NW Noggin: Collaborative neuroscience outreach in Portland and Vancouver - undergraduates, graduates, scientists, middle and high school students work together to learn about the brain

Griesar W.S., Leake J., Hadenfeld, S., Miller L., Miller, M., Smith M.L., Tremaine E., Wescom R., Wirthlin M.

In urban areas there are often several universities with thriving research and education programs in neuroscience, along with public schools teaching science to K-12 students. Yet despite a strong shared interest, these various students rarely interact. Here we describe a successful effort to involve them all in learning about the brain.

There are many positive reasons to get them together. Some graduate students are isolated, because their institution lacks undergraduate programs, as in the case of Oregon Health & Science University (OHSU) in Portland, Oregon. Graduate students may struggle to gain teaching experience and share their work with a broader audience. They are less competitive for jobs that require classroom expertise.

Undergraduates are often curious about graduate opportunities in neuroscience, which may be scarce (or non-existent) at their own university. They have questions about what research entails, what experience they need to acquire before applying to programs, and what studies are underway. The chance to work directly with graduate students improves their appreciation of graduate options, and exposes them to students involved in funded research. Outreach also benefits undergraduates by reinforcing concepts learned in class.

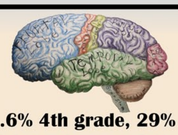
In addition, studies suggest that, in middle and high school, students are excited or discouraged by science. Fostering enthusiasm for inquiry into the mechanics of the natural world, including the brain, can enhance interest in science. Efforts to reach a broader public about scientific discovery contributes to fascination, understanding and support for research and education about behavior, and the brain.

Art is key to engaging students, by making science practice and discovery personally relevant, and by providing visual, tactile, and kinesthetic opportunities to explore and express ideas. Scientists of all ages learn new, creative ways of presenting ideas to the public, building interest and support for research investment, while art students gain insight and experience with how their skills can enhance STEM learning.

In spring, 2014, we brought together neuroscience graduate students from OHSU and Washington State University in Vancouver (WSUV), who participated in a teaching practicum, with undergraduates from Psychology departments at Portland State University and WSUV. The undergraduates enrolled in advanced neuroscience classes, and studied concepts and techniques before working with the graduates.

Then in summer, 2014, 35 of our graduates and undergraduates came together to design and deliver instruction in neuroscience and art to 220 academic priority students in grades 5 – 9, at five separate Portland Public schools!

Middle school highlight: JASON LEE K-8
(we also served Sabin K-8, and Harrison Park K-8)



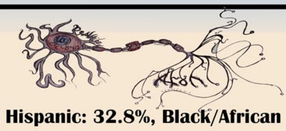
Demographics
Students, n=17; 53% female, 41% male; grade range .6% 4th grade, 29% 5th grade, 29% 6th grade, 18% 7th grade, and 12% 8th grade; race 24% White, 24% Black or African American, 41% Asian, .6% American Indian or Alaska Native; primary language 59% English, .6% Spanish, 29% Vietnamese.

Involvement
Jason Lee K-8 is in the Portland Public School (PPS) district, and is served by the Multnomah County Schools Uniting Neighborhoods (SUN) program.

Topics Covered
Basic brain anatomy, neurons, action potentials, neurotransmitters, autonomic nervous system, neural networks, neuroplasticity, emotions, learning, memory, sensation and perception, visual illusions, drugs, brain damage, brain disorders and brain safety; and the neuroscience of sleep. Language was covered when an OHSU graduate student brought song birds into the classroom. Human brains were available for students to hold and examine, and each student had their own sheep brain to dissect.

Art Integration
Each student built a neuron out of pipe cleaners, with beads for the myelin sheath. The class connected these neurons to form a network, which was used to demonstrate neuroplasticity. The role of sulci and gyri in relation to cortical surface area was explored using quick dry clay, which students first molded into cortex and then spread out to create a pot or other object. To better grasp learned motor behavior, students engaged in mirror drawing, and practiced tracing objects while looking at their own hand movements in a mirror. Each student kept a daily journal, which they used for notes, anatomical drawings, data collection, and thoughts about concepts covered in class.

High School highlight: MADISON High school
(we also served Franklin High school)



Demographics
Students, n=65; School demographics; White/Not Hispanic: 32.8%, Black/African American: 17.2%, Native American: 1.7%, Asian: 16.2%, Pacific Islander: 1.9%, Latino/Hispanic: 22.8%, Multiple: 7.4%

Involvement
James Madison High School is part of the Portland Public School (PPS) district and is served by the Multnomah County Schools Uniting Neighborhoods (SUN) program.

Topics Covered
Neurons, networks, brain lobes, decision making, basic anatomy and physiology of the limbic system, addiction, memory, feelings and emotion, and adolescent brain development. The scientific method was key to each day's lesson. Students proposed hypotheses, ran experiments, collected data, and displayed results. Teachers used real life examples to engage students. The final project was a public science fair, based on student experiments. Students also visited the Oregon National Primate Research Center.

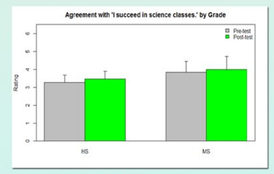
Art Integration
Each class included art projects to reinforce the lesson in a fun, engaging way. Students molded brains out of clay, and illustrated cortical lobes. Students created their own neurons on paper, and these neurons were connected together on a wall to represent a neural network. A favorite project was drawing an alien brain. The students chose what their aliens would excel at, and created a relevant brain (e.g. if an alien had amazing social skills, the frontal lobe was larger).

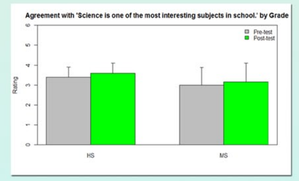
21 students participated in a pilot study to assess changes in attitudes toward science:
71% High School students (15) & 29% Middle School students (6) 29% Asian (6), 29% Hispanic (6), 19% Black (4), 19% White (4), 4% Native American (1) 52% Female (11), 48% Male (10)

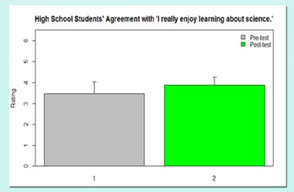
Measurement:
-14-item survey pertaining to attitudes about and perceived competence in science
-Adapted from National Association for Educational Progress' Science Opinion Survey
-Rated on a 5-point Likert-type scale (Strongly Disagree to Strongly Agree)
-Administered at start of program, and at the end.

Limitation:
-Only a few students could participate, limiting sample size.
-While we are hesitant to make any claims, we are excited to see positive trends in attitude change across the program.

Next Steps:
-Implement the survey on a larger scale next year
-Piloted measures of change in content knowledge are currently being analyzed







SUPPORT
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