

Physiology Notes (EEOB 2520)

Exam 1

8/25/15

Four Critical Equations

1. $ATP \leftrightarrow ADP + P_i + \text{energy}$
 - a. Our currency to spend to get things done
2. $\text{Glucose} + O_2 + ADP + P_i \rightarrow ATP + CO_2 + H_2O + \text{heat}$
 - a. Our job to make the most currency
3. $CO_2 + H_2O \leftrightarrow HCO_3^- + H^+$
 - a. Aiding transport of a key gas, but creating a pH issue
4. $PV = nRT$

Homeostasis - relatively stable maintenance of a body parameter (dynamic constancy)

Homeostatic control system (HCS)

- set of interconnected components
- keep parameter at a *set point* (SP): more like a range or target
- *Steady state* (SS): parameter at SP
 - o System is NOT changing but energy is being used
 - o NOT an equilibrium (no change in energy)

Energy is limited, trade offs required

Disturbances from Steady State

Reactive → response = feedback

1. Negative = opposite of disturbance direction
 - a. Return toward SS
2. Positive = continue in disturbance direction
 - a. Move further from SS

Proactive → preparation = feed forward (FF)

- Limits the degree of feedback required
- Less energy required

8/26/15

Homeostatic Control System - **Biorhythms**

- Circadian, annual, lunar

Proactive instead of reaction = Feed forward

- Internal trigger/clock (NOT the environment)

Set up for survival = ADAPTATION = genetic change

Adjustable (within limits) = ACCLIMATIZATION = adjustment to set point

- Clock reset (change in SP) = environmental
- Use-based (make adjustment as needed) NOT genetic
 - o Individual change
- Usually reversible
 - o Exception = developmental acclimatization

Reflex Arc (can be conscious or unconscious)

Receptor

- receives stimulus
- external or internal

Afferent Pathway

- going toward something

Integrating Center (brain, spinal cord, CNS, endocrine)

- compare to set point
 - If similar, done
 - If off, need to change (leads to efferent pathway)

Efferent Pathway

- Effector gets message of what to change
- Get response as determined by integrating center → physiological change

Control for HCS via Signals

- Chemical messengers
 - o Most travel through extracellular fluid

Messenger	Released by	Pathway	Communicates with
Endocrine (hormone)	Gland or neuron	Plasma	Distant effectors
Paracrine	Most cells	Interstitial fluid	Neighbor effectors (close communication)
Neurotransmitter	Neuron	Interstitial fluid (synapse)	Next neighbor neuron or effector

How can we collapse these three messengers into only two groups?

Endocrine - target cells in one or more distant places in the body

Neurotransmitter - neuron or effector cell in close proximity to site of neurotransmitter release

Paracrine - target cells in close proximity to site of release of paracrine substance

Special Cases

- Autocrine: pathway = interstitial fluid
effector = releaser
- Cytokine: pathway = IF/plasma/lymph
Immune signal

Some not based on extracellular fluid

- Gap Junctions: direct channels between adjacent cells (never leave the cell)
- Juxtacrines: bound to cell membrane (not released)

8/27/15

Body Organization

- Cell: each has some DNA = genetic info
 - o New cells via mitosis
 - o Unspecialized → specialized = Differentiation
 - o Major Categories
 1. Muscle: generate mechanical force
 2. Nerve: works with electrical signals
 3. Epithelial: interacts with the environment
 - a. Defines inside and outside
 4. Connective: connect, anchor, and support other cells
 - a. Bone, fat, blood cells
- Tissues: groupings of similar specialized cells
 - o Same 4
- Organs: combinations of tissues
 - o Vary in proportion and pattern
 - o Some never need epithelial cells
 - o Function unit (ex. Kidney-nephron)
 - Smallest portion yet still works by itself
 - Heart is the function unit - no back up
 - o Why have function units?
 - Redundancy: continue to work even if you lose some
 - Heart is important exception
 - Expansion: add more without stopping
- Organ Systems: organs with common functions
 - o Circulatory = heart, blood vessels, blood
 - o Organ systems can contain other organ systems
 - Immune = WBCs, spleen, thymus, circulatory