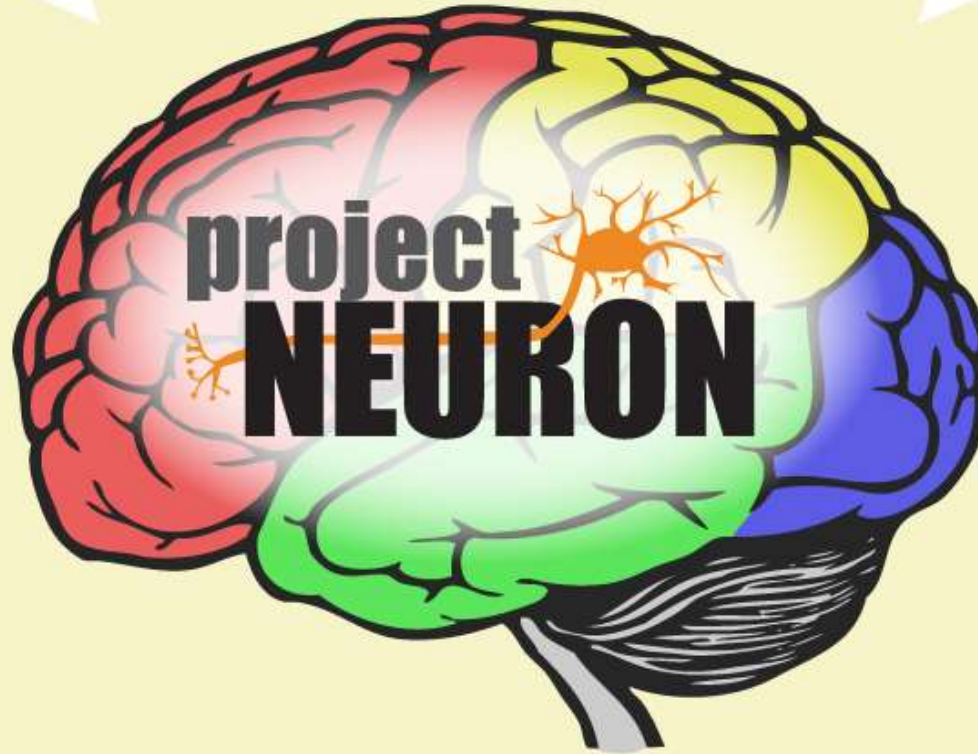


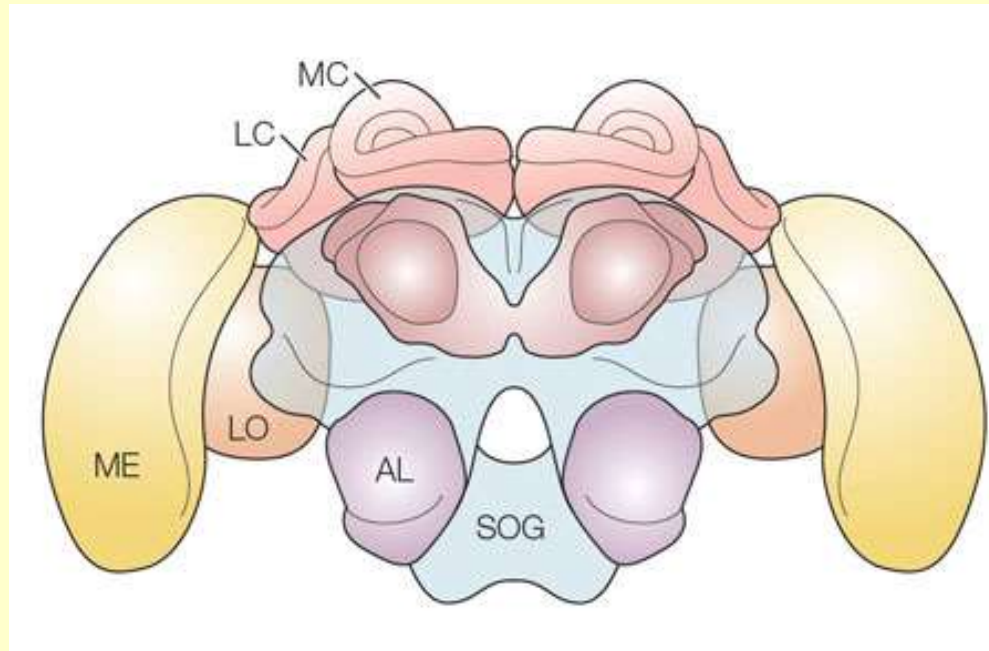
# Using real scientific research to develop students' ability to analyze and interpret data: *Making connections to the scientific practices*



*Claudia Lutz, Rob Wallon, Claire Scavuzzo,  
Sara Patterson Adamek, Barbara Hug  
University of Illinois*



# Or: Nature and Nurture; analyzing the evidence!



*Claudia Lutz, Rob Wallon, Claire Scavuzzo,  
Sara Patterson Adamek, Barbara Hug  
University of Illinois*



# Session Overview

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



# What is Project NEURON?

- Curriculum development
  - Inquiry-based
  - Connect to standards
- Professional development
  - Summer institutes
  - Conferences
- Educators, scientists, and graduate students



# 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*
- **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](http://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*
- **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](http://neuron.illinois.edu)

# 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?



# Nature and Nurture

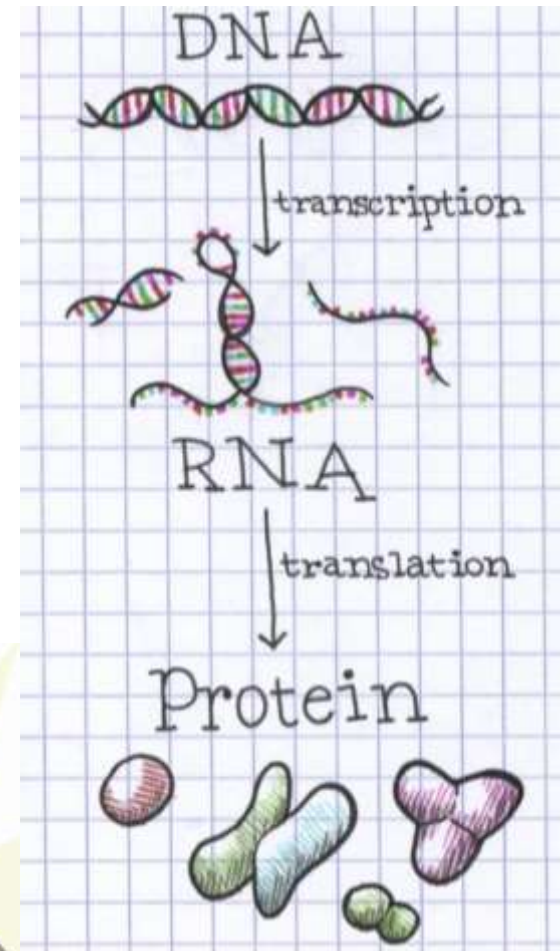
## **What factors influence behavior?**

- Genetics (nature)
- Environment (nurture)





# Nature and Nurture



# Nature and Nurture

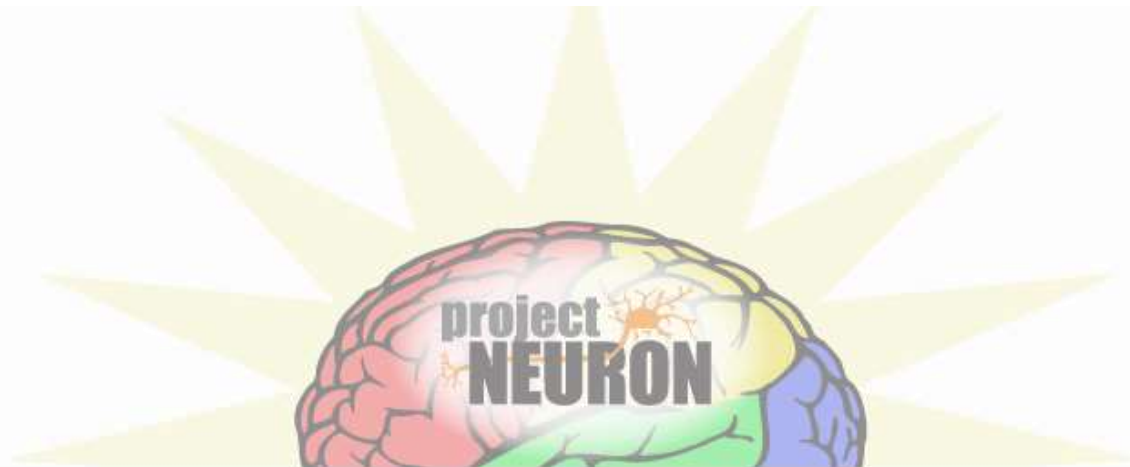
## What factors influence behavior?

- 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.**”



# Honey Bee Behavior

**What do honey bees do?**



# Honey Bee Behavior

## What do honey bees do?



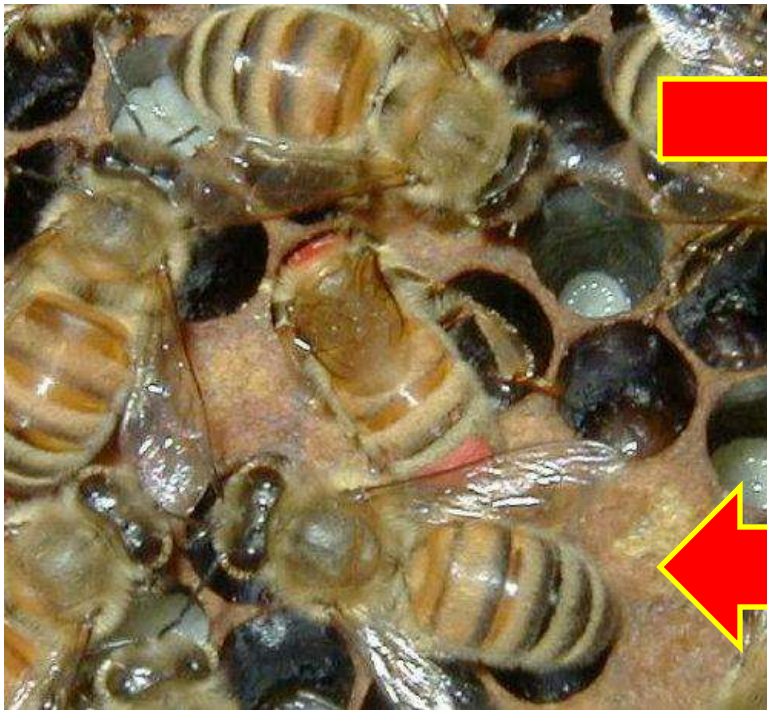
# Honey Bee Behavior

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

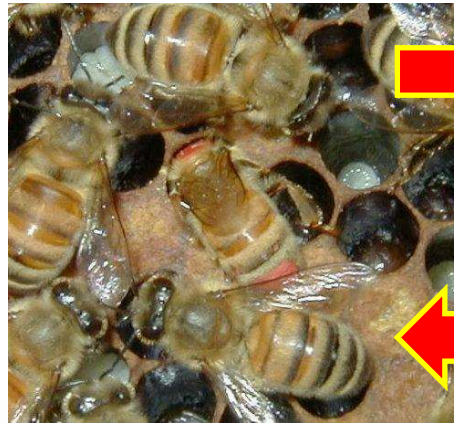
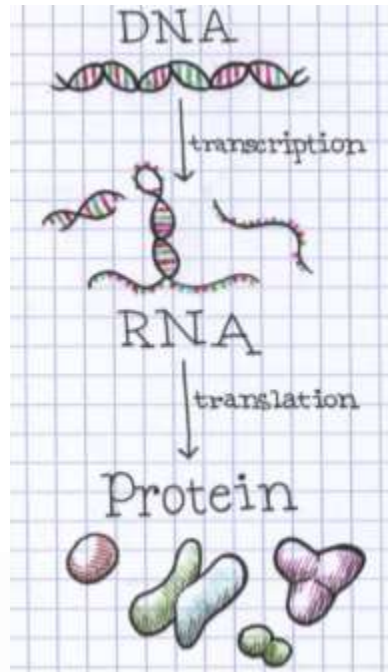


# Honey Bee Behavior

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



# Activity: Analyzing gene expression data



# Activity: Analyzing gene expression data

## Scientific Practices from the NRC Framework:

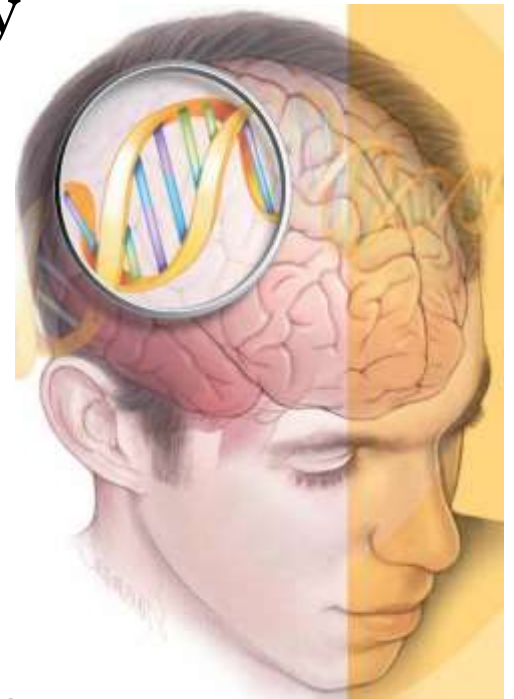
- Analyzing and Interpreting Data
  - “Recognize when data are in conflict with expectations”
  - “Use graphs . . . to explore relationships between variables”
  - “Evaluate the strength of a conclusion that can be inferred from any data set”
- Constructing Explanations
  - “Use primary or secondary scientific evidence . . . to support or refute an explanatory account of a phenomenon”



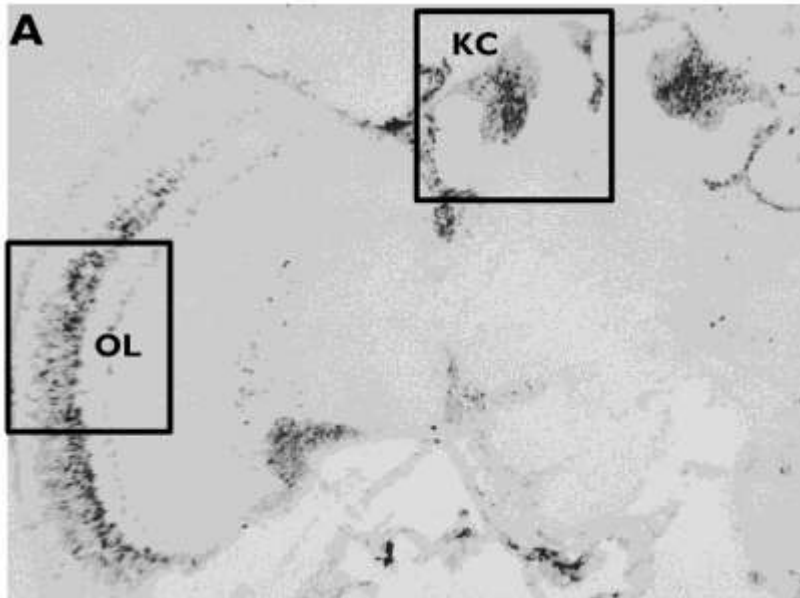
# Activity: Analyzing gene expression data

## 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

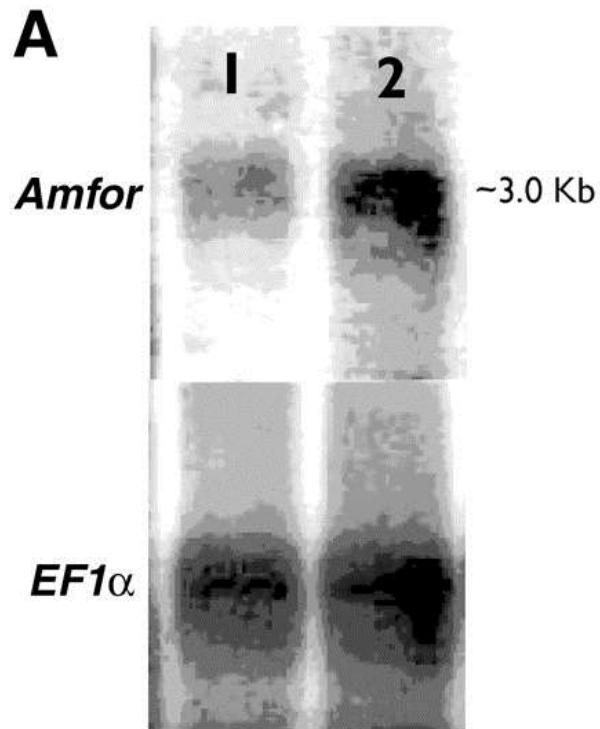


# Analyzing gene expression data: Discussion



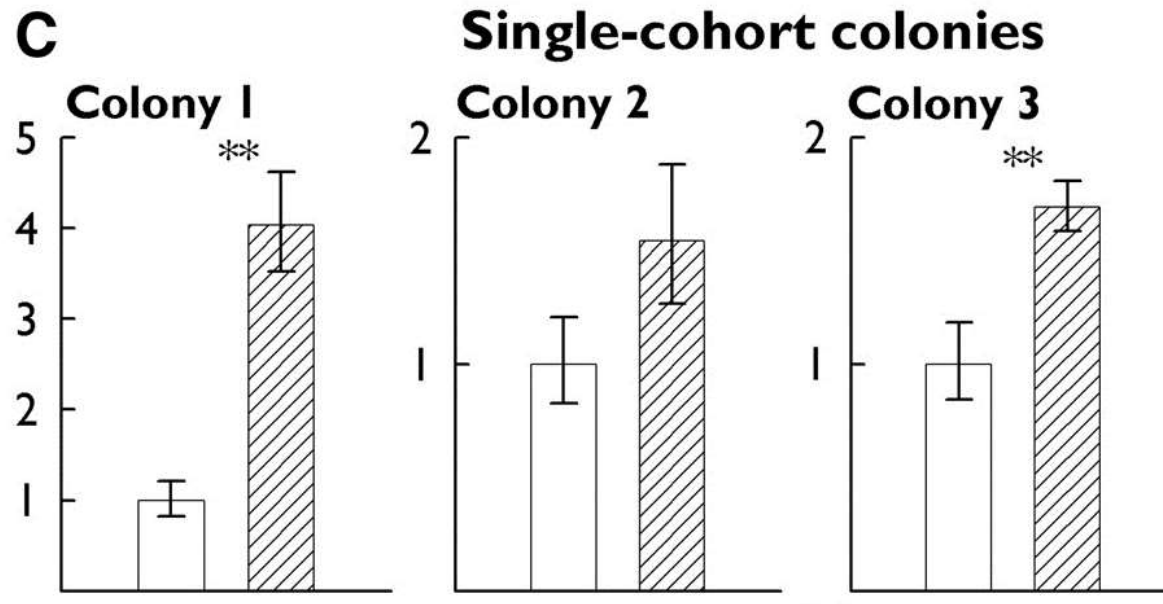
- Was *Amfor* expressed in regions of the brain that might have different activity in nurses and foragers?

# Analyzing gene expression data: Discussion



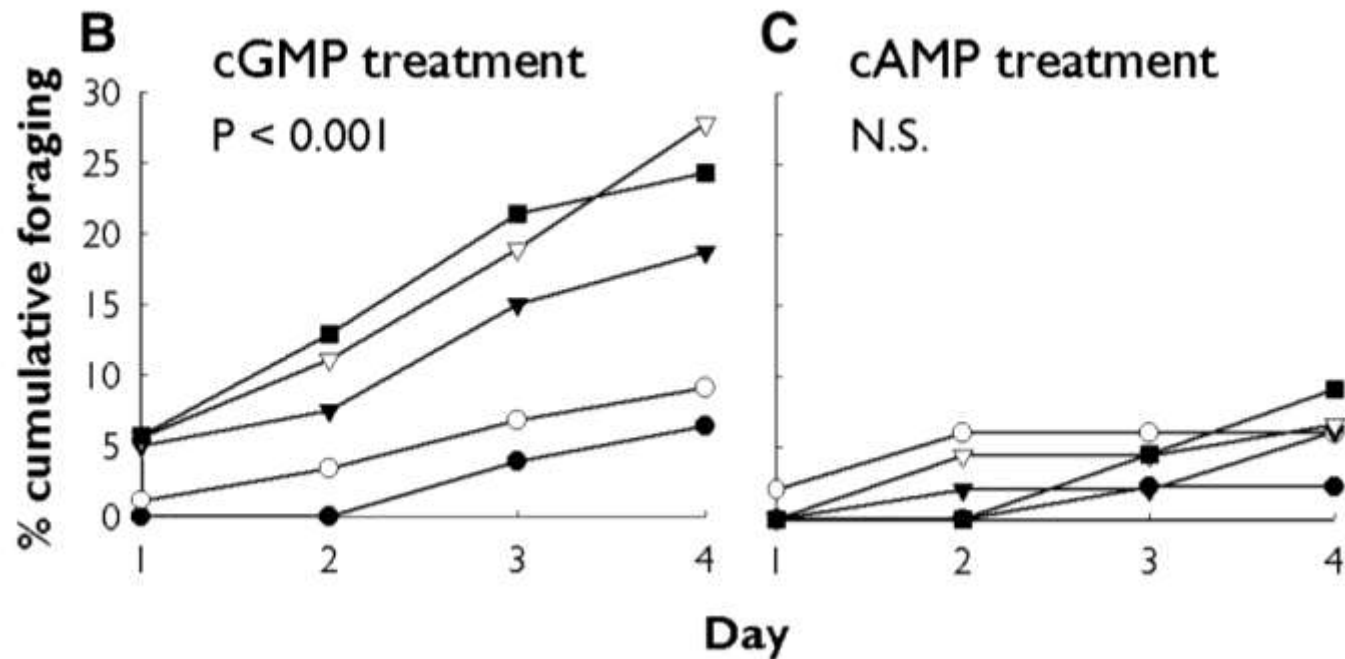
- How reliable are these data? What could be done to make them more reliable?

# Analyzing gene expression data: Discussion



- Can differences in *Amfor* expression be explained by age? What further test could be done to prove this?

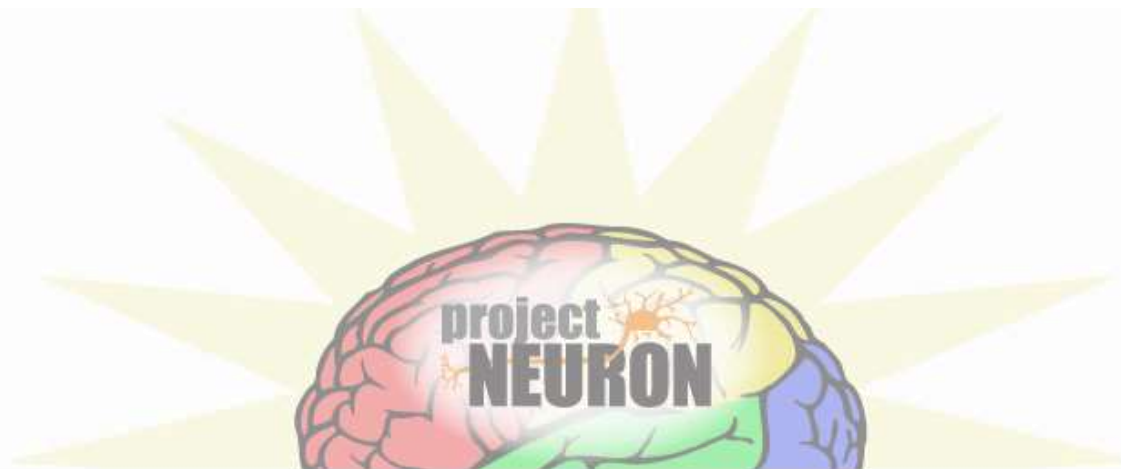
# Analyzing gene expression data: Discussion



- 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?



# Acknowledgements

- NIH, SEPA
- University of Illinois
  - Project NEURON
  - Robinson Lab
  - Institute for Genomic Biology

This project was supported by SEPA and the National Center for Research Resources and the Division of Program Coordination, Planning, and Strategic Initiatives of the National Institutes of Health through Grant Number R25 RR024251-03. The contents of this presentation are solely the responsibility of Project NEURON and do not necessarily represent the official views of the funding agencies.

# Thanks!

For additional information visit:  
**<http://neuron.illinois.edu>**

E-mail:  
**[neuron@illinois.edu](mailto:neuron@illinois.edu)**

The screenshot shows the Project NEURON website homepage. At the top, there is a navigation bar with the University of Illinois logo and a search box. Below the navigation bar is a header section with the text "Project NEURON" and "Novel Education for Understanding Research on Neuroscience". The main content area features a section titled "Find out more about our 2013 Summer Professional Development!" followed by three paragraphs of text. Below this is a "News and Events" section with several entries, including "Color Sorting Activity in The Science Teacher" and "Color Sorting Game is Back Online". On the right side of the page, there is a red-bordered box titled "Neuroscience Day" with a brain illustration and event details for Sioux City, NE and Mission, SD.

**ILLINOIS**     
log in / create account

Curriculum Units Professional Development Games and Media Additional Projects About

**Project NEURON**  
*Novel Education for Understanding Research on Neuroscience*

**Find out more about our 2013 Summer Professional Development!**

Project NEURON brings cutting-edge neuroscience to middle and high school students through classroom modules and activities based on research conducted at the University of Illinois at Urbana-Champaign. We bring together scientists, science educators, schoolteachers, and students to develop and disseminate materials that connect science with national and state science standards.

Our core project is the development of in-class curriculum units that emphasizing inquiry and active learning. These materials are tested by a dedicated group of high school teachers, to whom we provide support and professional development. We have adapted and expanded these materials into a variety of additional projects that include outreach for younger grades, informal education, and educational games and videos.

Please note that we are continuously improving this website and the materials listed here. We work hard to create quality materials, but if you notice any inconsistencies, missing materials, etc., please let us know! We also love to hear suggested improvements or adaptations from teachers who have used our materials!

**News and Events**

**Color Sorting Activity in The Science Teacher**  
March 25, 2013  
The March 2013 issue of The Science Teacher features the colored candy sorting activity in an article titled, "What color do you see?" (p. 60-65).

**Color Sorting Game is Back Online**  
February 20, 2013  
The Color Sorting Game is back up on the Project NEURON web site.

**Project NEURON at 2013 Public Engagement Symposium**  
February 8, 2013  
Keep an eye out for a poster at the 2013 Public Engagement Symposium that describes FTD-Drake.

**Neuroscience Day**  
**Neuroscience Day**

March 19 @ Science for S. SIOUX CITY, NE

March 21 @ Science Outreach MISSION, SD

9:00 - 2:00 with lunch provided

