developing Mouse Brain. PeerJ. 2017 Apr 18;5:e3173. doi: 10.7717/peerj.3173.
- Smith KM, Maragnoli ME, **Phull PM, Tran KM**, Choubey L, Vaccarino FM. Fgfr1 inactivation in the mouse telencephalon results in impaired maturation of interneurons expressing parvalbumin. PLoS One. 2014 Aug 12;9(8):e103696. doi: 10.1371/journal.pone.0103696. eCollection 2014.
- Smith KM, **Williamson T**, Schwartz ML, Vaccarino FM. 2012. Impaired motor coordination and disrupted cerebellar architecture in Fgfr1 and Fgfr2 double knockout mice. Brain Research 1460:12-14.

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I was used to MURES, but could you convince me to do a CURE?

Dr. Griffard “Our students are getting a Bachelor’s Degree in Science, not pre med. They need to learn the process of science and research, and not just a few students in MURES. Every student should be doing some kind of research.”

Pictured are Dr. Mire and Dr. Griffard, Advance Faculty Summit speakers for 2022
https://youtu.be/BSqm8DE8Nc0
https://youtu.be/9p5kZ3fE5fc

Dr. Patti Mire and Dr. Phyllis Griffard

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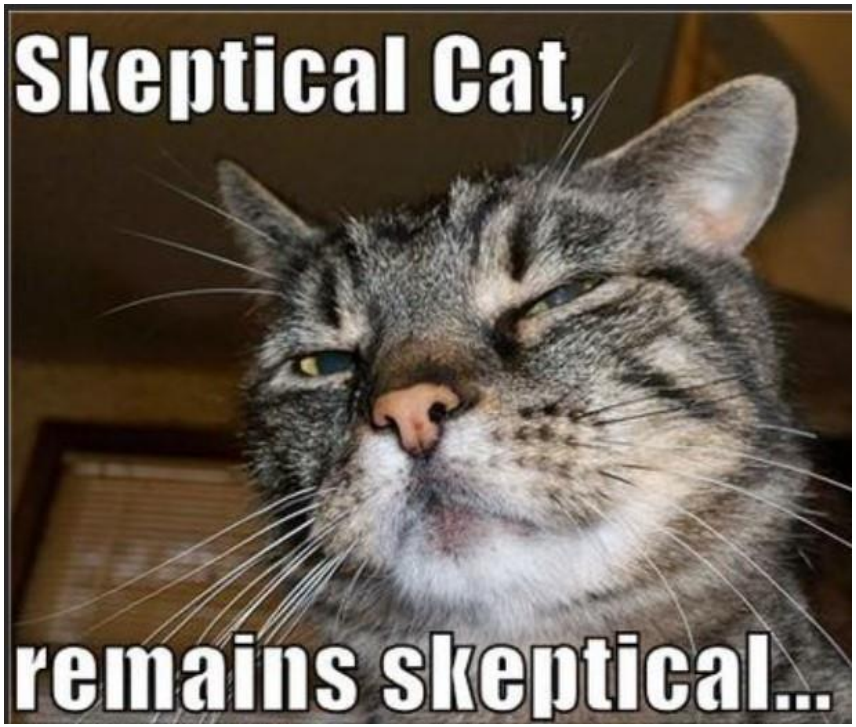
But I was reticent



- I already had labs set up
- It would be too hard to do meeting once a week
- Would students be able to do research that was new?

- But I started thinking…
- And I noticed the proliferation of CBD and Kratom products at gas stations and wondered about their safety for the developing brain

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COVID19 Pandemic 2020

Jedi Master Yoda, Empire Strikes Back, Star Wars

- How do my 410 students doing mentored research for credit, participate in research when we can't go into the lab?
- How can I make it meaningful?

410 Students Put to Work in Helping Design a CURE

Holly Mayeux, Dr. Smith, Dr. Krayesky

- Holly Mayeux, performed literature search on CBD and pregnancy, THC and pregnancy
- CBD and Neural Development
- Met every two weeks to discuss findings and design the experiment

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2021 My First Cure for BIOL424 Neurobiology- Cannabidiol Experiment

- 2021 Fall Neurobiology Course
- Included in IACUC approval
- TA gave CBD injections, or vehicle injections, to two pregnant dams each at late gestation
- Maternal behavior was observed and scored (Negative Control for Effects on Maternal Separation)
- Test if offspring have differences in Anxiety or Depression behaviors once they were 8 weeks of age
- Unexpected Results
- CBD injections, one mom ate all their pups
- Second Mom at most of her pups
- Only a few animals survived to adulthood, but these seemed less anxious based on preliminary experience

Dr. Lori Rubin Barton

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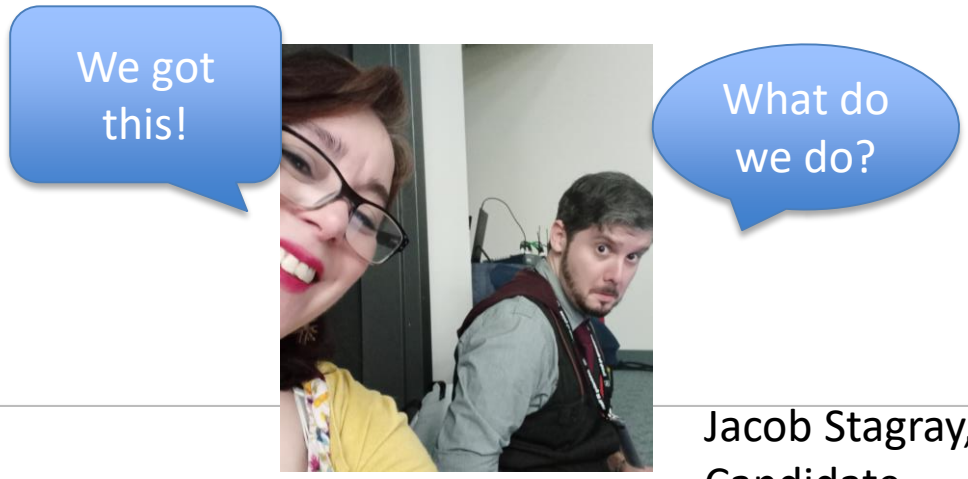
2022 Research, Redo Cannabidiol Experiment

- 2022Fall Neurobiology Course
- TA gave CBD injections, or vehicle injections,
- By the time we were ready for the lab on Maternal behavior, all pups were dead from CBD group
- ~~Test if offspring have differences in Anxiety or Depression behaviors once they were 8 weeks of age~~



- WAIT! THIS MIGHT BE A REAL EFFECT! Cool!
- Problem: What do we do for that last lab where they were supposed to do behavior?...
  - Had students take measurements of a brain area from microscopy pictures taken by one of our graduate students. They worked with real pictures, and a program called FIJI, that is used in labs across the world for quantifying microscopy pictures
  - Had students use the Allen Brain Atlas database to compare the expression of CB1 and CB2 receptors.

Jacob Stagray, TA, and PhD Candidate

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2022 Research, Redo Cannabidiol Experiment

- We will film the Maternal Behavior and have them score the videos
- We will have them to a hands on experiment with a non-injected mouse so that they can learn the technique and controls
- We will use their data combined with previous years

So, who is going to be an Author

- 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data
- 2) drafting the article or revising it critically for important intellectual content
- 3) sufficient participation in the work to take public responsibility for appropriate portions of the content; and
- 4) final approval of the version to be published
- 5) Acquisition of funding, collection of data (for example, from a fee-for-service core facility), or general supervision of the research group (e.g. by former or current mentors not directly involved in the conception or execution of the publication), alone, does not justify authorship.

- Holly Mayeux
- Jacob Stagray
- Abbi Faul (took BIOL424, wanted to keep working in the lab on the project so is taking 410 research credit hours)
- Students from BIOL424

  -All students from 2021, 2022, 2023 years?

  -Only those from Year 3 (2023)

  -Those who actually help write the paper, or whose lab reports will be incorporated into the writing?

What do you think?

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Funding that has contributed to Undergraduate Training

- 2022-2024 Lafayette Parish Medical Board Endowed Professorship
- 2022 Undergraduate Research Mini-Grant, Role- PI, “Astrocytes in Brain Energetics”
- 2021 Dr. Leon Lahaye Faculty Development Award, Role: PI
- 2020 Louisiana Board of Regents, Research Competitiveness Award, Role: PI, “The Endogenous Opioid System in Self Injury”
- 2018 Undergraduate Research Mini-Grant, Role- PI, “Glial Morphology in Animal Models of Neurological Disorders” $2000
- 2016 Undergraduate Research Mini-Grant, Role- PI, “Fibroblast Growth Factors in Astroglial Morphology and Function” $2000
- 2015 Undergraduate Research Mini-Grant, Role- PI, “Fibroblast Growth Factor Receptor Signaling in Stress and Injury” $2000
- McNair Scholars: Lillian Gathanga, Michelle Hendrick, April Pruitt, and Glenae Nora
- 2009 NIMH K01 Mentored Training Grant, “The Role of Astrocytes in Cortical Interneuron Development”
- 2009 NARSAD Young Investigator Award, “Postnatal Inhibitory Neuron Maturation”

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