– Robo-Brain –

An interactive exhibit for Brain Awareness Week and beyond

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Goals

1. To inform and promote enthusiasm about neuroscience to residents of North Carolina, targeting youth
2. To provide fun, structured opportunities for students, faculty and staff at the UNC Bowles Center for Alcohol Studies to practice community engagement

Partnerships

North Carolina Museum of Life and Science provided hands-on lab space and support from museum staff

UNC Bowles Center for Alcohol Studies provided new, brain-centered exhibit staffed by scientist volunteers

Dana Foundation provided Brain Awareness Week supplies (activity books, pencils, brain erasers, stickers)

National Institute of Alcoholism and Alcohol Abuse provided funding through P60 Alcohol Research Center at UNC and brochures on prevention of alcohol abuse

Materials

1. Brains
   - Human brain from the UNC Bowles Center for Alcohol Studies collection
   - Sheep brains from Carolina Biological Supply www.carolina.com
   - Rat and mouse brains from research labs (scheduled for euthanasia)
   - Brain models from www.amazon.com
2. The "Claw"
   - Claw Bundle from Backyard Brains https://backyardbrains.com/products/clawBundle
   - Small toy brains to pick up with the Claw
3. Videos on prosthetic hands
   - https://www.youtube.com/watch?v=F4wAvlA_Of0
   - https://www.youtube.com/watch?v=X_AI4MiY6L4

Brain Awareness Week: Robo-Brain Interactive Exhibit

Activity Guides

The following information was provided to all volunteers prior to their shift.

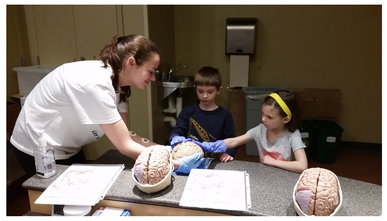
Activities in the Investigate Health Lab:

Station 1: The brain. The human brain that we bring is the star of the show. People are either excited or scared or disgusted or curious – they have definite opinions on touching a brain! Rat and mouse brains will be in small, sealed vials. Sheep brains and the human brain can be touched by visitors, but only with gloves. Sheep and human brains need to be kept damp when not in use (cover with a damp cloth).

- One person will staff this station, and we can talk to visitors about the brain and how it controls our muscles and behavior. We can talk about things like what parts of the brain control your muscles (the motor cortex), the spinal cord (point out the foramen magnum where the spinal cord exits the skull), and how nerves (specialized cells in the brain and spinal cord) communicate/send messages with electricity. Finally, introduce the concept that the brain controls muscles (point out the motor cortex) and mention that neurons use electricity to move information from one place to another. We can also bring up the concept of using electrical signals from the brain to control prosthetics that could help people with limited mobility. Example questions are:
  - What makes you move? (muscles, your brain)
  - What tells your muscles to move?
  - How does the brain talk to your muscles?
  - What part of the brain controls our muscles?
  - If someone got hurt, what could keep someone from being able to move their legs or hands? Where could the injury be? (motor cortex, spinal cord, arm or leg)
  - How could machines be used to help people who can't move their arms or hands?

Station 2: The "Claw" – controlled by brain power. Two people will staff this station. This activity uses a portable EMG to pick up the electrical potentials of your muscle to control a robotic claw. We will apply electrodes to the inside of the forearm, above the flexor digitoris muscles. (A step-by-step guide is below.) We will lead the visitors through visualizing the strength of the muscle contraction (little lights light up). Next, we will assist them to use the claw to pick up a plastic brain and hold it as long as they can. *You can get an idea of what we are doing by looking at the product description here backyardbrains.com/products/clawBundle.*

- Here is a step-by-step guide (**don't worry if it sounds complicated, we will train you on how to use it!**):
- Tell the visitor that we can use the electricity from their muscles to send a signal to the claw to and make it move. We have a prop (next page) that shows the brain sending a signal to the muscle, and the muscle sending a signal to the claw. ***Ask them if they want to try.***
- If they are willing, then tell them you will need to attach an electrode to their arm – it will be taped on. ***Again, make sure they are ok with this, as some kids will be timid.***
- We'll use a set of muscles called the flexor digitoris muscles – flexor means to flex, and digitoris refers to our fingers. ***Help the visitor to feel these muscles working before attaching any electrodes.*** To feel these muscles, extend your arm with your palm up. Make a fist and bring it back toward your body. You can feel the flexor muscles tighten. (You can see a picture of this on the attached "Claw" instructions.)
- *When they feel it, it will make it more real that they are actually moving their muscle.*
- *When you feel their muscle, you will have a good idea of where to attach the electrodes.*
- Attach two electrodes on the visitor's arm, above the muscle: one midway from wrist to elbow, and one closer to the elbow.
- Talk through what you are doing as you attach the leads to the electrodes. (They can't feel anything except the adhesive of the electrodes.) Make sure that they hold the metal part of the black (ground) lead.
- Now, before the claw is attached, have them tighten the muscles and see the LED lights on the main board light up – ***make sure they can reach red.*** If not, you can adjust the sensitivity with the white button. Ideally, a strong contraction will reach red, but after a few seconds it will flicker as the muscles fatigue. They will enjoy seeing the lights reflect their effort.
- Next, you can attach the claw – the yellow wire should be oriented toward the middle of the board. Be gentle – it won't go down all the way.
- Now when they contract – you will still have the LEDs but also the claw will contract. (The red button changes the direction of the claw – try to keep it on contraction = closing.)
- You can play around with trying to pick up the plastic brain with the claw and seeing how long they can hold it. These muscles will fatigue, so it's hard to hold it for more than a few seconds, unless the sensitivity is set wrong.
- Fun fact: researchers are using the electrical signals from the motor cortex of the brain (rather than muscle) to do the same thing for people, so that robotic arms and devices can help them.
- We know from experience that some kids will want to keep their electrodes on – that's fine!



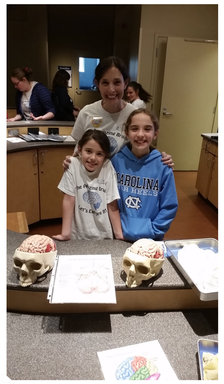
Public health messages. As always, we want some good take-home messages. The exhibit shows how electrical activity from our brain and muscles can be "picked up" and used to control a robotic claw – this is a simple model for a prosthetic. One message is that scientists are working to use brain signals to control prosthetics that can help people with various kinds of damage or mobility issues. Another general public health message is to keep our brains healthy. As we chat with kids and adults, we can reinforce healthy behaviors: wearing helmets, eating healthy food, protecting our brains from drugs and alcohol (or excessive alcohol in the case of adults).

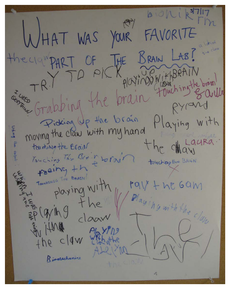
We will have brochures from NIH and SAMHSA on alcohol use – talking to your kids about alcohol, what is problem drinking, etc. Please encourage adults to take these, and talk about research we do to understand alcohol's effects on the brain and body.

Freebies to give to kids. We will have pencils with brain erasers, pins and stickers. Let children choose what they want (one item per child). We will also have brochures on underage drinking and how to talk to your kids about drinking for parents and educators.

The Exhibit - Specifics & Numbers

- 31 volunteer scientists from UNC and the community
- 630 visitors (425 children, 205 adults)
- Groups of 3-5 children (plus parents) came through the exhibit at a time
- Station 1: Brains
  - One scientist showed visitors the brains, asking questions
- Station 2: Robo-Brain
  - Three scientists worked with 2-3 children (and parents) each to illustrate how to use the claw
- Feedback
  - Visitors wrote what they learned on a poster board and received BAW stickers and pencils





UNC Science Expo

- An outdoor street fair on campus, attended by over 10,000 people
- Part of the NC Science Festival
- 9 scientists volunteered in 2 shifts
- Activities:
  - The "Claw"
  - Brochures
  - Give-aways

Acknowledgments

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