Dr. Takea sh Ahmed
Collage of dentistry
Tikrit university

Lec. 1
2nd class

جامعة تكريت

كلية طب الاسنان

مادة الفسلجة

المرحلة الثانية

م. د. تقية شاكر احمد

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Tikrit university
Suggested books and resources:
Medical Physiology (A.C. Guyton)
Human Physiology 2 or 3d Ed. (D. U. Silverthorn)
Review of Medical Physiology, 23th Ed. (W.F. Ganong)

Physiology

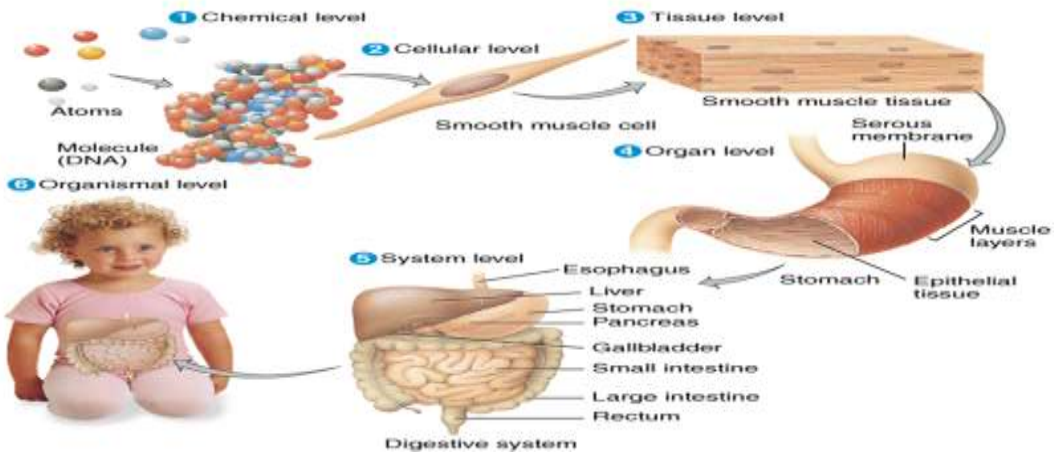
Physiology defined: The science that is concerned with the function of the living organism and its component parts, includes all its chemical and physical processes.

Basic properties of life

The seven properties of life: 1) Cellular organization, 2) Reproduction, 3) Metabolism, 4) Homeostasis, 5) Heredity, 6) Responsiveness, 7) Growth and development.

Levels of Organization

molecules → macromolecules → organelles → cells → tissues→ organs → organ systems



Body fluids: Water content of the body is divided into:

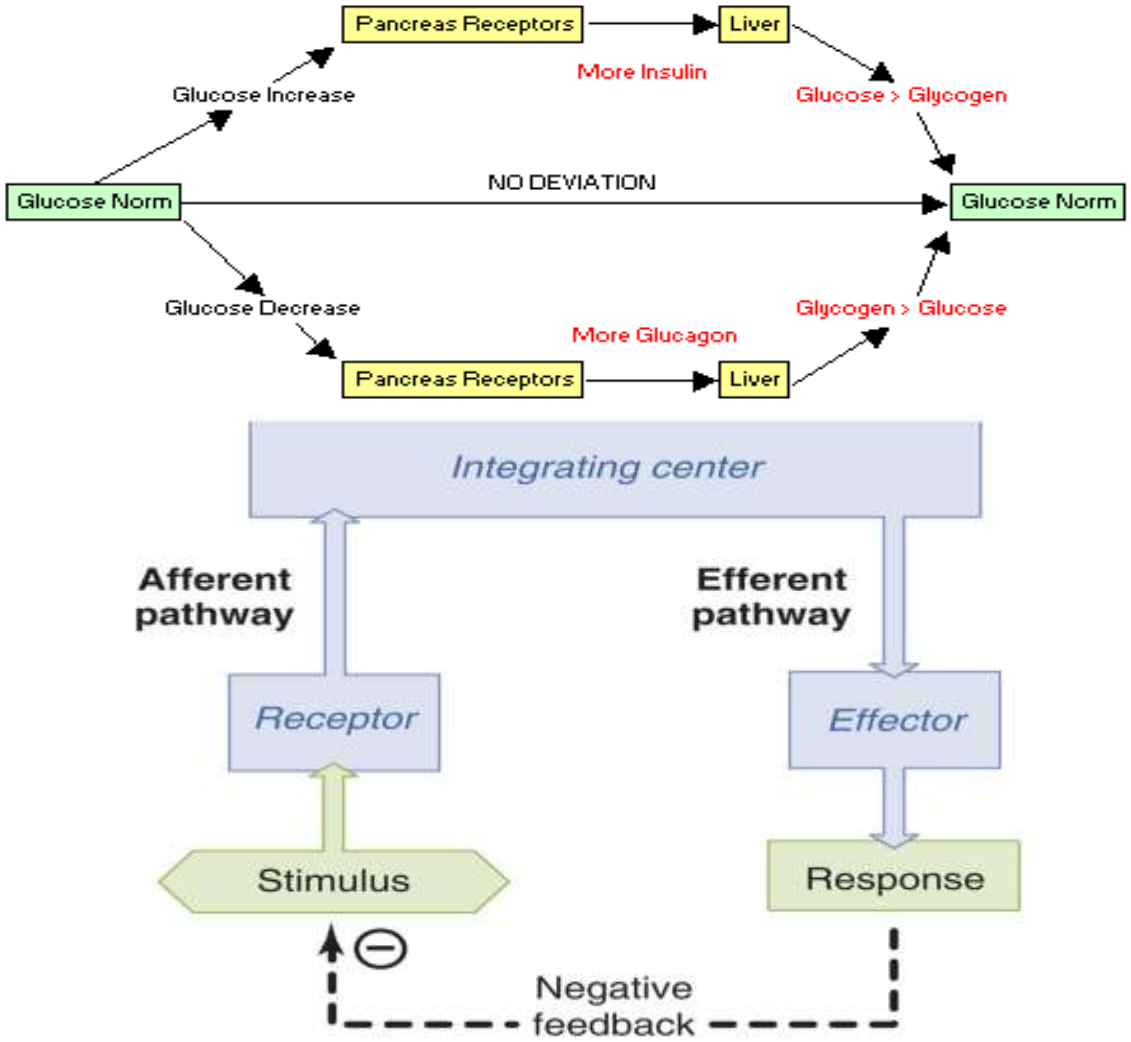
- Intracellular compartment 67% (inside the cell or Intracellular Fluid (ICF) Cytosol or cytoplasmic matrix is the liquid found inside cells)

It is a complex mixture of substances dissolved in water. Although water forms the large majority of the cytosol Comprises 2/3 of the body's water. If body has 60% water, ICF is about 40% of your weight). The ICF consists of Potassium organic anions proteins etc. The cell membranes and cellular metabolism control the constituents of this ICF.

- Extracellular compartment 33% (Outside the cell internal environment of the body) Denotes all body fluid outside of cells. It is the remaining 1/3 of your body's water. ECF is about 20% of the body weight. The ECF is primarily a NaCl and NaHCO3 solution. Composition of extracellular

fluid are main cations: Sodium (Na), Potassium (K) Calcium main anions: Chloride (Cl, Hydrogen Carbonate (HCO).

Cellular organization & homeostasis : The human organism consists of trillions of cells all working together for the maintenance of the entire organism. While cells may perform very different functions, all the cells are quite similar in their metabolic requirements. Maintaining a constant internal environment with all that the cells need to survive (oxygen, glucose, mineral ions, waste removal, and so forth) is necessary for the well-being of individual cells and the well-being of the entire body.
The varied processes by which the body regulates its internal environment are collectively referred to as homeostasis.
Homeostasis: in a general sense refers to stability, balance or equilibrium. It is the body's attempt to maintain a constant internal environment. Maintaining a stable internal environment requires constant monitoring and adjustments as conditions change. This adjusting of physiological systems within the body is called homeostatic regulation.
Homeostatic regulation involves three parts or mechanisms: 1) the receptor, 2) the control center and 3) the effector. The receptor receives information that something in the environment is changing. The control center or integration center receives and processes information from the receptor. And lastly, the effector responds to the commands of the control center by either opposing or enhancing the stimulus. This is an ongoing process that continually works to restore and maintain homeostasis. For example, A) in regulating body temperature there are temperature receptors in the skin, which communicate information to the brain, which is the control center, and the effector is our blood vessels and sweat glands in our brain. Because the internal and external environment of the body are constantly changing and adjustments must be made continuously to stay at or near the set point, homeostasis can be thought of as a synthetic equilibrium. B) Glucose levels within the blood are constantly monitored by a sensor, the islets of Langerhans in the pancreas. When levels increase, the islets secrete the hormone insulin, which stimulates the uptake of blood glucose into muscles, liver, and adipose tissue. The islets are, in this case, the sensor and the integrating center. The muscles, liver, and adipose cells are the effectors, taking up glucose to control the levels. The muscles and liver can convert the glucose into the polysaccharide glycogen; adipose cells can convert glucose into fat. These actions lower the blood glucose and help to store energy in forms that the body can use later.



❖In emergencies, adrenaline is released by the body to override the homeostatic control of glucose. This is done to promote the breakdown of glycogen into glucose to be used in the emergency. These emergencies are often known as 'fight or flight reactions'. Adrenaline is secreted by the adrenal glands. The secretion of it leads to increased metabolism, breathing and heart rate. Once the emergency is over, and adrenaline levels drop, the homeostatic controls are once again back in place.

Feedback mechanisms regulate biological systems:

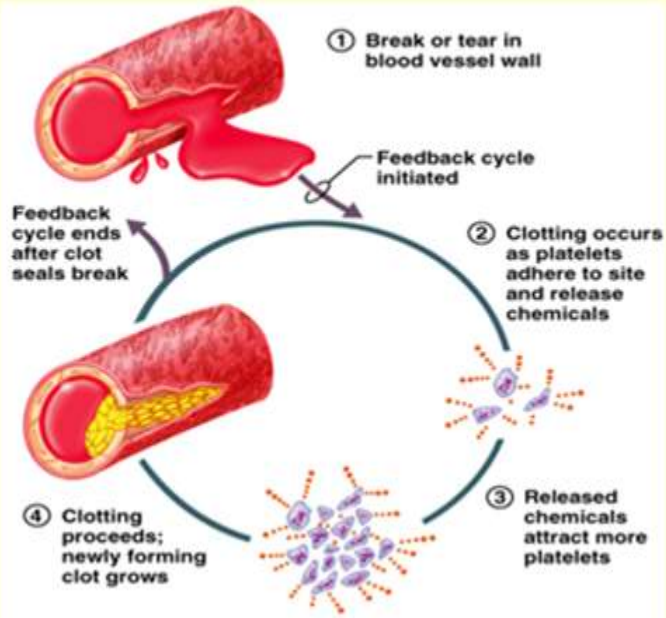
♦**Negative Feedback**: In negative feedback systems, the output shuts off the original stimulus . Most control systems of the body act by negative feedback .A stimulus causes a reaction that opposes the acting stimulus. examples :

- Increased CO2 causes increased pulmonary ventilation, which decreases CO2.

- Decreased arterial pressure activates the baroreceptor system which acts increase heart rate and arterial constriction, which increases arterial pressure
- Regulation of blood glucose levels (explained above)

The negative feedback system acts to maintain homeostasis

♦Positive Feedback : In positive feedback systems, the output enhances or exaggerates the original stimulus.in a positive feedback control system, a stimulus causes a responses that promotes the stimulus. In general, positive feedback systems lead to instability and therefore are not utilized as often as negative feedback systems. Examples: ❖Regulation of blood clotting. A rupture in a blood vessel initiates a clot formation, and enzyme activation within the clot causes other enzymes in the blood to clot. The cycle continues until the vessel in plugged and bleeding stops



❖Positive Feedback during Childbirth

- Stretch receptors in walls of uterus send signals to the brain
- Brain induces release of hormone (oxytocin) into bloodstream
- Uterine smooth muscle contracts more forcefully
- More stretch, more hormone, more contraction etc.
- Cycle ends with birth of the baby & decrease in stretch