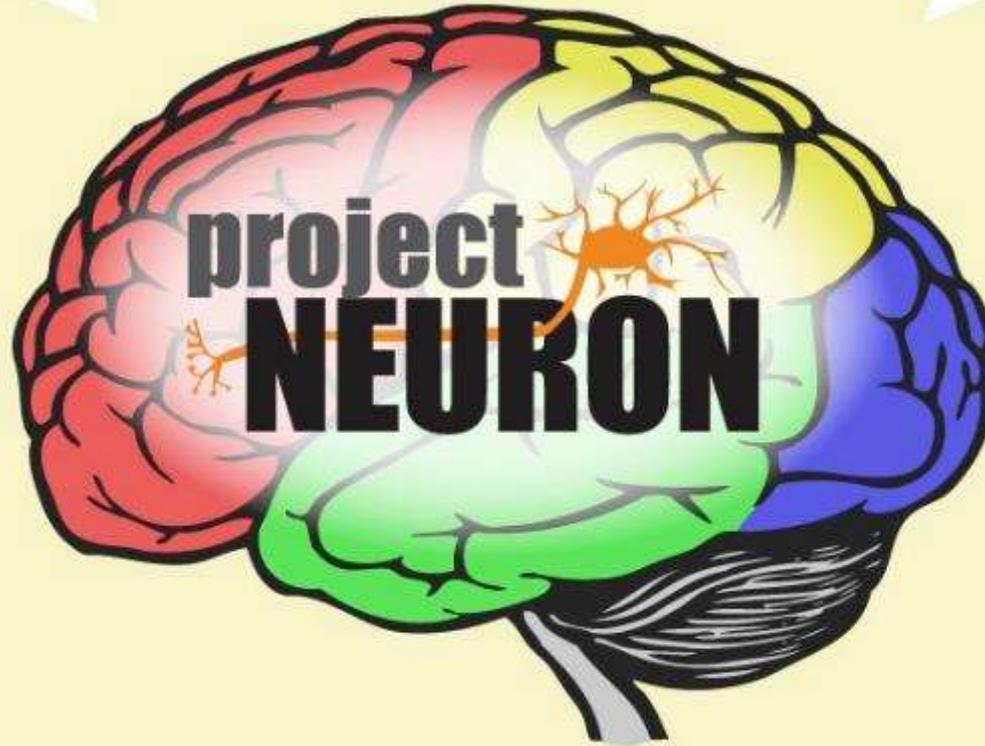


Food For Thought:

A **Modeling** unit investigating connections between the endocrine and nervous systems, metabolism, and health



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Wilson, Barbara Hug*



University of Illinois at Urbana Champaign

What is Project NEURON?

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

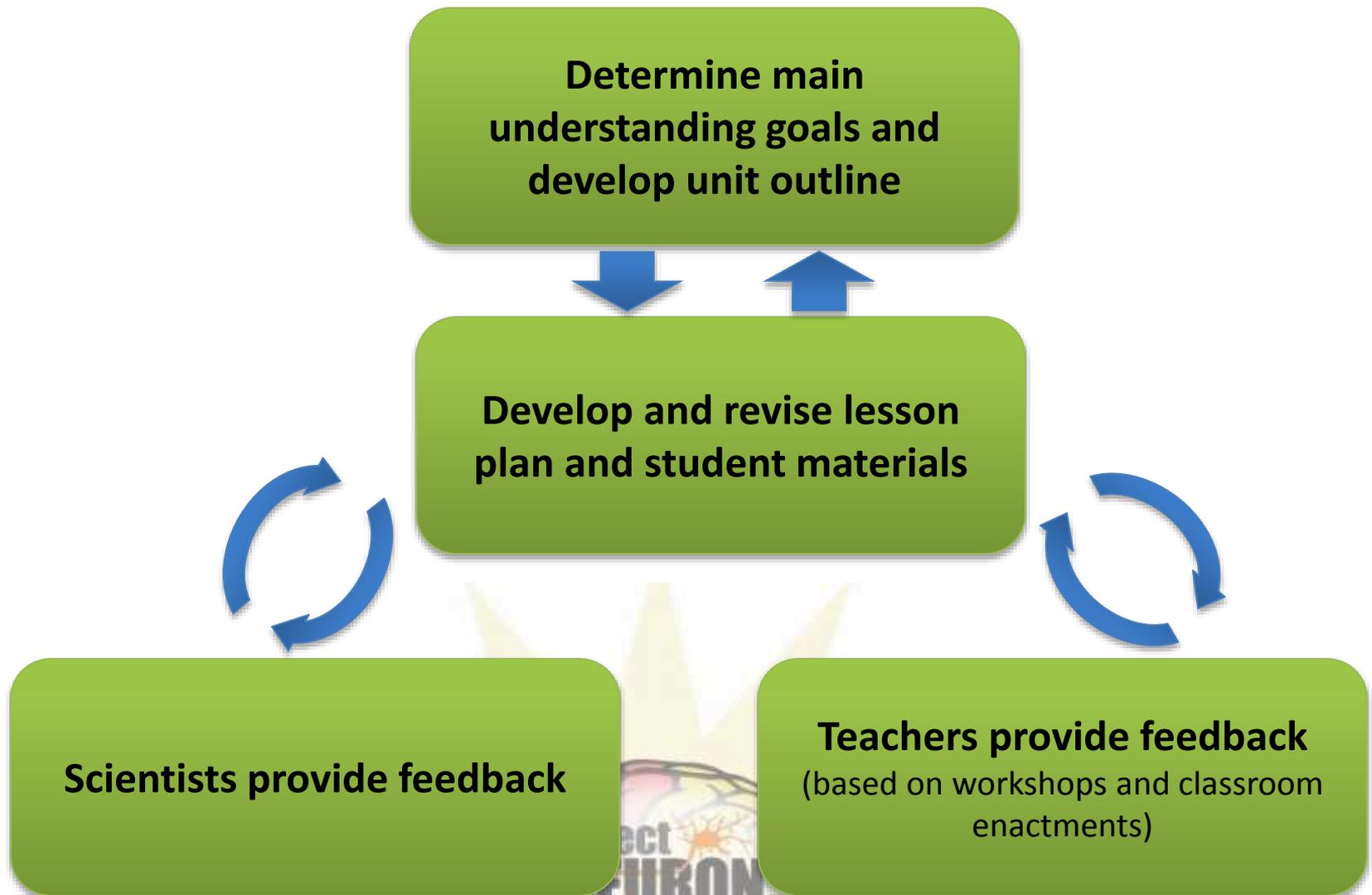


The Glucose Unit: A Collaborative Process

- Science Educators (Project NEURON)
 - Initial unit planning
 - Developing lessons
 - Modify/revise materials based on feedback
- Scientists (Donna & Paul Gold)
 - 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



Food for Thought:

L1: Why is glucose important for the body and brain?

L2: How does the body regulate glucose?

L3: What effect does adrenalin have on the body and brain?

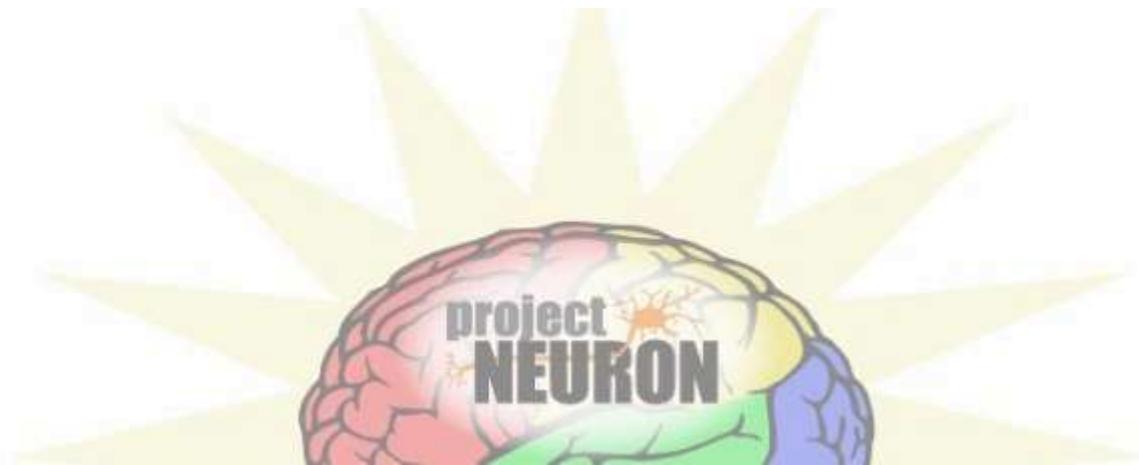
L4: How does glucose affect memory in aging populations?

L5: How does glucose dysregulation lead to disease?



Goal of Presentation

Introduce Project NEURON's Glucose Unit and focusing on the “development and use of models” as a perspective/approach for engaging students in the practices of science.



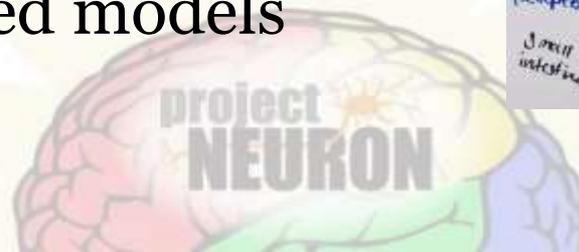
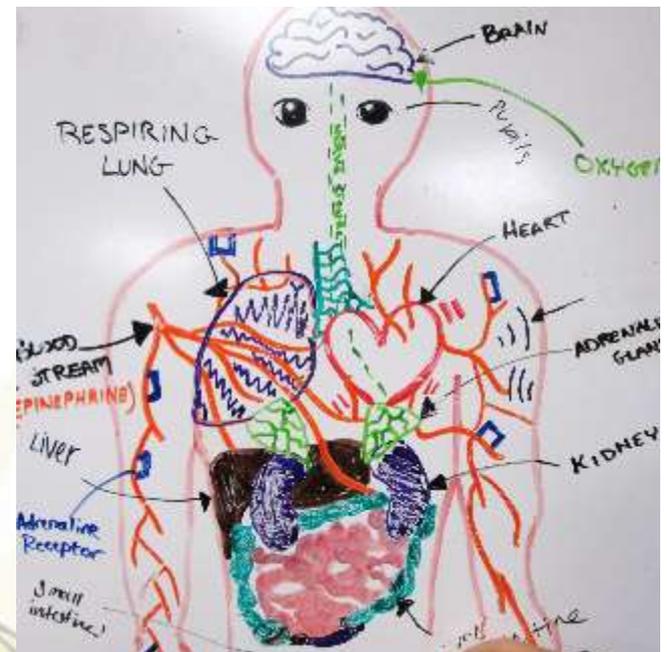
Nature of the “Food For Thought” Unit

- Emphasis on the scientific practice of modeling
- Small groups (4-5 students)
- Teacher and students actively engaged



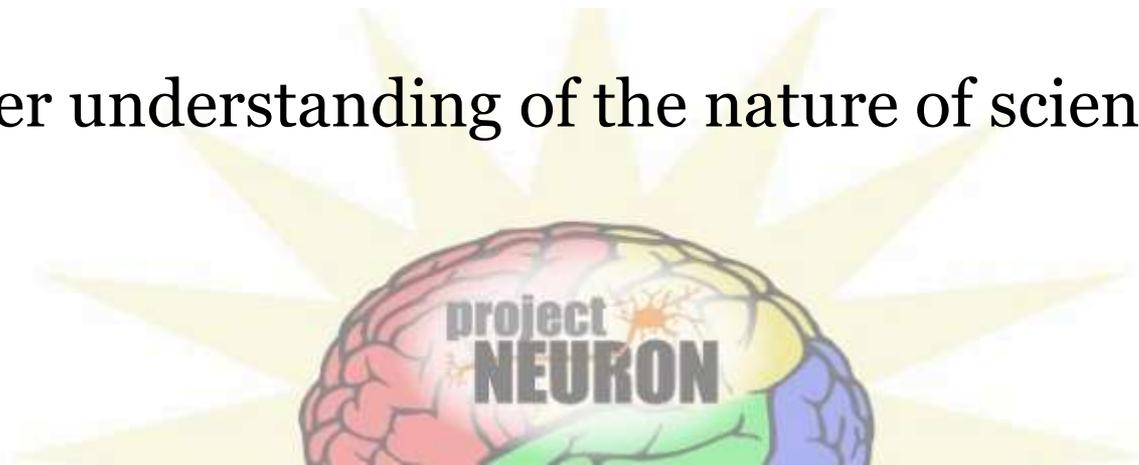
Modeling in NGSS

- **Scientific Practice 2:** Developing and Using Models
- **Crosscutting Concept 4:** Systems and System Models
- Scientists use models to
 - Predict
 - Test and revise
 - Explain and Communicate
- Models not static, but explore a process, an event, a phenomena over time
- Student-generated models



Modeling in Teaching

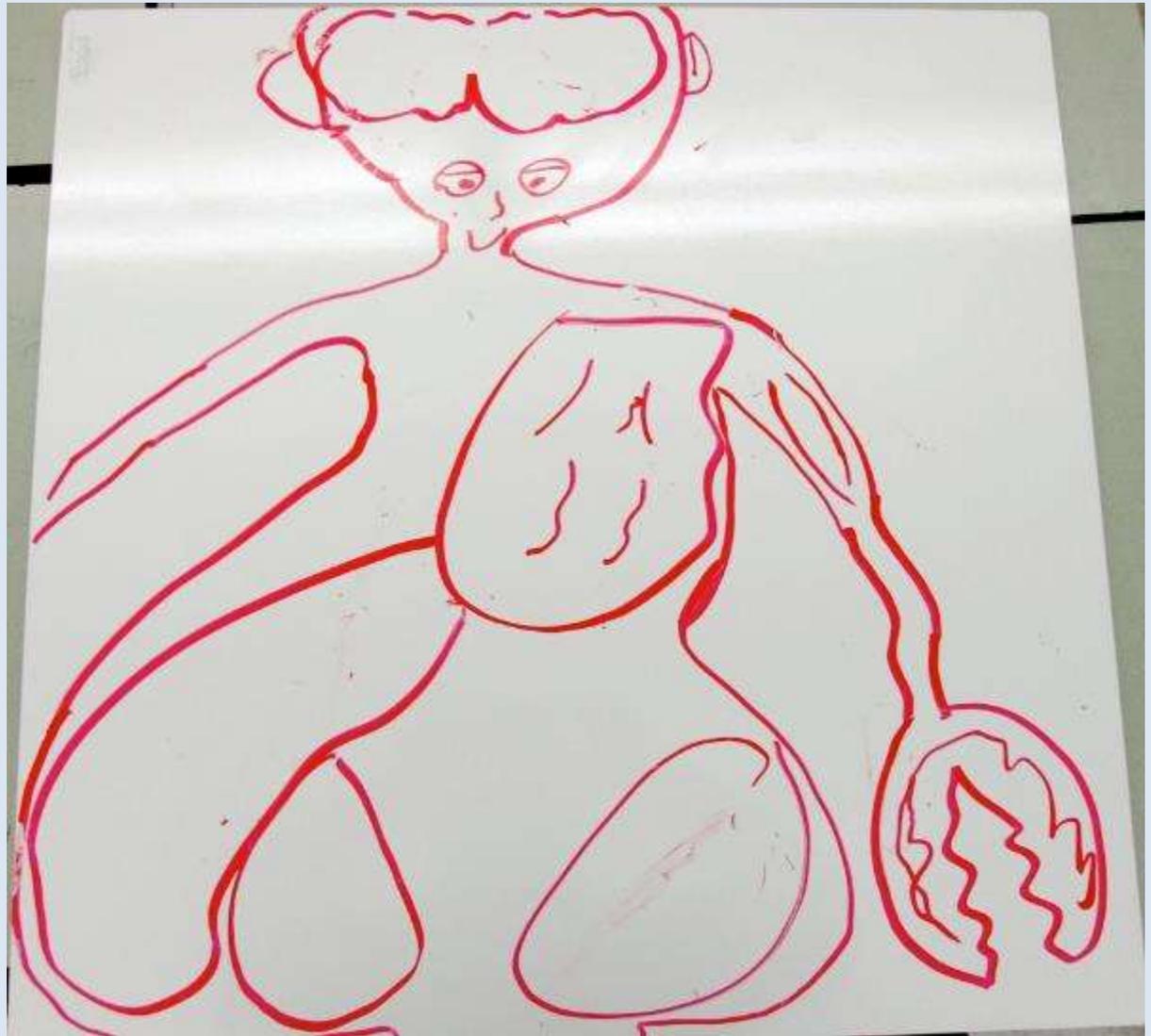
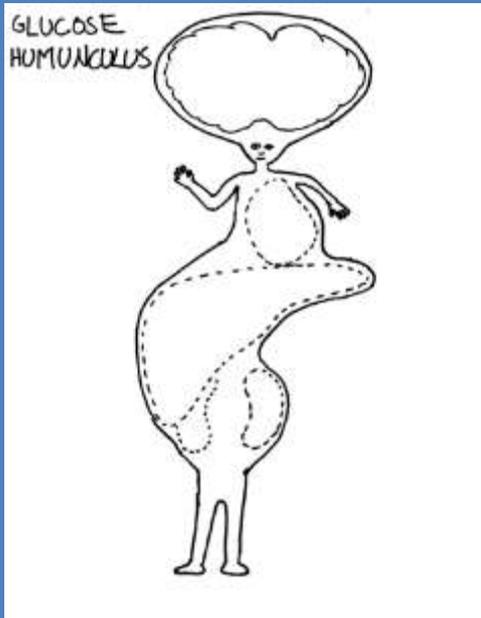
- Models can serve to connect ideas arising from multiple activities and readings
- Through modeling, student's mental models (student thinking) can be made known to teacher. Great for formative assessment
- The nature of models leads into other scientific practices
- Better understanding of the nature of science



Lesson 1

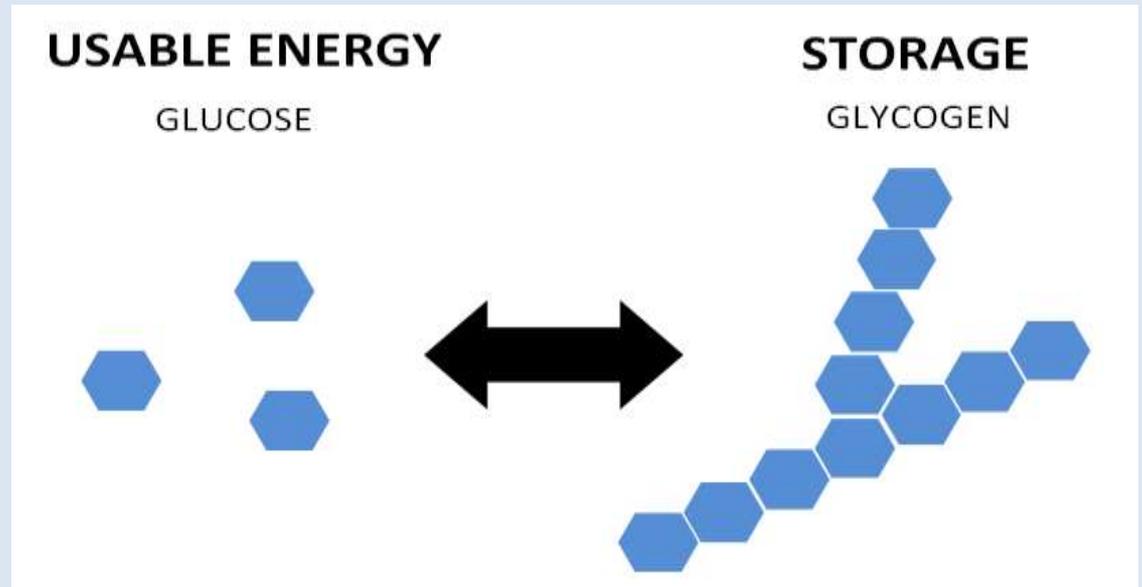
Why is glucose important for the body and the brain?

- Glucunculus as an explanatory model



Lesson 1

Why is glucose important for the body and the brain?



Lesson 2

How does the body regulate glucose levels?

- Cracker activity
- Stop-animation video
- Connecting analogy through class discussion

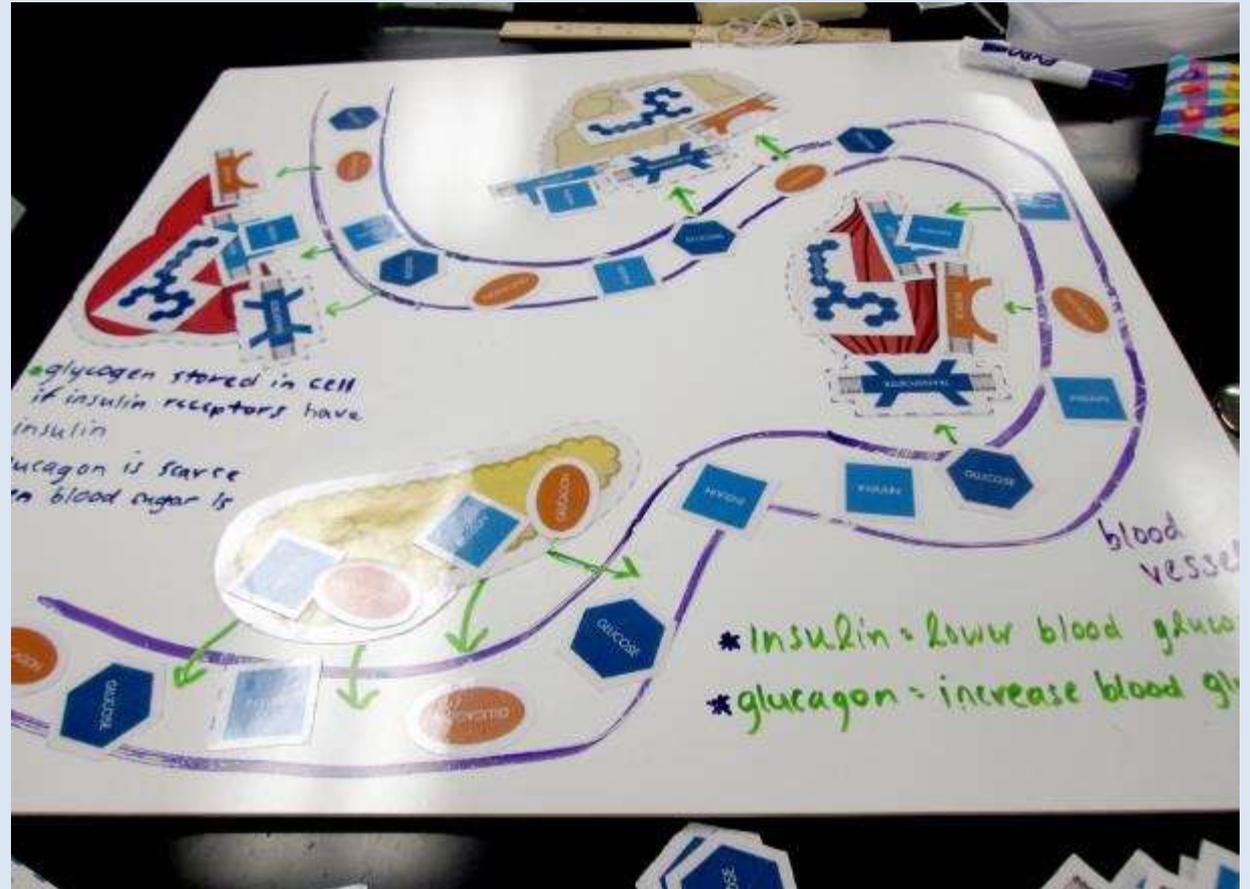
The original presentation had a video, which has since been removed to save space for sharing on the internet.

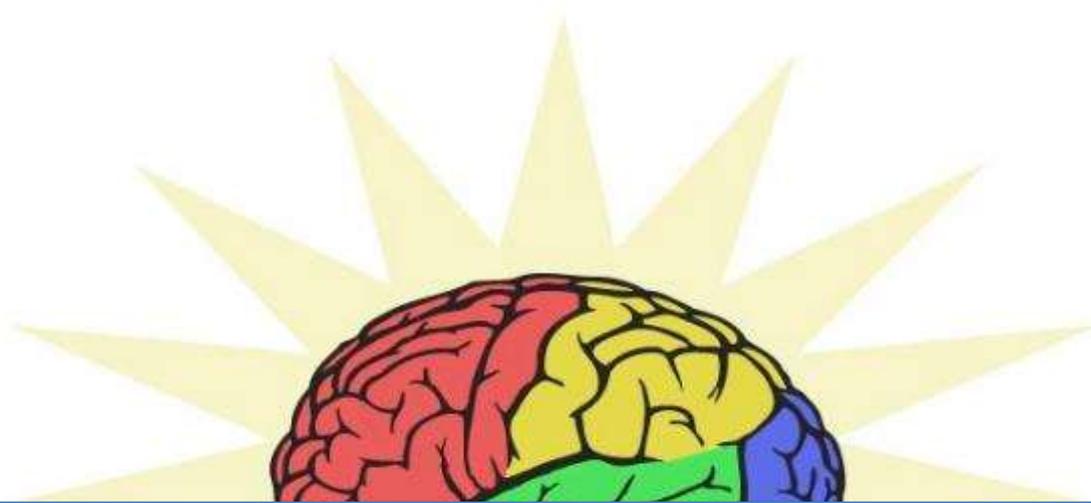
The video is available to view or download at <http://neuron.illinois.edu/endocrine-system>

Lesson 2

How does the body regulate glucose levels?

- Students apply their framework of the endocrine system to specific hormones: glucose and insulin
- Students apply their models working through different medical scenarios.

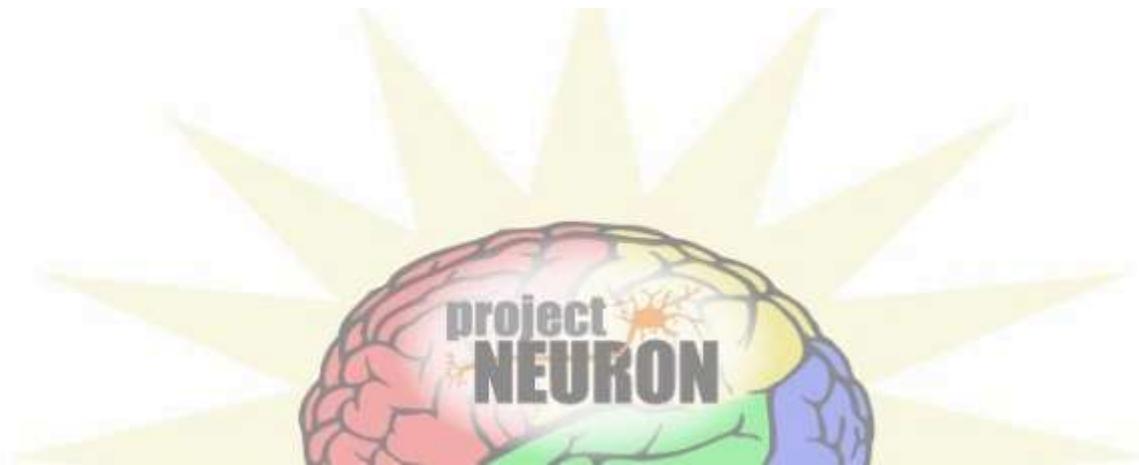




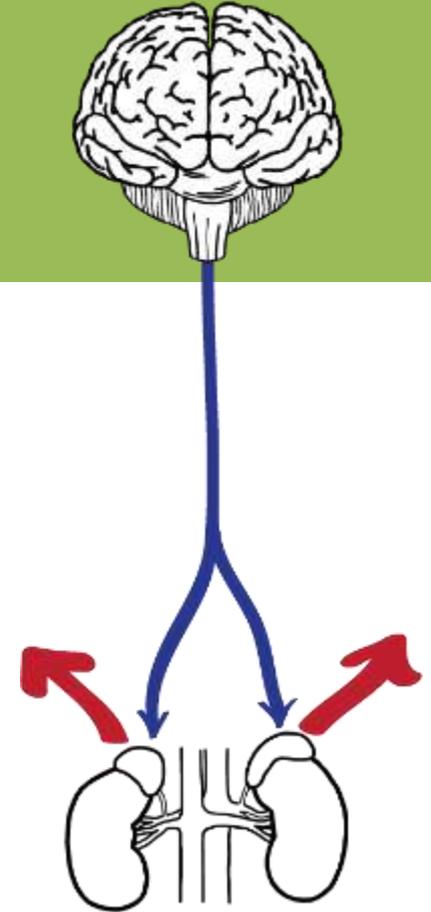
Lesson 3

How does adrenalin (epinephrine) have an effect on the body and the mind?

Lesson 3



Using Models to Make Predictions



PREDICT:

Develop a model of how adrenalin (epinephrine) induces changes in the body.

- Use what you know about the endocrine system
- Use what you know from prior experience

REMEMBER:

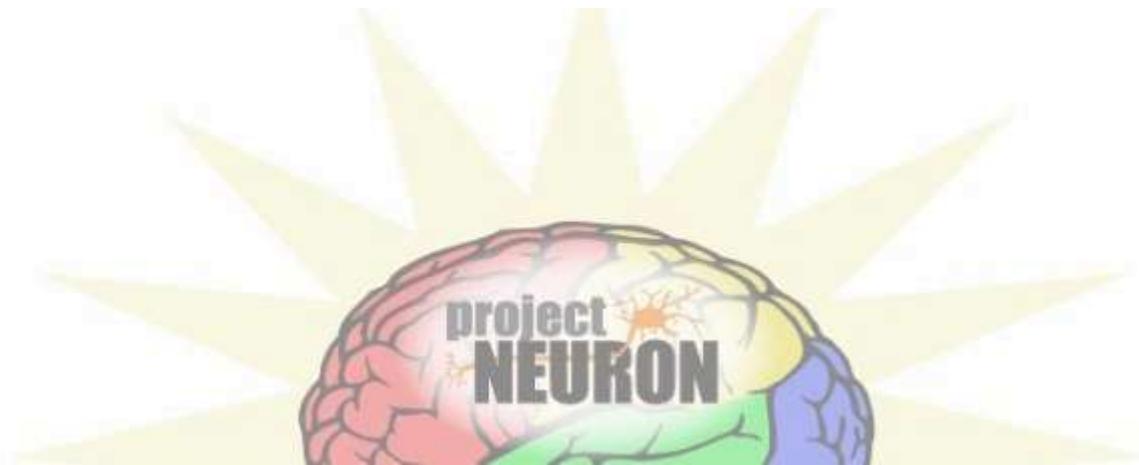
At this point you are creating a model to make predictions. This is exactly how scientists create models. They make predictions through observation and from previous scientific knowledge. After using their models to predict, scientists then test their models to see if their predictions are supported. If not, scientists then need to revise their existing model in light of new evidence. You will be testing your model in the second part of this activity.

Using Models to Test

TEST:

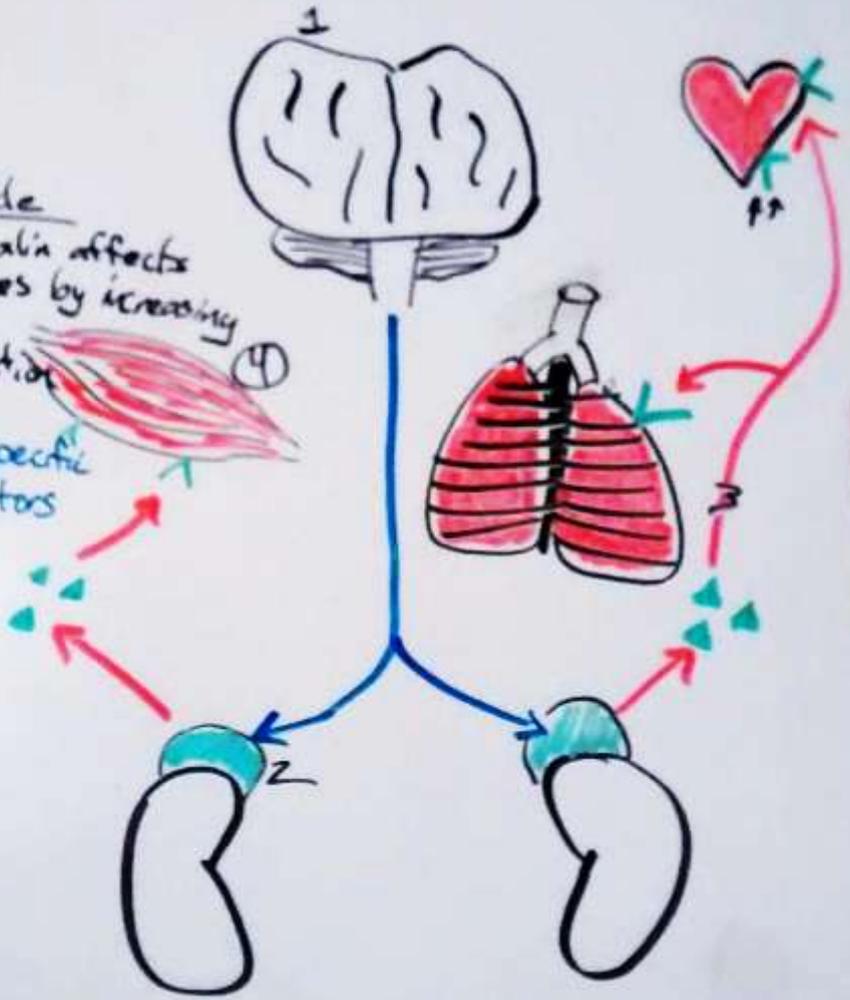
Based on new evidence determine if:

- Your model is supported by evidence
- If you need to add to your model
- If you need to revise your model

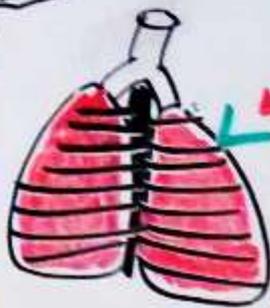
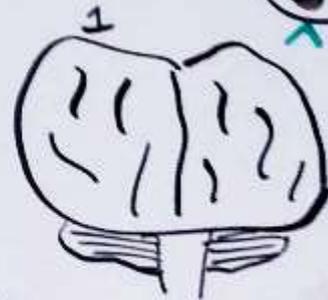
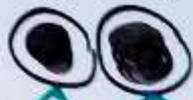


Muscle
adrenalin affects
muscles by increasing
cell
respiration

has specific
receptors



Eyes Dilate



Muscle
adrenalin affects
muscles by increasing
cell
respiration



has specific
receptors

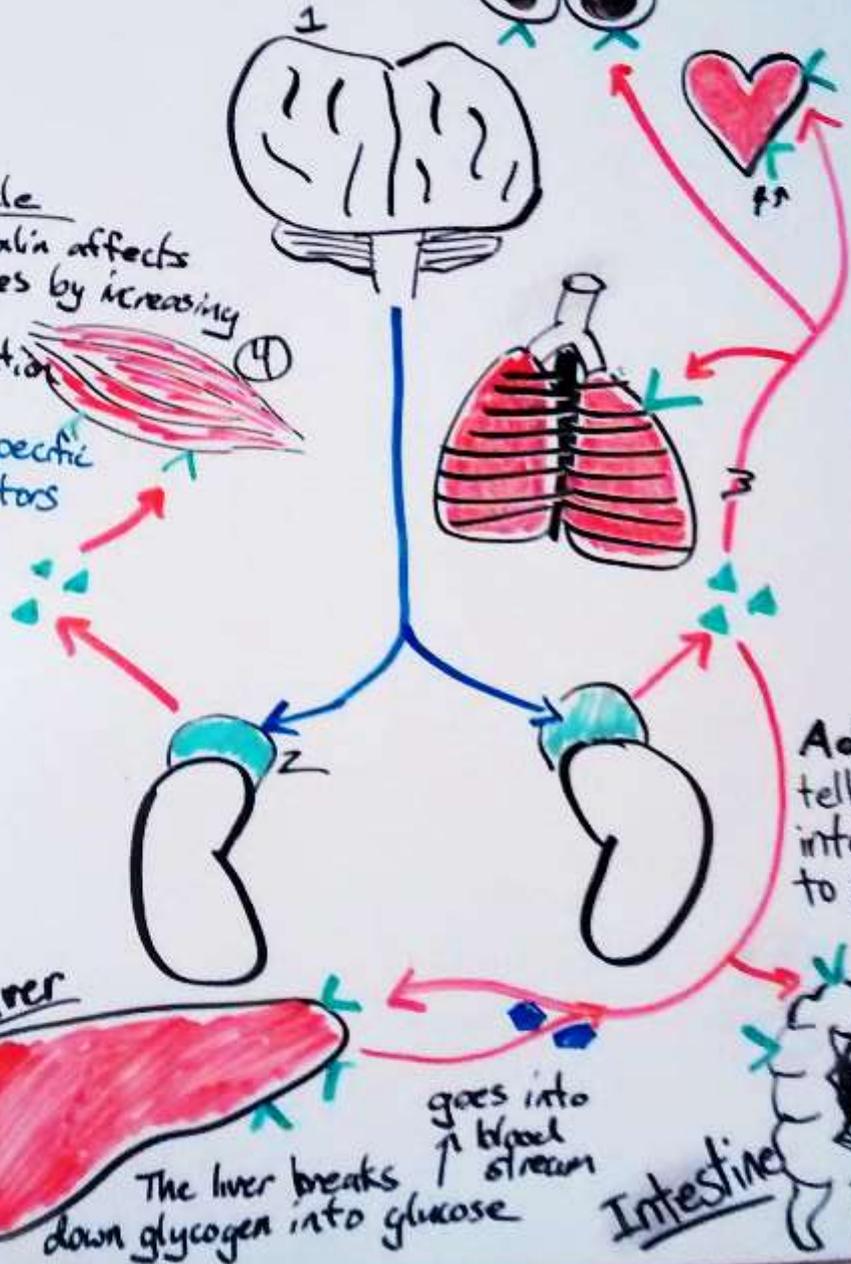
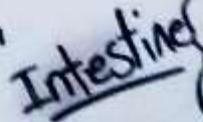


Adrenalin
tells the
intestines
to slow
down



The liver breaks
down glycogen into glucose

goes into
↑ blood
stream



Brain
adrenalin affects brain by allowing for better memories

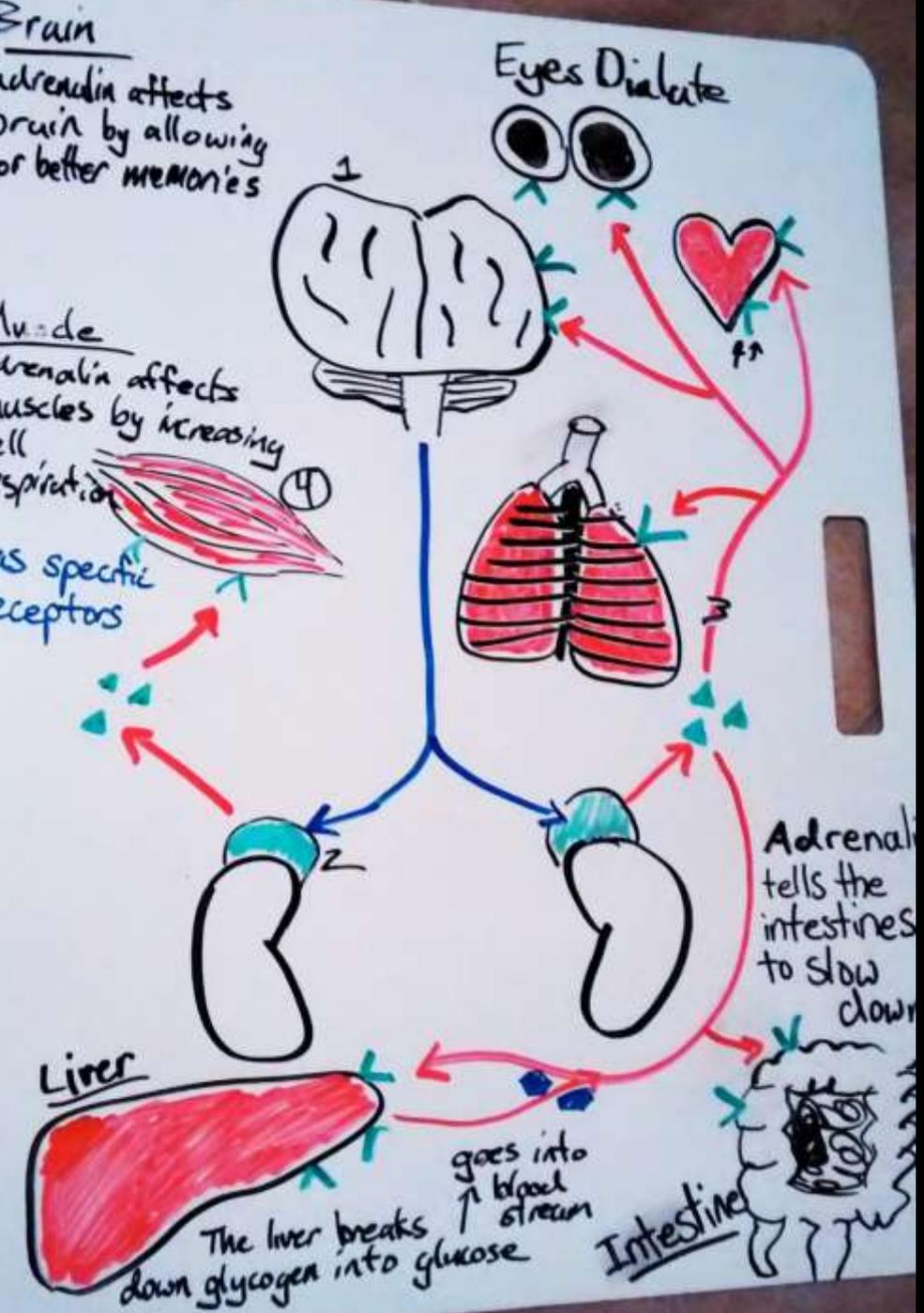
Eyes Dilate

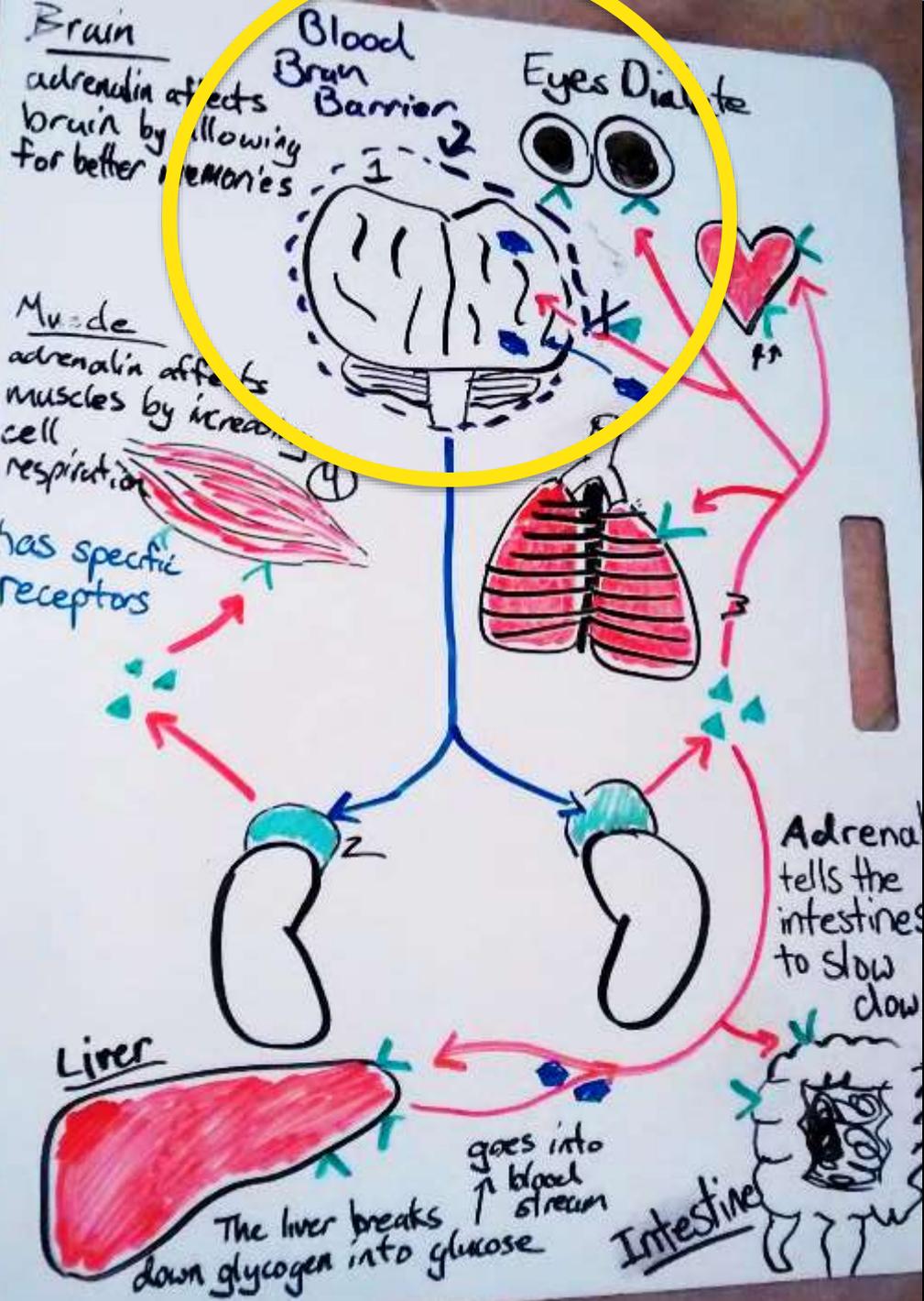
Muscle
adrenalin affects muscles by increasing cell respiration
has specific receptors

Liver
The liver breaks down glycogen into glucose

Adrenal tells the intestines to slow down

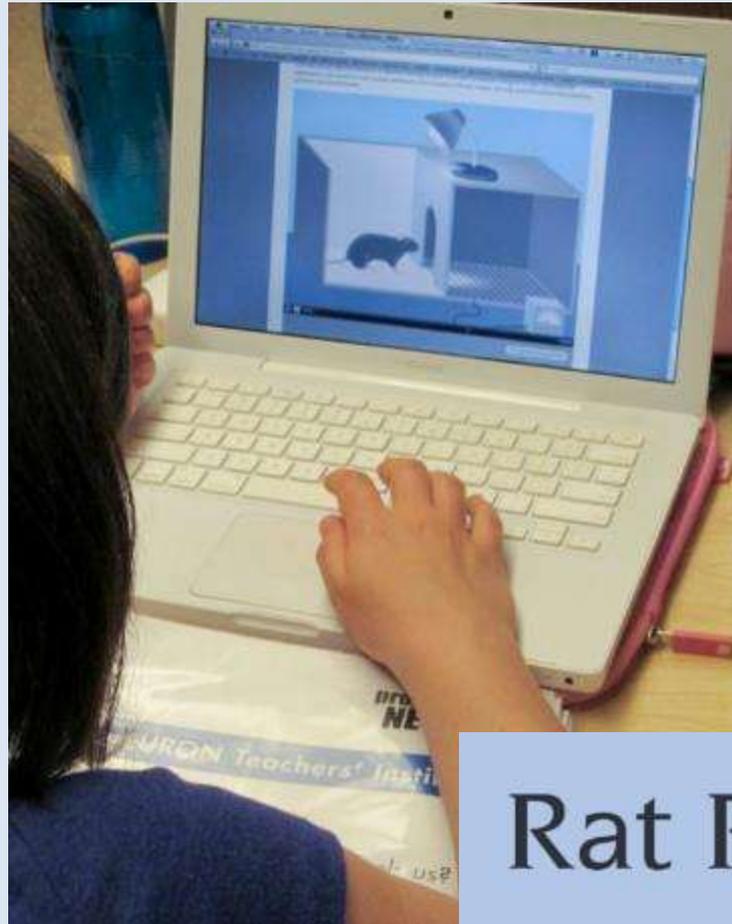
Intestine





Lesson 4

Do glucose and
adrenalin affect
memory in aging
populations?

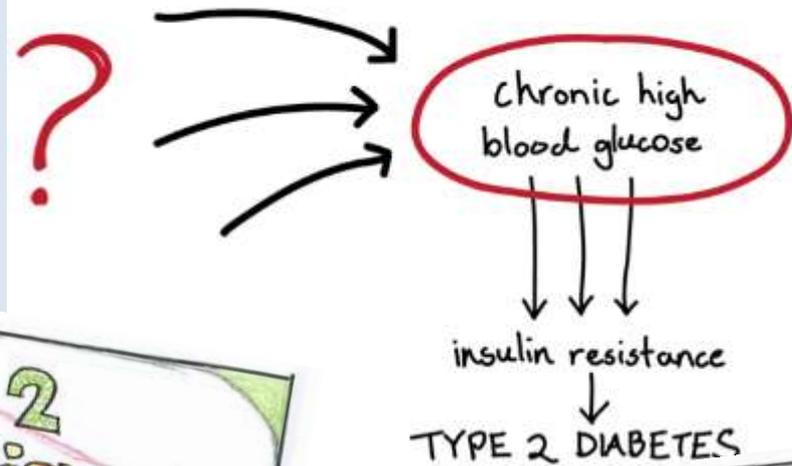


Rat Recall



Lesson 5

How does glucose dysregulation lead to disease?



TYPE 2 Diabetes

Cause: High insulin resistance.

What is that?
It is when cells in the body fail to respond to insulin output. Caused by constant high blood glucose levels, Hypertension, and hyperlipidemia. When having type 2 diabetes you have to watch what you eat to maintain homeostasis.

Prevention!!

- Eat right (in a healthy manner)
- Exercise regularly
- Sleep an average of eight hours each night.

SUGAR STRESS, LAZINESS, Oh My!

A lot of sugar consumption builds resistance to insulin. The sugar is never worked off and this is known as high sugar.

Sedentary -
When you rarely exercise, your blood sugar stays high. Over a long period of time this could lead to insulin resistance.

High stress is how someone responds to stress. Results that happen are, a high sugar diet, lack of sleep along with stress can lead to late night eating, little exercise, and unhealthy drinking choices.

Discussion

- How have we all used this unit?
- How has this unit influenced our teaching?
- Do you have comments or suggestions about Lesson 3?
- Questions about Modeling for teachers, students, scientists?

All materials can be found at: **neuron.illinois.edu**



Thank You

Acknowledgements

- NIH, SEPA
- University of Illinois

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