BIO 25 PAL Worksheet

Week 1 (#2): Homeostasis

**Remember**

**Homeostasis** is the body’s attempt to maintain a steady internal environment. There are relatively few, important ***regulated variables*** that are the focus of homeostasis, and they are the anchoring ideas for most of what you’ll be learning!

Some examples of regulated variables include: temperature, water level (osmolarity), pH, fuel levels (glucose, amino acids, and fatty acids), levels of electrolytes such as sodium, potassium, chloride, calcium, etc., and blood pressure.

1. WHERE are these variables monitored? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Why does this measuring location make sense?

**Understand**

To “monitor” these variables, receptors are constantly on the job, and if something is out of homeostasis (too high, too low), “effector” signals go out to correct things.

3. Identify two things (behaviors, urges, reactions) that would result from effector signals in each of these situations:

1. body temp is too cold
2. osmolarity is too high (blood is too concentrated, meaning water level is low)
3. body temp is too warm

4. Temperature is measured by thermoreceptors; osmolarity is measured by osmoreceptors (both of these are in the brain, FYI). Draw a complete feedback loop for each of the situations in #3, above. Include the regulated variable, receptor, and as many effectors as you can think of, and indicate the direction of disturbance of the variable (at the beginning) and the direction of change (via the effectors) at the end. Then, describe why we say homeostatic control is via negative feedback.

5. If blood levels of calcium are too low, and the body takes steps to increase the levels of blood calcium, how does it know how to stop when calcium levels are normal? How come it doesn’t “overshoot” the normal level for calcium?

**Apply**

“Effector” signals may be from the *nervous system* (electrical signals, very fast) or from the *endocrine system* (hormones, little chemical messengers that travel via the blood or body fluids). This question focuses on hormones, which are produced and released by endocrine glands around the body.

Thyroid hormone (thyroxine) is very important in regulating how efficiently we use fuel within cells. You may have heard of your “metabolic rate” or “BMR” (Basal, or resting, Metabolic Rate) – well, Thyroid Hormone regulates that!

Thyroid hormone is released by the thyroid gland in response to thyroid stimulating hormone (TSH). TSH, released by the pituitary gland in the brain, will increase when thyroid hormone levels in the blood are low.

1. DRAW the relationship of TSH with the thyroid gland and thyroid hormone, and indicate how feedback helps to maintain regular levels of thyroid hormone.

Graves’ disease is caused by the production of auto-antibodies to the TSH receptor on the thyroid gland. These antibodies interact with the TSH receptor to stimulate the thyroid gland in a manner similar to TSH. BUT, the antibodies are not subject to negative feedback.

Normal blood values of thyroid hormone are 6-10 μg/100 ml.

Normal values of TSH are 0.2-0.4 μg/100 ml

1. DRAW the effect of Graves’ disease, and indicate how it would affect the production of thyroid hormone.
2. Provide some expected values of thyroid hormone and TSH for someone who has Graves’ disease.