Engaging students in developing and using models: using clay models to visualize action potentials.

Natasha Capell: Unity High School
Barbara Hug: University of Illinois
Session overview:

• Project NEURON overview
• Nervous system unit
• Modeling action potential activities
• Discussion & sharing of student work
What is Project NEURON?

- Educators, scientists, and graduate students
- Curriculum development
  - Inquiry-based
  - Connect to standards
- Professional development
  - Summer institutes
  - Conferences
Project NEURON: A Collaborative Process

- **Science Educators (Project NEURON)**
  - Initial unit planning
  - Developing lessons
  - Modify/revise materials based on feedback

- **Scientists (UIUC)**
  - Initial unit planning
  - Provide feedback on lesson content

- **Teachers (High School Science)**
  - Initial unit planning
  - Enact lessons in the classroom
  - Provide feedback
An Iterative Development Process

- Determine main understanding goals and develop unit outline
- Develop and revise lesson plan and student materials
- Teachers provide feedback (based on workshops and classroom enactments)
- Scientists provide feedback
• **Do you see what I see?**
  – *Light, sight, and natural selection*

• **What can I learn from worms?**
  – *Regeneration, stem cells, and models*

• **What makes me tick...tock?**
  – *Circadian rhythms, genetics, and health*

• **What changes our minds?**
  – *Toxicants, exposure, and the environment*
  – *Foods, drugs, and the brain*

• **Why dread a bump on the head?**
  – *The neuroscience of traumatic brain injury (TBI)*

• **Food for thought: What fuels us?**
  – *Glucose, the endocrine system, and health*

• **What makes honey bees work together?**
  – *How genes and environment affect behavior*

• **How do small microbes make a big difference?**
  – *Microbes, ecology, and the tree of life*

Available at: neuron.illinois.edu
What changes our minds?  
*Food, drugs, and the brain.*

- **Lesson 5:**  
  What are the effects of drugs on the nervous system?
- **Lesson 6:**  
  How do neurons communicate?
- **Lesson 7:**  
  How do drugs affect neuron communication?
Why dread a bump on the head?
The neuroscience of traumatic brain injury

• Lesson 1:
  What is traumatic brain injury?
• Lesson 2:
  What does the brain look like?
• Lesson 3:
  How does a CT scan help diagnose TBI?
• Lesson 4:
  How to build a neuron
• Lesson 5:
  What happens to neurons after TBI?
• Lesson 6:
  Exploring the data behind brain injury
• Lesson 7:
  What can we tell others about TBI?
# A Framework for K-12 Science Education

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<td>1. Asking questions</td>
<td>1. Patterns</td>
<td>Core Idea LS1: From Molecules to Organisms: Structures and Processes</td>
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<td>5. Using math, information and computer technology, and computational thinking</td>
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<td>7. Engaging in argument from evidence</td>
<td>7. Stability and Change</td>
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Today’s activity

Part 1: Build a model of a presynaptic and postsynaptic cell.

Part 2: Simulate an action potential using your model.

Part 3: Model the possible effects that different drugs have on the nervous system.

Work in groups of 3-4
Part I: Building the model (15 minutes)

• Using the laminated cards as a guide:
  – build the axon and an axon terminal of a presynaptic cell, and the dendrite of a postsynaptic cell.
  – build the transport proteins
  – build ions, and vesicles

• Split up work!
Part II: Simulate an action potential (15 minutes)

• Use your model to show what happens during an action potential. You need to include what is happening during each phase (depolarization, repolarization, refractory period).

• Include how the presynaptic cell communicates with the postsynaptic cell (what happens at the synaptic cleft).

• Use your smartphone/tablet to make a video of an action potential.
Part III: Model how different drugs effect neuron communication (5 minutes)

- Use your model to predict what happens when different drugs are introduced to the nervous system:
  - Nicotine
  - Hexamethonium
Discussion

• Could you use this lesson in your classroom?
  – Why or why not?

• Where might your students struggle?
• How could you support them?
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Thanks!

For additional information visit: http://neuron.illinois.edu

E-mail: capelln@unity.k12.il.us neuron@illinois.edu