Name(s):		Period:	Date:	

Homeostasis and Diagnostic Tests HASPI Medical Biology Lab 04a Background/Introduction

Homeostasis & Feedback Mechanisms

Imagine drinking three bottles of water every day for a week, and not being able to excrete any of the water from your body? What do you think might happen? Bloating, pain, illness, nothing? In actuality, it would cause death! Balancing substances, even a substance as simple as water, is crucial to keeping the body healthy. This balancing act of substances is known as **homeostasis**. Examples of substances and/or conditions that need to be balanced include temperature, energy, pressure, calcium, pH, sugar, fats, iron, water, oxygen, carbon dioxide, blood, and even sleep. How does the body maintain homeostasis? It uses **feedback mechanisms** or **loops**. Feedback mechanisms respond when imbalance occurs by attempting to correct the balance, and returning the body to homeostasis.



Positive Feedback – Rare and most commonly occurs in illness or special circumstances, such as labor. In positive feedback the imbalance continues to <u>increase</u>, hence the use of the word "positive" to describe the feedback. An example of positive feedback is contractions during labor.

1. During labor the pressure of the baby's head on the cervix initiates the brain to start producing a hormone called oxytocin.

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- 2. Oxytocin stimulates the uterus to contract and push the baby, placing more pressure on the cervix.
- 3. The pressure on the cervix initiates the brain to produce more oxytocin, and the cycle continues until the pressure is relieved when the baby is delivered.

http://cnx.org/content/m45989/latest/106 Pregnancy-Positive Feedback



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An inability of the body to maintain homeostasis is known as **homeostatic imbalance**, and can lead to disease or even death. Conditions such as kidney failure, diabetes, and dehydration are all symptoms of homeostatic imbalance. In many cases, medical intervention can correct the imbalance.

An Example of Homeostasis in the Body: The Kidneys

Many organs are responsible for maintaining complex interactions that maintain homeostasis within the human body. An example of an organ that is integral to maintaining homeostasis is the **kidneys**. The kidneys are responsible for regulating the homeostasis of substances such as water, salt, and wastes in the bloodstream. They do this by filtering the blood as it circulates throughout the body.

The kidneys are two organs, located in the lower back on either side of the spine. The **renal arteries** pass blood into the kidneys, and the **renal veins** bring blood



http://media.tumblr.com/tumblr_ljolvaDdJ21qf00w4.jpg

back out of the kidneys. Anything that is removed from the blood by the kidneys is added to **urine**. Urine flows from the kidney, down the **ureter**, and ends up in the **bladder**. From there urine can be released out of the **urethra**.

Within the kidneys a complex network of filtering units and tubes called the **nephrons** can be found. The part of the kidney that is responsible for filtering is the **glomerulus**. Small capillaries, called **glomerular capillaries**, lead into the glomerulus and allow the substances to pass through their thin membranes. The filtered substances are then passed through a complex network of tubes that eventually lead to the bladder. As these substances pass through this network and into the bladder, they may be reabsorbed or secreted from the body. The kidneys filter the entire volume of blood in our bodies 20-25 times every day.

Diagnostic Tests: Checking for Balance

The majority of diagnostic tests in medicine are performed to check whether components of the body are within normal values. Essentially, they are determining whether tissues, organs, and/or systems of the body are working correctly by determining if they are maintaining homeostasis with the products they produce. There are many different types of diagnostic tests that can be performed to determine if a homeostatic imbalance is present. The following are examples of diagnostic tests:

- Vitals Signs Common vital signs include the pulse, temperature, skin color, respiration rate, and blood pressure. All vital signs have a normal value and any value lower or higher indicates a homeostatic imbalance.
- Blood Tests A blood sample is taken and can be tested for a wide variety of substances that circulate in the blood. This could include hormones, elements such as sodium (Na+), cells, proteins, lipids, glucose, vitamins, and substances that should not be in the bloodstream like toxins, bacteria, or drugs.

Name(s):

The Urinalysis

The urinalysis is a diagnostic test that determines what is present in secreted urine. It can reveal many different types of diseases, even those without any visible symptoms. A urinalysis usually includes a visual observation of the urine for color and clarity, a microscopic observation for sediment particles, and a urine dipstick chemical analysis. The chemical analysis is capable of determining pH, specific gravity, glucose, proteins, bilirubin, ketones, presence of blood, nitrites, urobilinogen, and leukocytes.

The urinalysis is a useful tool in determining whether a patient's kidneys are functioning regularly as well as helping

to diagnose conditions including hydration level, infections, bacteria, liver disease, kidney stones, gallstones, anemia, kidney failure, proteinuria, diabetes, or drug use to name a few.

Review Questions – answer questions on a separate sheet of paper

- 1. What is homeostasis and why is it so important to the human body?
- 2. What are feedback mechanisms?
- 3. Give and explain an example of positive feedback.
- 4. Give and explain an example of negative feedback.
- 5. Hypothesize what could happen if the hypothalamus did not respond to an increase in body temperature. Explain your answer.
- 6. What is homeostatic imbalance? Give an example.
- 7. How do the kidneys maintain homeostasis?
- 8. What part of the kidney is actually responsible for filtering the blood?
- 9. How are diagnostic tests able to determine whether an individual has a homeostatic imbalance?
- 10. A normal adult pulse is between 60-80 beats per minute. Hypothesize what it might indicate if the pulse was at 20 beats per minute.
- 11. How can a urinalysis determine whether an individual has a homeostatic imbalance?
- 12. List at least three conditions a urinalysis can diagnose.



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