

Physiology Chapter 1 Lecture

I. Anatomy and Physiology - structure and function.

*many subdivisions in both areas. See *Table 1.1, page 2*

*structure and function are interrelated, the structure often determines the function. eg, the structure of feet help provide upright locomotion?

2 approaches to physiology:

A. Vitalist view - some "vital force" beyond chemical & physical laws explains *life phenomena*. Not true science!

B. Mechanist view - all life phenomena are ultimately describable in terms of chemical & physical laws.

The human being is a complex machine.

* Most predominant in 20th century.

* All physiologists agree that:

1. There is an enormous integration of individual chemical/physical events occurring @ all levels of integration in order for biological systems to function!!!

2. The common denominator of physiological processes is their contribution to survival & adaptation of the species.

Consider these statements:

"The furnace is on because the house *needs* to be heated."

" During exercise a person sweats because the body *needs* to get rid of excess heat generated."

Teleology - the explanation of events in terms of purpose, but not an explanation in the scientific sense.

* [Write in terms of cause and effect.]

Reworded:

1. "The furnace is on because the temp. has fallen below the thermostat's set point & the electric current in the connecting wires has turned on the heater."

2. "The cause of sweating is a sequence of events initiated by increase heat generation:

* [In science: to explain a phenomenon is to reduce it to a causally linked sequence of physiochemical events!]

II. Levels of Structural Organization:

Chemical > cellular > tissues>organs>systems>organism

Figure 1.1: page 3

* 11 principle systems of the human body are integrated!

TABLE 1.2: pages 4-7

III. Life Processes (6): all humans have these in common.

1. ***Metabolism*** - all chem. processes in the body

a. **catabolism** - decomposition rxns; (provide energy)

b. **anabolism** - synthesis rxns; (uses energy)

2. ***Responsiveness*** - ability to sense & respond to changes or a stimulus w/in & around us. (ie. excitability & conductivity)

3. ***Movement / Contractility*** - ability of the whole body, cells, or cell parts to move.

4. ***Growth*** - an increase in body size as a result from an increase in cell size and number or both.

5. ***Differentiation*** – the development of a cell from an unspecialized to a specialized state, ie. stem cells become specialized during embryonic development.

6. ***Reproduction*** – two types.

a. new cell reproduction for growth and repair(cellular)

b. production of a new individual

IV. Survival Needs – factors essential to life and maintaining homeostasis, i.e. H₂O, O₂, nutrients, temp. & pressure.

V. Homeostasis (same;steady state): a condition in which the body's *internal environment* remains w/in certain physiological limits. i.e, proper pH, blood sugar levels, water, etc... in order for cells to function properly.

A. Internal Environment/ExtraCellular Fluid(ECF) is fluid outside of the cells consisting of gases, nutrients, and ions which circulates thru the blood and lymphatic system to all body cells.

*** See Figure 27.1 and 27.6; pages 1037 and 1042**

***ECF is found in four places:**

NOTE: the fluid is the same, but the name changes depending on where it is in the body!!

1. interstitial fluid(between cells)

“intercellular fluid” or “tissue fluid” -

all fluid between the cells except for plasma fluid. Fluid that bathes the cells w/in the various tissues. eg. between skin cells, or bone cells.

2. plasma - extracellular fluid in the blood vessels.

3. lymph fluid - extracellular fluid in lymph vessels.

4. cerebral spinal fluid – surrounds the brain & spinal cord.

**B. Intracellular Fluid(ICF) - fluid inside(w/in) the cells.
ie, the cytoplasmic fluid.**

*** Organisms in Homeostasis Exhibit:**

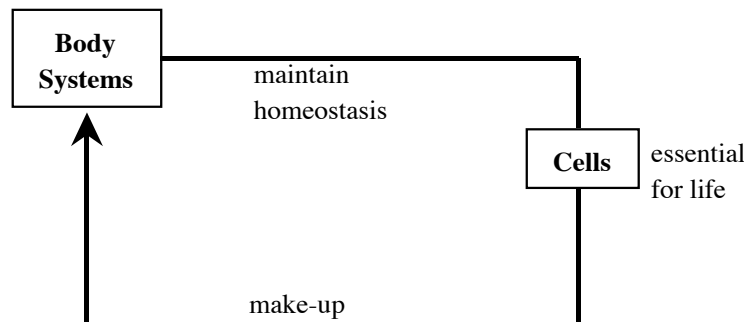
1. optimum conc. of ions, gases, nutrients, pH & water

2. opt. body temp.

3. opt. pressure for healthy cells

The Central Dogma of Physiology:

Cells are essential for life; cells make-up body systems. Homeostasis must be maintained at the cellular level in order for all body systems to maintain a homeostatic balance. That is ... for all the body's cells to survive, the composition of the surrounding fluids (ECF) such as ions, H₂O, gases, nutrients, pressure, pH and temperature must be maintained at ALL times.



VI. Stress & Homeostasis: “stress” is anything that takes you away from homeostasis and can cause sickness or disease.

* the body has many regulating(homeostatic) device that oppose stress & maintain balance. i.e, the ability to compensate!!

*Homeostatic responses (feedback systems) of the body are subject to control by two main body systems:

1. Nervous - detects deviations in the body's homeostasis, and sends *nerve impulses (electrical info. via nerves)* to the proper organ to counteract the stress, eg. *nerve impulses* from the brain cause an ↑ in sweat gland activity.

2. Endocrine - glands that secrete *hormones* (chemical info. via the blood stream) which have an effect on specific target tissues, eg. *adrenaline* is a hormone that ↑ heart rate.

VII. Homeostasis & Feedback Systems: eg. blood sugar regulation.

***Feedback System** - a circular situation in which info. about the status of something is fed back to a central control region. It involves a stimulus (input) and a response(output). **Feedback Systems** consists of 3 components:

- a) **Control Center** – maintains a controlled condition. eg. B.P
- b) **Receptor** – monitors change in controlled condition and sends info. to control center (input). eg. pressure receptors detect pressure changes in blood vessels.
- c) **Effector** – receives info.(output) from control center & produces a response [a change in the condition].
eg. blood vessels constrict or dialate to adjust the B.P.

*** See definitions on page 9 & Fig. 1.2!**

Two types: Negative and Positive Feedback Systems

1. Negative Feedback system/Stimulatory-inhibitory system:

***A reverse in the direction of the initial condition; the output counteracts the input.**

***Most feedback systems of the body are of this type because they continually monitor and fine-tune *everyday homeostatic conditions*.**

eg. an increase in blood pressure causes other changes which lower the blood pressure back to normal.

***See page 10, fig. 1.3!**

2. Positive Feedback System/Stimulatory-stimulatory system:

***The output intensifies the input.**

***Most are destructive and lead to disorders.**

***Using child labor as a non-destructive example:**

eg. the weight of the fetus causes the walls of the uterus to stretch this causes the brain to send a signal back to the uterus and contractions become even more forceful!

***See page 11, fig. 1.4!**

VIII. Homeostasis & Disease:

- ***Disease*** – when one or more components of the body fail to contribute to homeostasis, eg. AIDS or cancer
- ***Pathology*** – study of diseased tissue.
- ***Symptom*** – is subjective; can't be seen by the observer, eg, nausea or pain
- ***Signs*** - are objective; can be observed & measured. eg. body temp.
- ***Syndrome*** – a group of symptoms & signs which accompany a particular disease, eg. FAS, or Down's Syndrome
- ***Epidemiology*** – the why, when, and transmission of diseases. e.g. study of sexually transmitted diseases
- ***Diagnosis*** – determination of the type of disease.
- ***Prognosis*** – a prediction of the outcome??