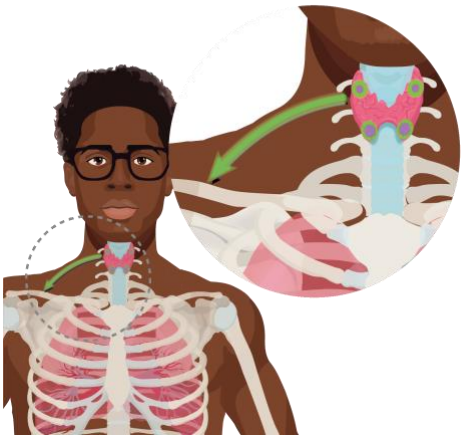
TOPIC: FEEDBACK LOOPS: NEGATIVE FEEDBACK

- *Recall*: Negative feedback loops return body to set point; oppose the direction of the stimulus.
- Nervous and _____ systems: control many feedback loops.
- 3 components to a negative feedback loop:
  1. **Receptor:** measures _____ - a change in internal environment.
  2. **Control center (integration center):** processes information and signals a _____.
  3. **Effector:** carries out action to _____ set-point.



Parathyroid gland detects low blood calcium. _____

Parathyroid gland integrates low blood calcium signal and releases parathyroid hormone. _____

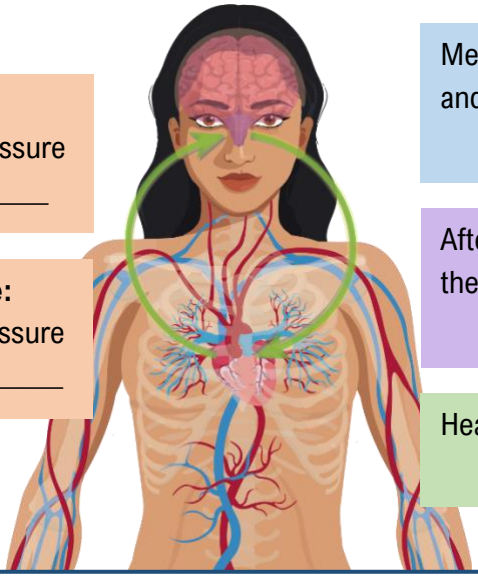
Bone tissue is stimulated by parathyroid hormone to increase blood calcium. _____

EXAMPLE: Identify the components of a negative feedback loop:

You stand up quickly causing your blood pressure to fall and you to feel lightheaded. Your pulse begins to increase, raising your blood pressure, and after a moment you feel fine. Using the diagram below, first identify the stimulus and the response; then, label the receptor, control center, and effector in this feedback loop.

Stimulus:
Blood pressure
_____

Response:
Blood pressure
_____



Medulla processes low blood pressure signal and sends a message to the heart. _____

After standing up quickly, baroreceptors above the heart measure a drop in blood pressure. _____

Heart rate increases to increase blood pressure. _____

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PRACTICE: What is the role of the effector in a negative feedback loop?

a) The effector works to restore conditions in the original tissue.

b) The effector is another name for the stimulus in a feedback loop.

c) The effector measures changes in a tissue to initiate a response.

d) The effector integrates stimuli and sends messages for how the body should respond.

PRACTICE: An increase in blood solute concentration, as measured by the osmoreceptors of the hypothalamus, indicates a net loss of water in the body. The hypothalamus responds by both stimulating a thirst response and releasing antidiuretic hormone. Antidiuretic hormone directs the kidneys to recover more water during urine production. In this case, what two parts of a feedback loop are occurring in the hypothalamus?

a) The control center and the response.

b) The receptor and the control center.

c) The control center and the effector.

d) The receptor and the effector.

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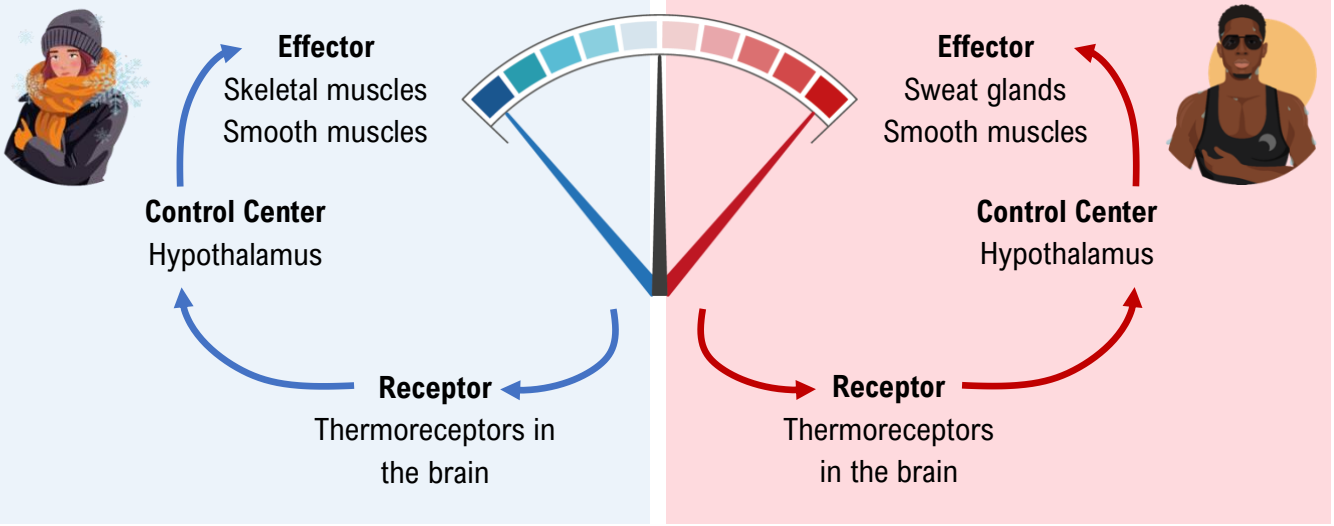
Temperature

- Thermoregulation follows a _____ feedback mechanism.
  - **Receptors:** temperature -_____ cells of the hypothalamus.
  - **Control Center:** thermoregulatory center in the hypothalamus.
  - **Effectors:**
    - _____ glands of the skin—respond when body is too _____.
    - Skeletal muscles—respond by shivering when body is too _____.
    - Smooth muscles controlling _____ flow respond to hot and cold.



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EXAMPLE: After exercising outdoors on a summer day you find that your face is flushed and red and that your clothes are drenched in sweat. What variable is your body controlling for? What is the stimulus that initiates the negative feedback loop? In your own words, how do both red face and sweaty clothes relate to the negative feedback loop in this example?

Variable: _____ Stimulus: _____

Response:

Red face - _____

Sweaty clothes - _____

PRACTICE: When the body temperature rises above the set point, how will the body respond?

a) Shivering.

b) Increased glucagon signaling.

c) Sweating.

d) Reducing blood flow to the skin.

PRACTICE: While waiting for a bus on a very cold winter day, your body temperature starts to drop. Specialized cells in your preoptic area (POA) of the hypothalamus register a drop in your internal body temperature. Cells in the hypothalamus integrate that information and activate nerve cells that cause muscles around the blood vessels leading to the skin and extremities to contract. When these muscles contract, less blood flows to the skin and extremities. What is the effector in this scenario?

a) The specialized cells in the POA of the hypothalamus that detected the change.

b) The muscles of the blood vessels that limited blood flow to the skin and extremities.

c) The internal body temperature as measure by the cells of the POA.

d) The hypothalamus that integrated input and output.