

## Biology 103 Exam 2 practice

1. **Homeostasis:** Homeostasis maintains certain body conditions within an ideal range. Consider the following story:

Melvin, ace biology student, takes a walk on a cold day but is thinking so deeply about his next science project that he forgets his coat. Cells in his brain that aren't busy thinking about his project sense a change in body temperature and tell the pituitary gland to send a hormone called TSH to his thyroid gland. This signals the thyroid gland to produce a hormone called thyroxine. Thyroxine is secreted into the bloodstream. It causes Melvin's body cells to increase their metabolism, which produces heat. Melvin's alert brain cells also signal his muscles to shiver, creating more heat, and cause the blood vessels in his skin to constrict. These actions help bring Melvin's body temperature back up, until he finally notices it's cold out and decides to go back for his coat.

From this story, name the following:

The variable that the feedback system is controlling: body temperature

The initial receptor in the system: "cells in the brain" (hypothalamus)

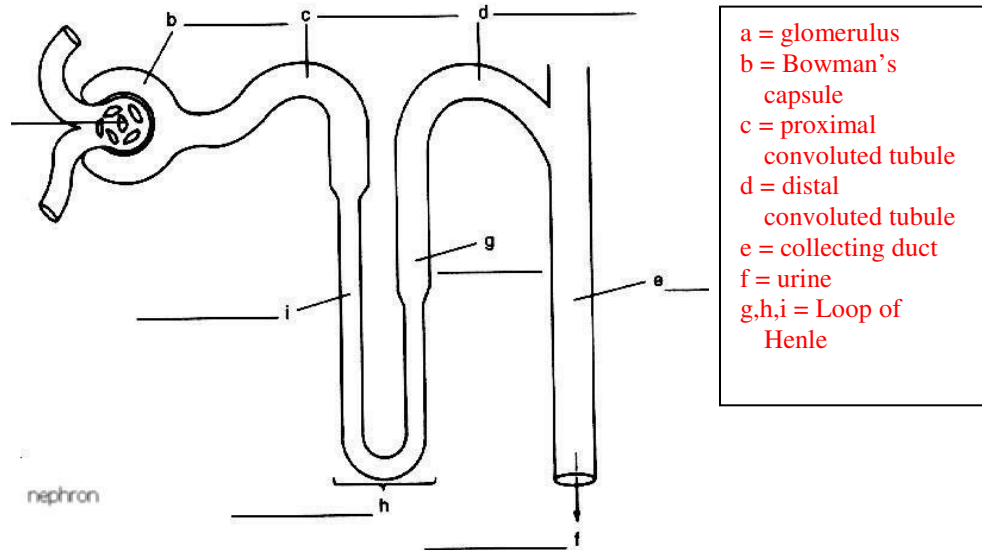
The ultimate effectors in the system: muscles, body cells

This is an example of a negative feedback loop.

The thyroid is a type of endocrine gland.

Glandular tissue is a type of epithelial tissue.

2. **Urinary system:** Label the parts of the nephron in this diagram, then match the functions with the parts (consider g, h, and i together).



Functions:

\_D\_ Tubular secretion, active transport of drugs, potassium into the urine.

\_A\_ Filtration of plasma from the blood, using blood pressure.

\_B\_ Active transport of salts out of the filtrate.

\_C, GHI, E\_ Osmosis of water out of the filtrate due to high salt concentration around this structure.

\_E\_ Collection of urine, further concentration by osmosis of water.

\_B\_ Collection of plasma from the bloodstream.

What are the effects of diuretics (caffeine, alcohol, herbal diuretics such as parsley or dandelion) on the nephron?

Decreases permeability in the nephron, allowing more water to be secreted

What are the effects of antidiuretic hormone (ADH) on the nephron?

Increases permeability in the nephron, conserving more water

3. **Circulatory system:** Fill in the following description of mammalian circulation using the following words: **atrium, ventricle, vena cava, pulmonary arteries, pulmonary veins, aorta, septum**. Some words may be used more than once, and some will not be used at all.

Deoxygenated blood from the upper and lower vena cavae enters the right \_\_\_\_\_ **atrium** \_\_\_\_\_. From there, deoxygenated blood passes into the right \_\_\_\_\_ **ventricle** \_\_\_\_\_, then out of the heart and to the lungs through the \_\_\_\_\_ **pulmonary arteries** \_\_\_\_\_. Blood loses carbon dioxide and picks up oxygen in the lungs. It is carried back to the heart through the \_\_\_\_\_ **pulmonary veins** \_\_\_\_\_, and enters the left \_\_\_\_\_ **atrium** \_\_\_\_\_ of the heart. Blood passes through a valve into the left \_\_\_\_\_ **ventricle** \_\_\_\_\_, then leaves the heart and goes to the body through the \_\_\_\_\_ **aorta** \_\_\_\_\_.

Where are blood cells produced?

Red bone marrow

What are the functions of the following blood cells?

red blood cells **transport oxygen**

white blood cells **immunity, defense**

platelets **blood clotting**

The southern copperhead, a poisonous snake, has a protein called disintegrin in its venom. Disintegrin binds to cell membrane receptors called integrins. Blood platelets use integrin receptors to aggregate at a site of tissue damage and form a clot. What is the advantage to the snake of having disintegrin in its venom?

Disintegrin reduces the ability of the prey's blood to form clots around the site of the snake bite. This allows the snake's venom to be transported more quickly through the prey's body.

4. **Endocrine system:** The endocrine system produces hormones that serve as chemical messengers. Many hormones are involved in maintaining homeostasis. Among these hormones are insulin and glucagon. In the right-hand column, write what is happening with blood sugar levels and the levels of these two hormones to the person in the story on the left.

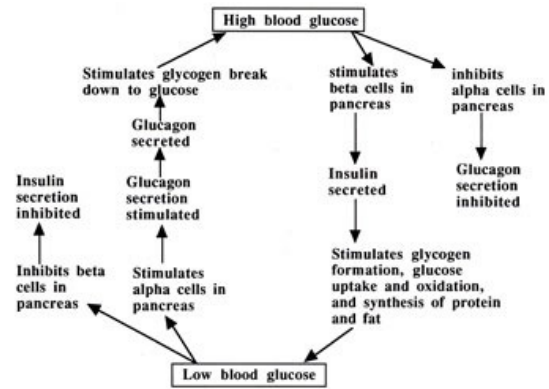
Buster wakes up to the sound of his alarm at 7:00 in the morning. As usual, he's hungry and a little cranky.	Blood sugar = low Insulin = low Glucagon = low
After his shower, Buster has a big breakfast, including three doughnuts, a bowl of Choco-Krispies, and, to be healthy, a glass of orange juice. Shortly after eating breakfast, Buster feels much better.	Blood sugar = rising Insulin = rising Glucagon = dropping
About 10:00, after his first class, Buster feels hungry again. But he has another class to go to, so he can't stop for a snack yet. By the time his second class gets out at 11:30, Buster is feeling a little tired out, and is quite hungry.	Blood sugar = low Insulin = low Glucagon = low
Buster goes to Burger Baron for lunch. He orders a cheeseburger, fries, and a milkshake. He feels much better.	Blood sugar = rising Insulin = rising Glucagon = dropping
About 3:00 in the afternoon, Buster is hungry. He's had a long day of classes and is feeling a little cranky again.	Blood sugar = low Insulin = low Glucagon = low
Buster and his friends go to Moonbeam's Coffee. Buster has large latte and a sticky bun. After eating, Buster feels great, and goes off to play some football with his friends.	Blood sugar = rising Insulin = rising Glucagon = dropping

Suppose that Buster goes to a doctor and has a full physical. His doctor does a glucose tolerance test and finds that Buster's blood glucose is slightly high, and there is a small amount of glucose in his urine. What do these tests indicate, and, given what you know about Buster's typical day, what advice should the doctor give Buster?

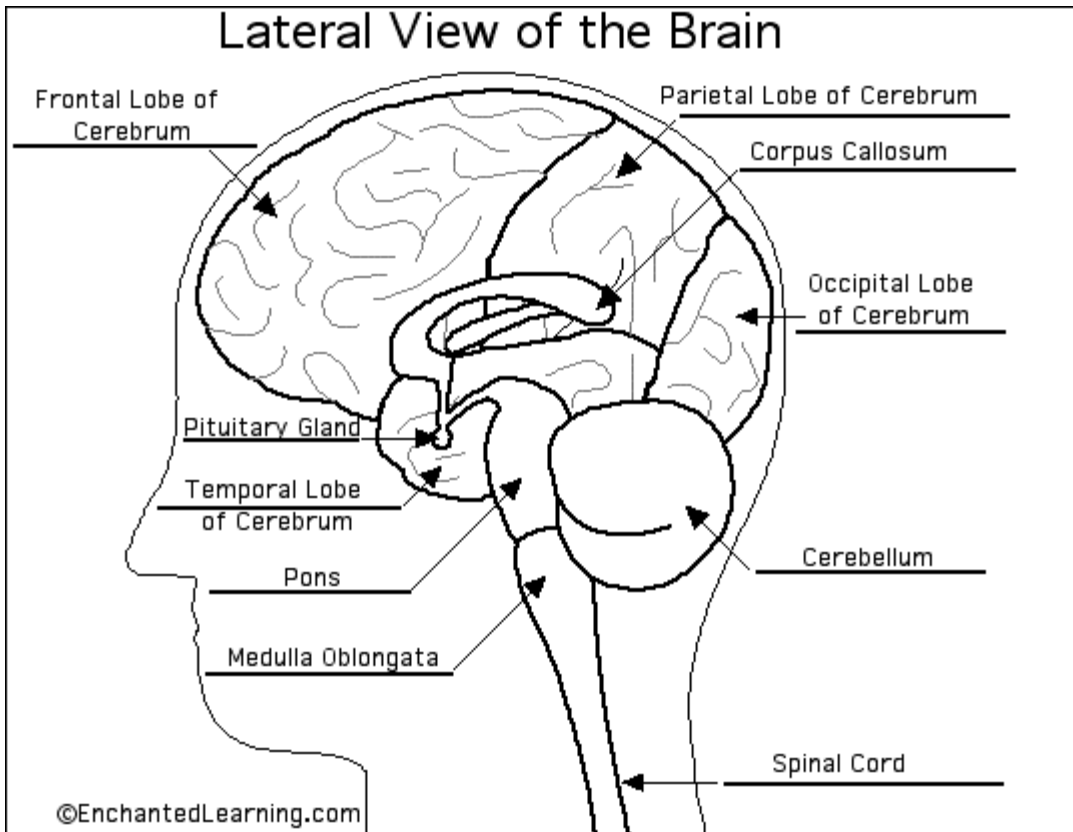
Buster may be borderline Type II diabetic. His diet is loaded with too much sugar and not enough healthy foods. His doctor would probably advise him to cut way back on his sugar consumption, and to add fresh vegetables, fruits, proteins, and whole grains to his diet.

Draw the feedback loop that is controlling Buster's blood sugar levels:

This is one way you could draw it:



5. **Nervous system:** Label the parts of the brain indicated on the diagram (including four lobes of the cerebrum):



State the functions of each of these brain parts:

Cerebrum (in general): thought, memory, sensory and motor processing

Cerebellum: motor memory, motor coordination

Pons: Controls sleep patterns

Medulla: Controls basic body functions such as breathing and heart rate

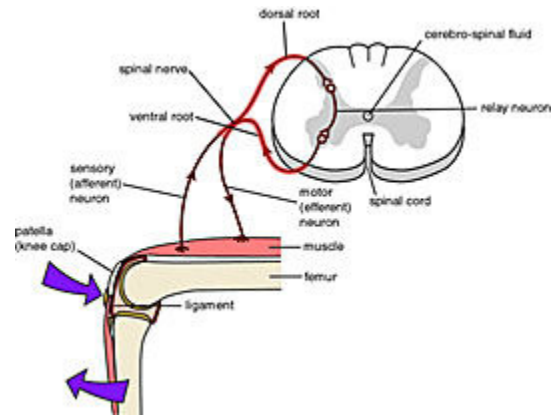
Thalamus: Relays sensory signals to the cerebrum, also involved in motor control

Hypothalamus: Controls homeostasis, signals the pituitary to signal other glands

Pituitary: Sends stimulating hormones to other endocrine glands

Corpus callosum: Connects the two cerebral hemispheres.

In the space below, sketch a reflex arc:



## 6. Musculo-skeletal system

For each of the following activities, state which kind of fiber is most active: slow twitch or fast twitch:

- a. sprinting \_\_\_\_\_ **fast** \_\_\_\_\_
- b. hiking \_\_\_\_\_ **slow** \_\_\_\_\_
- c. lifting weights \_\_\_\_\_ **fast** \_\_\_\_\_
- d. high jump \_\_\_\_\_ **fast** \_\_\_\_\_
- e. an all-day canoe trip \_\_\_\_\_ **slow** \_\_\_\_\_
- f. knitting \_\_\_\_\_ **slow** \_\_\_\_\_

If a researcher did a biopsy on the muscles of an athlete and the muscles of a couch potato, which person would have the most muscle fibers (muscle cells), and why?

**Neither. They'd both have similar numbers of muscle fibers because mature muscle cells usually don't divide. Instead, they grow larger by adding more actin and myosin filaments.**

State the functions of:

- a. compact bone  
**Strength, support, muscle attachments, storage of calcium and phosphorous**
- b. spongy bone  
**Holds and protects red bone marrow**
- c. red marrow  
**Manufactures blood cells**
- d. yellow marrow  
**Stores fats**

Buster holds a dumbbell in one hand. As he bends his elbow and brings the dumbbell toward his shoulder:

a. what kind of movement (flexion, extension, adduction, abduction, rotation) is this?

flexion

b. what muscle is responsible for the action?

biceps

c. where is the origin of this muscle?

scapula (shoulder)

d. where is the insertion of this muscle?

radius (lower arm)

Now Buster slowly lowers the dumbbell, straightening his elbow as he does so.

a. what kind of movement (flexion, extension, adduction, abduction, rotation) is this?

extension

b. what muscle is responsible for the action?

triceps

c. where is the origin of this muscle?

scapula (shoulder)

d. where is the insertion of this muscle?

ulna (lower arm)

In the space below, sketch the arrangement of protein filaments inside of muscle cells that allow muscles to contract.

