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Sabin lesson plans

Here's a list of topics we discussed in today's brainstorming session. If everyone wants to pick two to be their own and start developing plans, that would be great. Feel free to meld a couple of topics together, incorporate stuff from the pre-planning spreadsheet (<https://docs.google.com/spreadsheets/d/1qzil6wHfsGk0MB2o7SIsI389IscCDfhjOOoYL9jdF0/edit#gid=0>), or add topics too!

Monday, Day 1: Brains & Lobes

Lobe cookies and pipe cleaner neurons. Allie leading

What do you know about the brain? True or False advent calendar...bizarre brain facts/brain myths

BRAIN FACTS/MYTHS:

- We only use 10% of our brains (F)
- We are either "left-brained" or "right-brained" (F)
- Brain damage is always permanent (nope, plasticity!) (F)
- The bigger your brain, the smarter you are (F)
- Listening to classical music makes you smarter (F)
- While you're awake, your brain generates enough energy to power a lightbulb (10 to 23 watts) (T)
- Brains can't make new cells (neurogenesis) (F)
- Brains gain new wrinkles (sulci & gyri) when we learn something new (F).
- Your brain stays active for a while after you are decapitated (the brain loses oxygen and immediately enters a coma, losing consciousness in approx. 2-3 seconds. I thought it was super [interesting](#)) (F)
- Your brain is like a filing cabinet/ computer database for memories, Data in, data out. (F)
- Television rots your brain. (F)
- Alcohol kills brain cells (F)
- Your brain is largely inactive during sleep (F)
- The human brain feels no pain (T)
- The more you think about a particular memory, the more accurately you remember the details (F)
- The brain uses about 20% of the body's energy (T)
- The human brain is basically a computer made out of meat (F)
- The human brain continues developing until our 40's... and possibly even beyond (T)

- The physical structure and function of your brain can be changed by what's going on in your life (T)

Tuesday, Day 2: Human brains! CNS/PNS/ENS

Brain in a jar, pinboard brain game, brains. Kat and Kalera leading.

Wednesday, Day 3: Learning & Memory

Visual memory (NEED EXTRA ACTIVITY). Christie leading. Memory board game....different smells, and then have them describe the experience....mention sleep telephone/charades game

Thursday, Day 4: Sheep brains!

Dissections, T-shirts. Christie leading.....Kalera co-leads

Monday, Day 5: Networks

Lemon battery robots. Neal and Raeann leading.
rubber arm

Tuesday, Day 6: Human brains! Gut-brain axis

Human brains. Mashup cookies. Kalera leading.

Wednesday, Day 7: Neurotransmitters/drugs

Miracle berries, drunk goggles, neurotransmitter potato stamps. Allie leading. make sure there are lemons on this day.

Thursday, Day 8: Sheep brains!

Dissection, T-shirts. Kalera leading.

Monday, Day 9: Development

Monster Monday Frankenstein. Neal leading.

Tuesday, Day 10: Human Brains! Stress and mood

Very emotional charades. Sara leading.

Wednesday, Day 11: Visual perception

Glowsticks & flipbooks. Kat and Raeann leading.

Thursday, Day 12: Sheep Brains

Dissection and T-shirts. Sara leading.

Interesting Links to Show

- [See-Through Brains](#)
- [TedTalk - Your Body Language Shapes Who You Are](#)
- http://www.ted.com/talks/heribert_watzke_the_brain_in_your_gut?language=en
- <http://www.tedmed.com/talks/show?id=293045> (John Cryan talks about the microbiome impact on the gut-brain axis)
- <http://www.scientificamerican.com/article/gut-second-brain/> (More gut-brain stuff)
- <https://www.youtube.com/watch?v=zLp-edwiGUU> (decent introductory/development/ overview video)

RadioLab on memory

- <http://www.radiolab.org/story/91570-eternal-sunshine-of-the-spotless-rat/> (memory eraser)

Detailed Lesson Plans (*Rough Drafts*)

Monday, Day 1:
Brains & Lobes

Tuesday, Day 2:
Human brains! CNS/PNS/ENS

PROJECT: Brain in a Jar

ESSENTIAL QUESTION:

How do we do what we do? How does communication within the nervous system work? What role does the CNS have in the body? What role does the PNS have in the body? What role does the ENS have in the body?

GOALS:

To be able to name the three parts of the nervous system and identify what each does

PREPARATION:

Lay out materials, get children's attention

MATERIALS:

Human Brains: 1) Gloves 2) Goggles 3) Masks 4) Lab Coats

Pinboard Brain Game: ?

Brain in a Jar:

1) Mason Jars 2) Plastic Bags 3) String 4) Hand Sanitizer 5) Glitter 6) Food Coloring

SUBJECT CONNECTIONS:

Central Nervous System

Peripheral Nervous System

Enteric/intrinsic Nervous System

SCIENCE POWERS NEEDED

LEAD IN:

SCIENCE POWERS NEEDED

PROCEDURES:

Roll 5 min

Talk a little bit about the Nervous system 15 min

pinboard brain game 25?

Get them suited up to be MAD SCIENTISTS and touch human brains! 5 min

Touch BRAINS! 25 min?

Come back inside and get re-settled in 10 min

explain making brain in a jar 10 min

Make brains 20 min?

clean up & wrap up 10 min

CLOSURE:

Ask everyone to right on their [scientists log?](#) something they learned that day.

Wednesday, Day 3: Learning & Memory

PROJECT: Learning and Memory

ESSENTIAL QUESTION: What are memories? How do our neurons code for memories and how do we recall them? What influences memory? What enhances or detracts from memories? Are they permanent? What is forgetting? (There is no ONE essential question here, just lots and lots of really interesting questions that basically sum to the concept of “who am I?”.)

GOALS: 1) Identify brain structures important for learning and memory,
2) Discuss the different stages of memory,
3) Discuss ways we can enhance memories,
4) Discuss ways we can diminish memories,
5) Discuss how failures of memory do not necessarily reflect failures of learning,
6) Play memory games

PREPARATION: Not too much required, just attention.

MATERIALS: Pens and paper

SUBJECT CONNECTIONS: Learning and memory, attention, networks

LEAD IN: N/A

PROCEDURES: We're going to play several versions of the telephone game. In this way, we can see how "memories" (the target word or phrase) move through networks and how vulnerable they are. We'll also practice ways to strengthen those "memories" or weaken them.

CLOSURE: We can have a brief discussion about what we learned.

Thursday, Day 4: Sheep brains!

PROJECT: Sheep Brain Dissection

ESSENTIAL QUESTION: What does the brain *actually* look like? Can we identify structures within the brain? Why do we think certain structures look the way they do?

GOALS: 1) "Brain-basics"- identify the four primary lobes of the brain, cerebellum, and brain stem, 2) Identify grey matter, identify white matter- what is the difference between the two?, 3) Identify primary brain structures and learn their function- corpus collosum, optic chiasm, pons, etc, 4) Why do the brains smell so bad? Explain what fixation is, why it's necessary, and why we do that often in science, 5) Identify sulci and gyri, explain why we have them, 6) Discuss two hemispheres, why we have two of many structures, what happens if one fails, 7) Discuss anatomical terms (dorsal, ventral, posterior, anterior) and planes (sagittal, coronal, etc), 8) Be prepared to field questions from students as they arise.

PREPARATION: We will set up "brain stations" so that there are at least 2, but not more than 3 students per brain. Gloves, scalpels, and paper towels will be provided.

MATERIALS:

- 1) Sheep Brains
- 2) Scalpels
- 3) Gloves
- 4) Paper towels
- 5) Pens
- 6) Sheep brain diagrams (to label once we learn what the structures do)

SUBJECT CONNECTIONS: Every topic....it's a brain!

LEAD IN: Brief conversation about the brain- what do you know about structures? Can anyone name a part of the brain? What do they think it does? Conversation about safety- no gloved hands on anything but the brains and scalpels. Conversation about respecting animals and respecting the contribution they make to science by allowing us to learn from their brains.

PROCEDURES: I will walk everyone through where to look and where to cut. I want this to be fun and not too "teach-y" so I'll let the students guide where we look and what we talk about. There is no wrong way to dissect a brain (that isn't going to be used for an experiment). I expect we'll actually dissect for 30 minutes, labeling diagrams should take roughly 5 minutes, and perhaps 10-15 minutes for questions and answers as they arise.

CLOSURE: Compare diagrams, discuss what we liked, discuss what we didn't, what did we learn? Clean up stations and send kids outside to work on T-shirts :)

Monday, Day 5: Networks

PROJECT: Lemon Battery Robots / Rubber Arm

ESSENTIAL QUESTION: What are neural networks and what can they tell us? **(add more?)**
How do neurons send signals to the rest of the body?

GOALS: 1) Emphasize Structure --> Function; Communicate that: 2) neural networks are capable of complex functions, from sensory input to integration to motor/behavioral output (borrowed from Noggin) as well as processing motivated behavior (mesolimbic vs mesocortical motivation); 3) the more neurons linked together, the more varied the opportunity for output/response to stimuli; 4) networks adapt and change with experience; 5) why/how communication shortages/errors occur (phantom limb, speech disorders?); 5) Describe networks pertaining to body mapping and nociception **(add)**

PREPARATION: *(We'll need more direction on the lemon battery robots in order to guide our discussion).* Setup of the rubber arm is relatively quick. Potential image or video prep.

MATERIALS:

- Video? Cool images?
- Lemon battery robots:
 - Lemons
 - ??
 - Paper
 - Scissors
 - Brads
 - Paper towels

- Rubber arm:
 - Arm
 - Box
 - Feather?
 - Hammer?
- Pipecleaner neurons
 - Pipecleaners

SUBJECT CONNECTIONS: Neural Networks,

LEAD IN: Brief recap of neuron structure and function; have students from the previous week describe what they learned about neurons. Ask them how neurons communicate and what they think of when they hear “network”.

PROCEDURES:

Recap of structure and function of a neuron (10 minutes)

Discussion about neural network communication (10 minutes)

Show short video or series of images of neural networks? (5-10 minutes)

Lemon battery robots (30 minutes?)

Follow-up discussion, leading into rubber arm (10 minutes)

Cleanup (5 minutes)

Brief discussion of body mapping, nociception (5 minutes)

Rubber arm (10-15 minutes depending on how many students want to try)

Remaining time for pipe cleaner neurons/ questions (15 minutes)

Reading/discussion of Phantoms in the Brain chapter related to rubber arm experiment if time remains (10-15)

CLOSURE: Discuss what we’ve learned about neural networks and why communication is key!

Tuesday, Day 6:

Human brains! Gut-brain axis

PROJECT: Neurotransmitter cookies

ESSENTIAL QUESTION:

What is the gut-brain axis? How does it communicate with the central nervous system? What affects does it have on our behavior and our sense of self? Can what we eat affect how we feel? What is the gut microbiome, and is it important?

GOALS:

To understand what the enteric nervous system does, how it communicates with the central nervous system, how it can impact our behaviors, and ways we can affect it through our choices.

PREPARATION:

Communicate that oven will be needed that day, prep ingredients, wash hands, get children's attention

MATERIALS:

Human Brains: 1) Gloves 2) Goggles 3) Masks 4) Lab Coats

Cookies:

Flour, Butter, Sugar, eggs, etc.

Sprinkles to demonstrate neurotransmitters (or microbes?)

SUBJECT CONNECTIONS:

Central Nervous System

Enteric/intrinsic Nervous System

Microbiome

Neurotransmitters

LEAD IN:

Brief discussion of how we feel when we eat something good or bad, how being anxious can give us a tummyache, or how a tummyache can ruin your whole mood.

PROCEDURES:

Roll 5 min

Talk a little bit about the Nervous system 15 min

Get them suited up to be MAD SCIENTISTS and touch human brains! 5 min

Touch BRAINS! 25 min?

Come back inside and get re-settled in 10 min

Explain making cookies & what it's meant to demonstrate 10 min

Make and decorate cookies 40 min?

clean up & wrap up 10 min

CLOSURE:

Ask everyone to write on their **scientists log?** something they learned that day.

Wednesday, Day 7:

Neurotransmitters/drugs

Thursday, Day 8:

Sheep brains!

PROJECT: Sheep Brain Dissection

ESSENTIAL QUESTION: What does the brain *actually* look like? Can we identify structures within the brain? Why do we think certain structures look the way they do?

GOALS: 1) “Brain-basics”- identify the four primary lobes of the brain, cerebellum, and brain stem, 2) Identify grey matter, identify white matter- what is the difference between the two?, 3) Identify primary brain structures and learn their function- corpus collosum, optic chiasm, pons, etc, 4) Why do the brains smell so bad? Explain what fixation is, why it’s necessary, and why we do that often in science, 5) Identify sulci and gyri, explain why we have them, 6) Discuss two hemispheres, why we have two of many structures, what happens if one fails, 7) Discuss anatomical terms (dorsal, ventral, posterior, anterior) and planes (saggital, coronal, etc), 8) Be prepared to field questions from students as they arise.

PREPARATION: We will set up “brain stations” so that there are at least 2, but not more than 3 students per brain. Gloves, scalpels, and paper towels will be provided.

MATERIALS:

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- 2) Scalpels
- 3) Gloves
- 4) Paper towels
- 5) Pens
- 6) Sheep brain diagrams (to label once we learn what the structures do)

SUBJECT CONNECTIONS: Every topic....it’s a brain!

LEAD IN: Brief conversation about the brain- what do you know about structures? Can anyone name a part of the brain? What do they think it does? Conversation about safety- no gloved hands on anything but the brains and scalpels. Conversation about respecting animals and respecting the contribution they make to science by allowing us to learn from their brains.

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CLOSURE: Compare diagrams, discuss what we liked, discuss what we didn’t, what did we learn? Clean up stations and send kids outside to work on T-shirts :)

Monday, Day 9: Development

Tuesday, Day 10: Human Brains! Stress and mood

PROJECT: Very Emotional Charades

ESSENTIAL QUESTION: What effect do neurotransmitters and hormones have on our stress levels and mood?

GOALS:

- Be able to identify which neurotransmitters and hormones affect your mood and stress levels, and how they do
- Be able to act out their feelings
- Put themselves out there in front of the class (to not be shy)
- To problem-solve and think of how to cope with that particular emotion

PREPARATION:

- Cut out pieces of paper
- Write names of neurotransmitters and hormones on them (initial thoughts are – dopamine, serotonin, norepinephrine/epinephrine, cortisol)

MATERIALS:

- Paper
- Markers (of various colors)
- Scissors
- Projector - for TedTalk

SUBJECT CONNECTIONS:

- Stress
- Mood
- Emotions

LEAD IN:

- An introduction to the most common neurotransmitters

- Talking about stress – the good and bad stress, what cortisol is, fight or flight, how to handle stress
- Emotions – watch TedTalk on how body language shapes your mood

PROCEDURES:

- Settling down + roll call – 15 minutes
- Presentation on mood and stress – 30 minutes
- TedTalk – 20 minutes?
- Very emotional charades – 30 mins
- Talking about activity – 10 mins
- Closure, wrapping up for the day – 15 mins

CLOSURE:

- Talk about how the students acted out certain emotions
- Go over how to handle these emotions

**Wednesday, Day 11:
Visual perception**

Neuroscience Outreach Art Project Lesson Plan

PROJECT: Flip Books

ESSENTIAL QUESTION:

How are we able to perceive fluid motion from flashing still images in movies, on phones, and computer screens?

GOALS:

To understand the concepts of *Persistence of Vision* and the *Phi Phenomenon*
To apply this understanding in a basic animation

PREPARATION:

This project is to educate the students about the illusion of movement and reinforce these concepts by creating their own animations.

MATERIALS:

Sticky note pads

Pencils/pens
Billy and Mandy Brains?
Glow Sticks

SUBJECT CONNECTIONS:

Persistence of vision
Motion Perception
Phi Phenomenon
Frames Per Second
Dorsal stream

LEAD IN:

If any of you or your parents have an iPhone you have probably seen the slow motion option and know a little bit about “FPS or Frames per second” Do you understand what that means and what is happening? Our brain is stitching together still images to create the illusion of motion. So lets make our own moving images!

PROCEDURES:

Let everyone get settled 10 min
Talk about all the different ways we interact with the illusion of movement in our daily lives. (cartoons, phones, screens) 5 min
Explain the basic concept of Persistence of vision and Motion Perception 5 min
Observe Light trail from glow sticks 10 min
Brusspup animations 5 min
Show them the Explain project of creating a flip book and talk about key frames. 15 min
Let the kids animate for remainder of class
While they are working talk about Dorsal stream? Then put on Billy and Mandy Brain episode?
And Duck Amuck?

CLOSURE:

Have everyone share their work, ask them to turn them in and Kat will make them into a youtube video.

Thursday, Day 12:
Sheep Brains