

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

## Novel Education for Understanding Research On Neuroscience

Project NEURON brings cutting-edge science to middle and high school students through inquiry-driven activities based on research conducted at the University of Illinois.

<http://neuron.illinois.edu/>

### Food for thought: What fuels us? *Glucose, the endocrine system, and health*

#### **Lesson 1: Why is glucose important for the body and brain?**

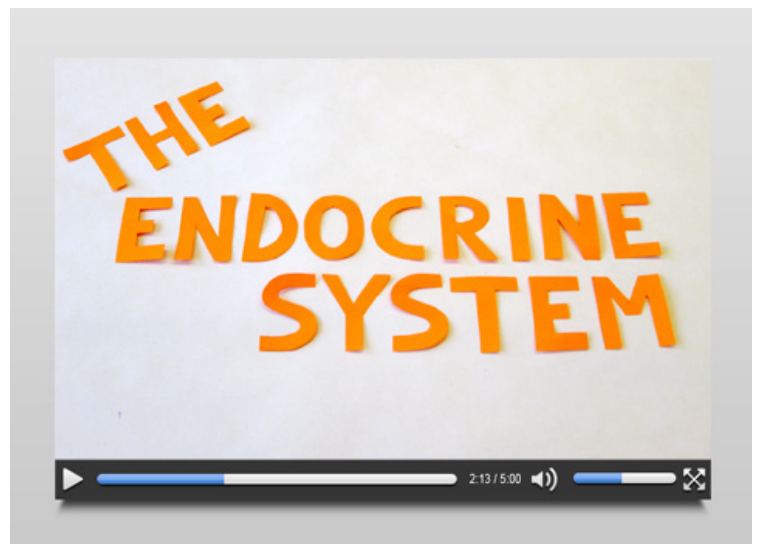
The purpose of this lesson is to introduce the driving question of the unit, "What fuels us?" Through a series of activities, students actively participate in examining how the body uses its main energy source, glucose. First, students calculate and draw models exhibiting the disproportionate distribution of glucose throughout the body, and discuss why certain organs may require more energy than others. Second, students analyze and interpret data to explain the role of glycogen and glucose in maintaining blood glucose homeostasis.

#### **Lesson 2: How are glucose levels regulated in the body?**

The purpose of this lesson is to introduce the endocrine system and its role in maintaining blood glucose homeostasis in the body. Students model the endocrine system by participating in a system that makes cheese and crackers. Students then watch a video explaining the fundamental aspects of the endocrine system. Afterwards, students discuss what parts of their cracker and cheese production system represented specific aspects of the endocrine system. To further relate the lesson to glucose homeostasis, students develop a model for the action of glucagon and insulin in the body by organizing cards that represent different organs, hormones, receptors, and intracellular molecules.

#### **Lesson 3: How does adrenalin affect the body and the brain?**

Lesson 3 aims to explore the fight-or-flight response and how it relates to glucose availability in the body and the brain. Students reflect on personal adrenalin experiences to recognize how their heart rate, breathing, and memory change in this sympathetic state. Using their personal experiences and the information learned from Lessons 1 & 2, students construct a model to predict how the stress hormone adrenalin affects the body. Next, students proceed through a series of three checkpoints to test their model and make revisions as needed. Finally, students use their models to explain, communicate, predict, and test the effect an adrenal rush has on the endocrine system and the body as a whole.



# Food for thought: What fuels us?

## *Glucose, the endocrine system, and health*

### **Lesson 4: How does glucose affect memory in aging populations?**

In this lesson, students learn about the role of adrenalin and glucose in age-related rapid forgetting. Using the models from previous lessons, students design and conduct their own experiments to discover possible reasons for age-related memory loss in elderly people. Students perform experiments using “Rat Recall”, a program simulating behavior of young and old rats in a task designed to test memory retention. Rat Recall allows students to test the effects of glucose and epinephrine on memory. This simulation builds on behavioral data collected in experiments conducted by neuroscientist Dr. Paul Gold at Syracuse University. After performing their group experiments, students work as a class to determine the roles that adrenalin and glucose may have in age-related memory loss.

### **Lesson 5: How does glucose dysregulation lead to disease?**

In this lesson, students learn about the consequences of the dysregulation of blood glucose levels in type 2 diabetes. Students apply their knowledge of the insulin/glucagon model from Lesson 2 by integrating information from multiple readings that discuss risk factors for type 2 diabetes. Students learn that type 2 diabetes is preventable and is brought on by a sedentary lifestyle, poor diet, and stress. Using the information they collect, students collaborate to develop a PSA that promotes the prevention of type 2 diabetes and includes information on the dangers of stress on glucose regulation and health.

