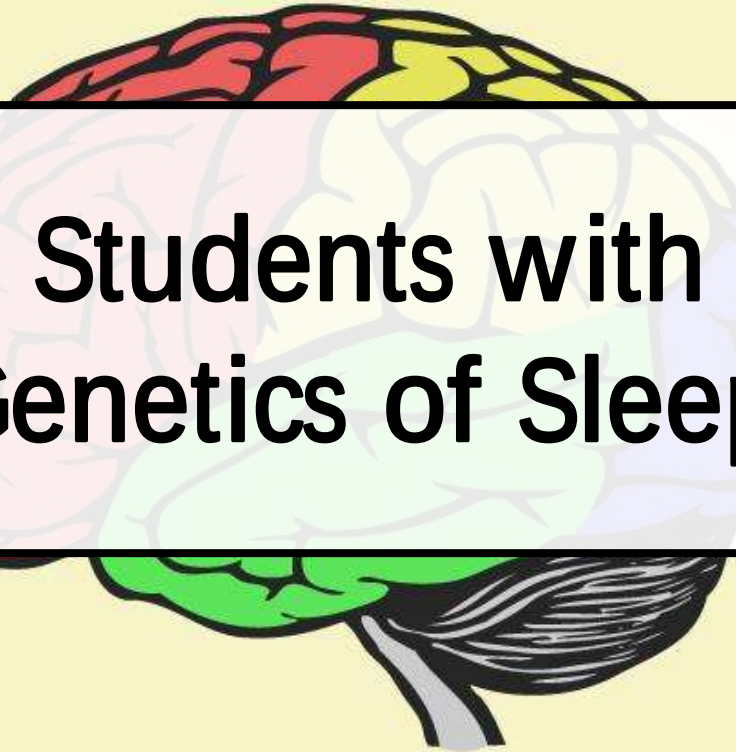

Wake Up Students with Activities on the Genetics of Sleep Cycles

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NIH National Institutes of Health

SEPA Science Education Partnership Award

What is Project NEURON?

- 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*

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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?

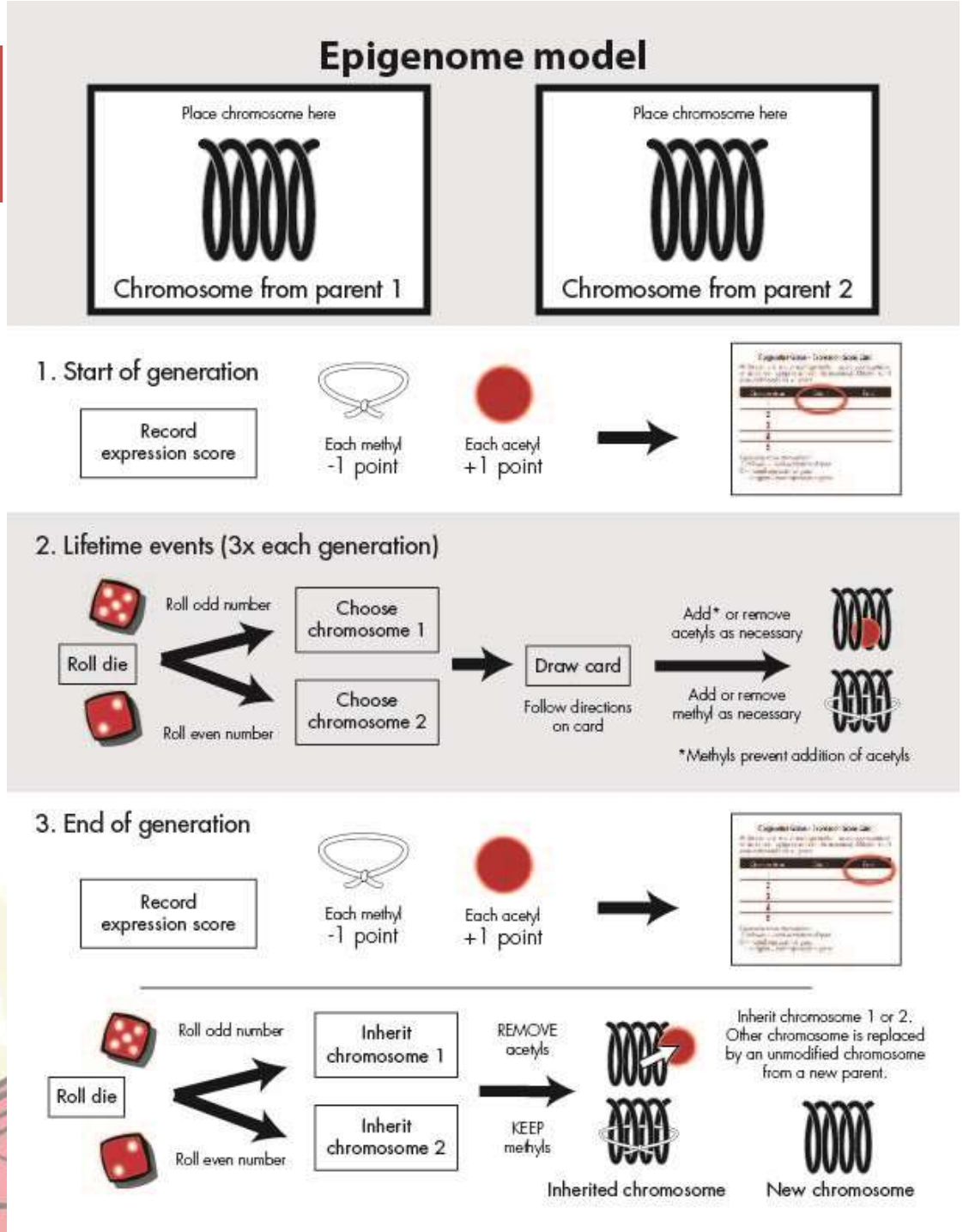
1. What is a circadian rhythm?
2. Why do scientists study fruit flies to understand what makes us “tick?”
3. How can genetics change your clock?
4. Tick tock…Broken clock
5. How do environment and modern society influence our rhythms?
6. What happens to humans when normal rhythms are disrupted?
7. How 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
Place chromosome here
Chromosome from parent 1
Place chromosome here
Chromosome from parent 2
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
Roll even number
Choose chromosome 1
Choose chromosome 2
Draw card
Follow directions on card
Add* or remove acetyls as necessary
Add or remove methyl as necessary
*Methyls prevent addition of acetyls
3. End of generation
Record expression score
Each methyl -1 point
Each acetyl +1 point
Roll die
Roll odd number
Roll even number
Inherit chromosome 1
Inherit chromosome 2
REMOVE acetyls
KEEP methyls
Inherit chromosome 1 or 2. Other chromosome is replaced by an unmodified chromosome from a new parent.
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

Acknowledgements

- NIH, SEPA
- University of Illinois

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Thanks!

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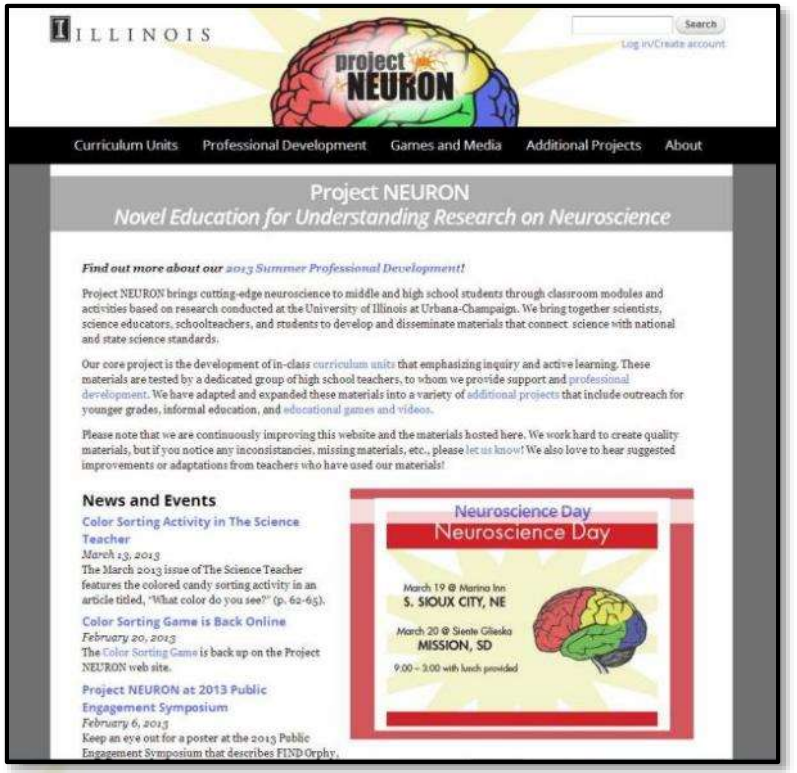

Hillary's blog about Science, Education, Games, and Design:
The Science Slug: http://scienceslug.wordpress.com