SCIENCE THEATER EXPLORE 1 LESSON 9



Science Theater Teacher Directions

Key Outcomes

- Students experience the model from two points of view: an observer and a participant assigned to the role of an organ and/or specialized cell within an organ.
- Students cooperate to combine information about individual organs and cells to make sense of the pathways, processes, and purpose of digestion of milk in the body.

Materials

The following is a list of the printed materials which are located in the student handout. There you will find:

Table Tents for each organ that depict the structure of the organ and the specialized cells it is composed of.



Tokens represent relevant nutrients, stimuli, processes, and responses that occur during the mechanism being modeled.

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Role Cards for each organ (including any specialized cells) that describe the function of each organ and its specialized cells as well as instructions for how students will engage in the model.



ROLE CARD

Physical Classroom Setup

Set up and label the layout of the classroom as shown below so that a table (or grouping of desks) represents each organ. Ensure each organ has the corresponding visual poster where it is visible. Students will stand or sit at each table as they represent the cells of each organ. Molecule cards will be "moving" from one organ to another.



Below is a table listing the initial locations for each token:

Organ	Tokens Act 1	Tokens Act 2
Brain	Signal produce sweatSignal vasodilation	 Signal stop producing sweat Signal constrict/shrink blood vessels
Nerves, Spinal Cord	• N/A	• N/A
Blood Vessels	 Increase blood flow between core organs to surface Dilate (expand) blood vessels 	 Decrease blood flow core organs to body surface Blood vessels constrict/shrink
Skeletal Muscle	 Muscle cells expand and contract Active the movement 	 Muscle cells expand and contract Deactivate the movement
Skin	 Body temperature increasing Produce and secrete sweat Release body heat via evaporation Release body heat to surroundings Sweat Detect body temperature increase Signal increasing body temperature 	 Decrease body heat loss to evaporation Body temperature decreases Stop producing sweat Decrease body heat loss to surroundings Detect body temperature decrease Signal decrease in body temperature
Facilitator	Exercise beginsExercise continues	Exercise endsLess energy needed/generated

Science Theater Actions By Role

- Hypothalamus: Neurons
 - During exercise, the hypothalamus detects a signal of temperature increase from thermoreceptors in the skin and sends a signal to sweat glands in the skin (to cool).
 - At rest, the hypothalamus receives a signal of temperature decrease from the thermoreceptors in the skin and sends a signal to sweat glands in the skin to stop producing sweat.
- Nerves, Thermoreceptor Neurons
 - During exercise, thermoreceptors send signals to the brain that indicate an increase in the temperature of the skin.
 - At rest, thermoreceptors detect a decreasing temperature of the skin, so they stop sending nerve signals to the hypothalamus.
- Skeletal Muscles: Myocytes
 - During exercise, muscle cells expand and contract to use energy to move and generate energy for heat, resulting in body temperature increasing.
 - At rest, muscle cells expand and contract less and produce less energy as heat, resulting in body temperature decreasing.
- Blood Vessels (Nerves, Vasoconstrictors, and Vasodilators)
 - During exercise, these nerves receive a signal from the hypothalamus to dilate the blood vessels to allow more blood flow to the surface of the skin. During exercise, blood vessels receive a signal to dilate to increase blood flow and transfer heat from the body's internal organs to the body's surface, where it can be lost to the surroundings.
 - After exercise, these nerves receive a signal from the hypothalamus to constrict blood vessels to allow less blood flow to the surface of the skin. At rest, blood vessels receive a signal to constrict and lower blood flow, and thus heat transfer, from the body's internal organs to the surrounding environment.
- Sweat Glands: Myoepithelial Cells
 - During exercise, sweat glands receive a signal from the hypothalamus via nerves to produce sweat to cool the body.
 - At rest, sweat glands receive a signal from the hypothalamus to stop producing and releasing sweat to maintain body temperature.

Science Theater Actions in Sequence

Act 1 - During Exercise

- 1. During exercise (facilitator), *body temperature increases. Muscle cells expand and contract* and when they do so they use energy. Some of this energy is used for movement and some is used to generate heat. When you exercise you generate more heat. This increase is *detected* by nerve cells and thermoreceptors in skin.
- 2. The thermoreceptors in the skin send a *signal* to the brain. This change in temperature is detected by a specialized region known as the hypothalamus.
- 3. The hypothalamus responds by sending two different signals:
 - a. A signal to the sweat glands in the skin that the body needs to cool off. Sweat glands receive the signal from the hypothalamus to *produce sweat* as a response to cool off the body by *releasing body heat via evaporation*.
 - b. A signal to the vasodilator nerves, which cause the blood vessels to expand/dilate, which increases blood flow from the body's core organs and muscles to the surface of the body so that heat can be lost to the surroundings.

Act 2 - At Rest

- 1. After exercise (facilitator), *body temperature decreases* due to the muscles cells *not using as much energy* to generate heat (facilitator). This decrease in temperature is *detected* by nerve cells and thermoreceptors in skin cells.
- 2. The thermoreceptors send a *signal* to the brain that the temperature is decreasing. This change in temperature is *detected* by a specialized region known as the hypothalamus. The hypothalamus responds by sending two *signals*.
 - a. A signal to the sweat glands in the skin that the body has cooled off and needs to increase slightly to reach a stable state. Sweat glands receive the signal from the hypothalamus to *stop producing sweat* as a response as body temperatures decrease and return to the stable state.
 - b. A *signal* to the vasoconstrictor nerves, which cause the *blood vessels to constrict/shrink*, which decreases blood flow from the body's core organs and muscles to the surface of the body so that *heat is no longer lost* to the surroundings.