Wake Up Students with Activities on the Genetics of Sleep Cycles

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What is Project N EURO N?

- At the University of Illinois
- Educators, scientists, and graduate students
- Curriculum development
  - Inquiry-based
  - Connect to standards
- Professional development
  - Summer institutes
  - Conferences
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 things make a big difference?**
  – *Microbes, ecology, and the tree of life*
Think-Pair-Share

1. What are some examples of circadian rhythms?
2. What can alter circadian rhythms?
3. What causes genetic variation?
4. What is epigenetics?

5 minutes: Discuss with neighbors, then share with group
What makes me tick...tock?

1. What is a circadian rhythm?
2. Why do scientists study fruit flies to understand what makes us “tick?”
3. How can genetics change your clock?
4. Tick tock...Broken clock
5. How do environment and modern society influence our rhythms?
6. What happens to humans when normal rhythms are disrupted?
7. How can epigenetics change your clock?
8. When should the school day begin?
How can epigenetics change your clock?

Previous knowledge
• PER2 gene regulates sleep cycles
• Careers and behaviors can affect circadian rhythms
• Disruptions to circadian rhythms can cause secondary health effects
Let’s play!

Epigenome model

1. Start of generation
   - Record expression score
   - Each methyl -1 point
   - Each acetyl +1 point

2. Lifetime events (3x each generation)
   - Roll die
     - Roll odd number: Choose chromosome 1
     - Roll even number: Choose chromosome 2
   - Draw card
     - Follow directions on card
     - Add* or remove acetyl as necessary
   - Add or remove methyl as necessary
   * Methyls prevent addition of acetyl

3. End of generation
   - Record expression score
   - Each methyl -1 point
   - Each acetyl +1 point

- Roll die
  - Roll odd number: Inherit chromosome 1
  - Roll even number: Inherit chromosome 2
- Inherit chromosome 1 or 2. Other chromosome is replaced by an unmodified chromosome from a new parent.
- REMOVE acetyl
- KEEP methyls
- Inherited chromosome
- New chromosome
Group Discussion

• What patterns in expression did you see?
• How did the level of expression change over time?
• Are higher levels of expression always better? Are lower levels always worse?
Challenge questions

• If one gene was mutated so that it did not produce a functional product, how would the expression level change?

• If you have a heterozygote (1 mutated, 1 normal) genotype, what would be a beneficial level of expression for the normal gene?
Think About It Again…

1. What are some examples of circadian rhythms?
2. What can alter circadian rhythms?
3. What causes genetic variation?
4. What is epigenetics?

Hopefully this activity has expanded your awareness and knowledge of epigenetics!
Think-Pair-Share

1. How do you envision using this activity in your classroom?
2. What modifications would you make to the lesson?

5 minutes: Discuss with neighbors, then share with group
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Thanks!

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