
◉Sheet ○Slides

Number

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## Some points to review from the previous lecture:

### Fluids

- Contribute 60% of male body, and 55% of female body, (Because female has more fat).
- Distributed 2/3 intracellularly and 1/3 extracellularly (in plasma and interstitial fluid).
- Our internal environment is the interstitial fluid.

### Homeostasis:

- Each system has a homeostasis functions except Reproductive System.
- Homeostasis is to maintain *almost constant* conditions of the body's internal environment.
- Homeostasis is dynamic not static; the body has a normal range of values for each variable with (narrow variation).
- Control center can be in the nervous system or in the endocrine system.
- Imbalance in our internal environment (dis-homeostasis) causes a disease.
- The disease causes signs and symptoms. But if the imbalance is severe, it can lead to death.
- Signs are what you can see in the patient or measure, such as swelling, heart rate, temperature.
- Symptoms are what the patient describe but you can't detect it, such as pain.
- Types of dis-homeostasis
  - Physiological stress (demand or work)
  - Physical insults like heat, lack of oxygen due to lower partial pressure in heights
  - Change in the internal environment : Drop of blood sugar due to lack of food
  - Disruption in different degree:

  1- Mild and temporary (balance is quickly restored)

  2- Intense and Prolonged (poisoning or severe infections) it might lead to death

Notes

- Hyperkalemia (increasing in Na+ concentration)
- Hypotension (low blood pressure), Hypertension (high blood pressure).
- Hypernatremia (increasing in K+ concentration)

### Feedback mechanisms:

Stimulus: is the change in any variable in the body, the change could be increasing or decreasing. *For example: Changes in blood pressure and glucose level.*

Receptors: are body structure that detect and monitor changes in a controlled condition. Each variable has its own type of receptors; they work as sensors for any change in that variable.

Controlled condition: is a variable mostly controlled in a certain range.

**Negative and positive Feedbacks:**

- ❖ Negative Feedback**:** when response is opposite to the stimulus, and it is the normal Feedback (compatible with life).
- ❖ Positive Feedback: The response is the same direction to the stimulus (incompatible with life)**.**

**Let us take blood pressure as an example:**

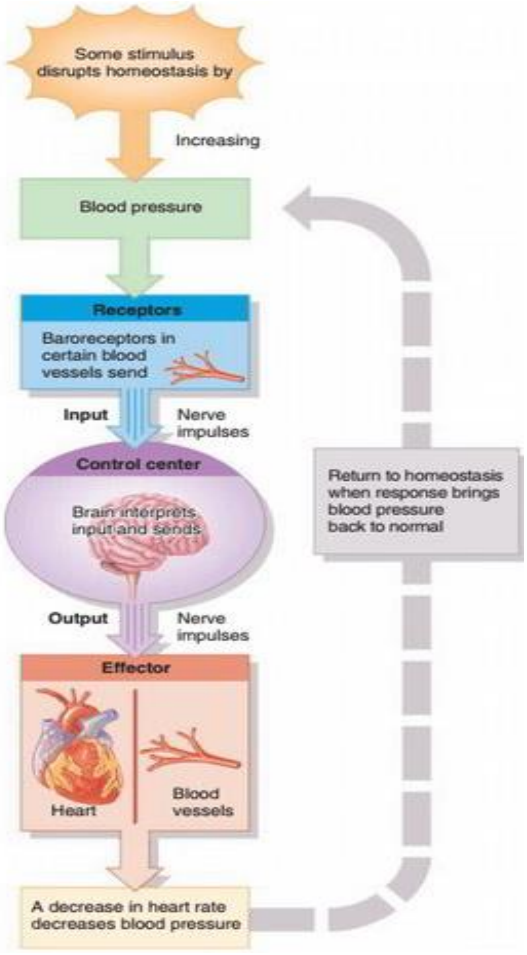
**a-** When the blood pressure increases, this simulates certain receptors (found in the blood vessels), which are called "Baroreceptors" These Receptors monitor changes of blood pressure.

**b-** The receptors send this change (input) to the control center (mainly the brain) as nerve impulses or chemical signals.

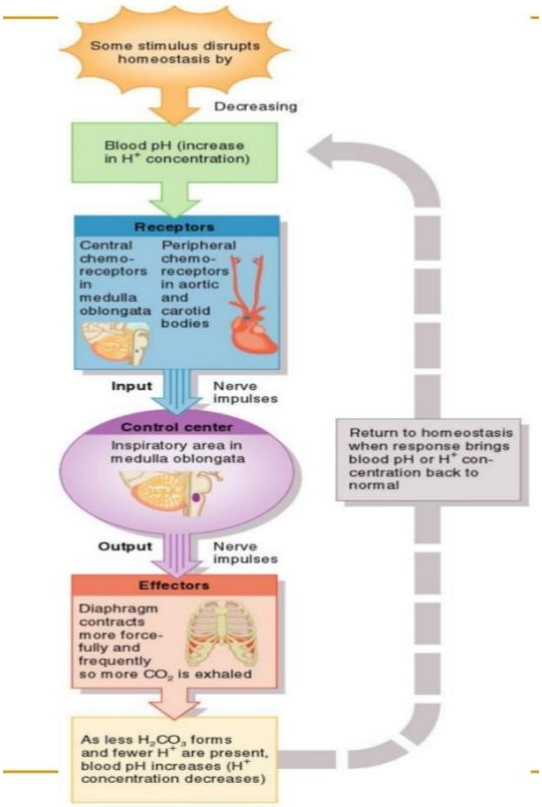
**c-** The Control system will analyze the input received from receptors and generates an (output) command, then send it to certain (effectors). ➔ In this case, the blood vessels are the effectors.

**d-** Effectors receive the output from the control center, then produce a (response) which is "**vasodilation"** *to decrease the resistance and therefore decrease the blood pressure to its normal range.*

⇨ If the input is blood pressure decreasing, the Response will be "**vasoconstriction"** *to increase the resistance and therefore increase the blood pressure to its normal range.*



## The pH:




**a-** H+ concentration increases (pH decreases) stimulating chemoreceptors.

**b-** This input is sent to a control center, which then sends output to the (effectors).

**c-** This result in decreasing of H+ concentration (pH increasing).

## The temperature:

When your body temperature is low, your skeletal muscles start to contract rapidly (shivering) to release heat, because our energy system efficiency is very low, so most energy is lost as heat.

The efficiency = energy used to do work/total energy.

The contraction efficiency in our skeletal muscles = 25%, while 75% of the total energy is released as heat.

**Note: the usual mechanism is the negative feedback. However,** in some cases positive feedback might be normal.

## Positive feedback:

Strengthen or reinforce a change in one of the body's controlled conditions

**Examples:**

**a-** During delivery process of a newborn, there is contraction of the uterus, the contraction will increase until getting delivery. Once the delivery is finished, everything will return to its normal condition.

Notice that the response (increase in contraction) **is in the same direction** as the stimulus (which is the beginning of contraction of the uterus).

**b-** Insulin moves glucose from interstitial fluid to inside the cell, reducing glucose concentrations in the blood.

**c-** When someone is bleeding, the blood coagulates (stimulus). The response will be increasement in coagulation to prevent blood loss. Blood coagulation is similar to formation of snow balls.

Notice that the response **is in the same direction.**

## Feedback Gain:

I. Feedback gain is a measure of the effectiveness of a specific feedback system.
II. Gain = correction value/error value.
III. More gain = more effectiveness of the system, and for each control system there is a gain.
**IV. Example:**

The normal BP is **100**. If the BP increases to **120**, the control system will try to decrease it, and drops it to **105**. Find the **Gain** of the control system.

**Solution:**

Correction = 120-105= **15** Error = 105-100= **5**

Therefore, Gain = 15/5= **3 ((very small gain))**

**Note:** Gain equals almost 0 when there is no correction and in positive feedbacks.

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## Cell membrane

**1- Definition & Function:**

⇨ An important structure that separates the intracellular part from the extracellular part of the cell.
⇨ A flexible yet sturdy selective barrier, plays a role in cellular communication.
- ♦ The fluid mosaic model: the arrangement of molecules within the membrane resembles a sea of lipids containing many types of proteins. The lipids act as a barrier to certain substances and the proteins act as "gatekeepers" to certain molecules and ions.

**2- Structure:**

**A- The lipid bilayer:**

- It's made up of phospholipids, cholesterol and glycolipids.
- The extracellular fluid and the fluid inside the cell is aqueous therefore there is two layers of phospholipids with their heads (hydrophilic) facing towards them.
- The membrane is not static and constantly moving.

**B- Glycocalyx:**

The sugary coating surrounding the membrane made up of carbohydrate portions (glycolipids and glycoproteins).

### C- Carbohydrates:

- **Glycoproteins:** membrane proteins with a carbohydrate group attached, which protrudes into the extracellular fluid.

- **Glycolipids:** membrane lipids attached to a carbohydrate group.

### D- Proteins:

According to the cell function, the cells have many types of proteins in different percent.

- Integral proteins: extend into or through the lipid bilayer, they are structural.
- Transmembrane proteins: most integral proteins, span the entire lipid bilayer.
- Peripheral proteins (surface proteins): Attached to the inner or outer surface of the membrane and do not extend through it.

**Note:** The amount of protein in the membrane differs from cell to another. The amount of protein in the membrane depends on the type of the cell (depending on the cell's function).

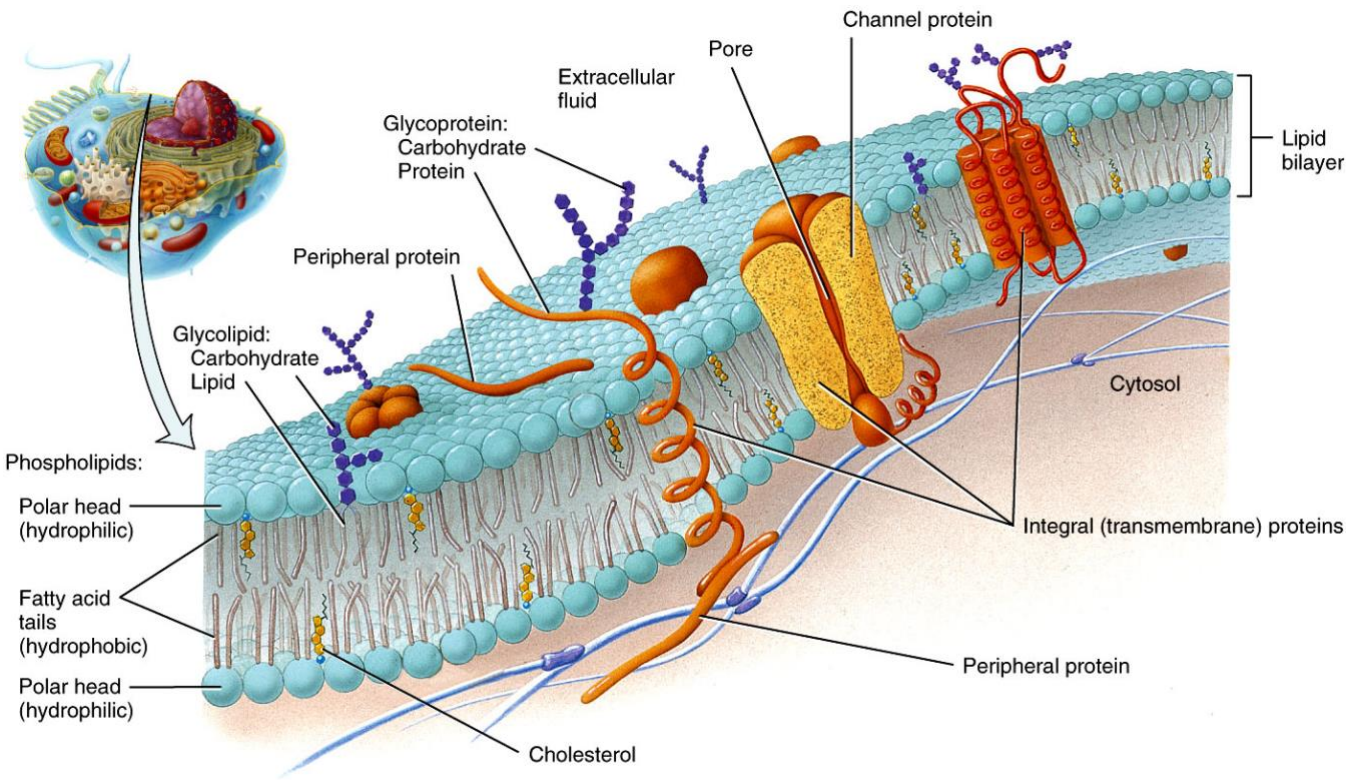


Figure 03.02 Tortora - PAP 12/e