Using real scientific research to develop students’ ability to analyze and interpret data: Making connections to the scientific practices

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Or: Nature and Nurture; analyzing the evidence!

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Session Overview

- What is Project NEURON?
- Introduce the curriculum unit
- Experience a data analysis activity as students
- Discuss and provide feedback
What is Project N EURO N?

• Curriculum development
  – Inquiry-based
  – Connect to standards

• Professional development
  – Summer institutes
  – Conferences

• Educators, scientists, and graduate students
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
Project NEURON Curriculum Units

- Do you see what I see?
  - *Light, sight, and natural selection*

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

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  - *Circadian rhythms, genetics, and health*

- **What changes our minds?**
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  - *Foods, drugs, and the brain*

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- **Food for thought: What fuels us?**
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- **What makes honey bees work together?**
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The Curriculum Unit

What makes honey bees work together?

• Lesson 1: What do honey bees do?

• Lesson 2: Why do honey bees have different jobs?

• Lesson 3: How do honey bees heat the hive?

• Lesson 4: What is the genetic basis for the evolution of eusocial behaviors?
What factors influence behavior?

- Genetics (nature)
- Environment (nurture)
Nature and Nurture
What factors influence behavior?

- LS1.B: “programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently”

- LS3.B: “Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depend on both genetic and environmental factors.”
What do honey bees do?
What do honey bees do?
Honey Bee Behavior

- Nurse bees (days 3-11)
- Forager bees (days 14-42+)
Honey Bee Behavior

- Nurse bees (days 3-11)
- Forager bees (days 14-42+)
Activity: Analyzing gene expression data
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Scientific Practices from the NRC Framework:

• Analyzing and Interpreting Data
  – “Recognize when data are in conflict with expectations”
  – “Use graphs . . . to explore relationships between variables”
  – “Evaluate the strength of a conclusion that can be inferred from any data set”

• Constructing Explanations
  – “Use primary or secondary scientific evidence . . . to support or refute an explanatory account of a phenomenon”
Activity: Analyzing gene expression data

Reading and data interpretation activity

• Everyone: background information

• Groups (work until 10:20):
  – Experiment 1
  – Experiment 2A
  – Experiments 2B and 3
  – Experiments 4A and 4B

• Discuss in groups, use large pads to share your group’s interpretation and conclusions!

• Think about how this activity might fit into your classrooms
Analyzing gene expression data: Discussion

- Was Amfor expressed in regions of the brain that might have different activity in nurses and foragers?
Analyzing gene expression data: Discussion

- How reliable are these data? What could be done to make them more reliable?
Analyzing gene expression data: Discussion

- Can differences in Amfor expression be explained by age? What further test could be done to prove this?
• Does this experiment demonstrate correlation or causation?
Discussion

• What challenges do your students face with analyzing and interpreting data?
  – How could you use these lessons in your classroom?
  – How might you modify these materials to fit with your curriculum?
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Thanks!

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