



Homeostasis

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HAEMOSTASIS ?

HOMEOSTASIS ?

Lesson Plan

What is homeostasis?

Variables of homeostasis.

Mechanism of homeostasis.

Negative feedback.

Positive feedback.

Vicious cycle.

Feed forward mechanism

Failure of homeostasis.

Homeostasis

- Maintenance of favourable , suitable, optimal constant condition of internal environment is called homeostasis.
- “Homeostasis," means "same standing." Every organism from the simplest single-celled amoeba to the human being, relies on this internal environment, to sustain life.
- A simple example of **homeostasis** is the body's ability to maintain an internal temperature around 98.6 degrees Fahrenheit, whatever the temperature outside.

- Why Homeostasis ?

- Essential for survival of each cell, through its specialized function as part of a system , maintain the internal environment.

- Is internal environment constant ?

Is not a rigid , fixed state But
a dynamic steady state.

Continuously change but these changes do not deviate
from a constant steady level.

- What is internal environment....?

Fluid inside cell is called ...ICF while fluid outside the cell called .. ECF which is the internal environment.

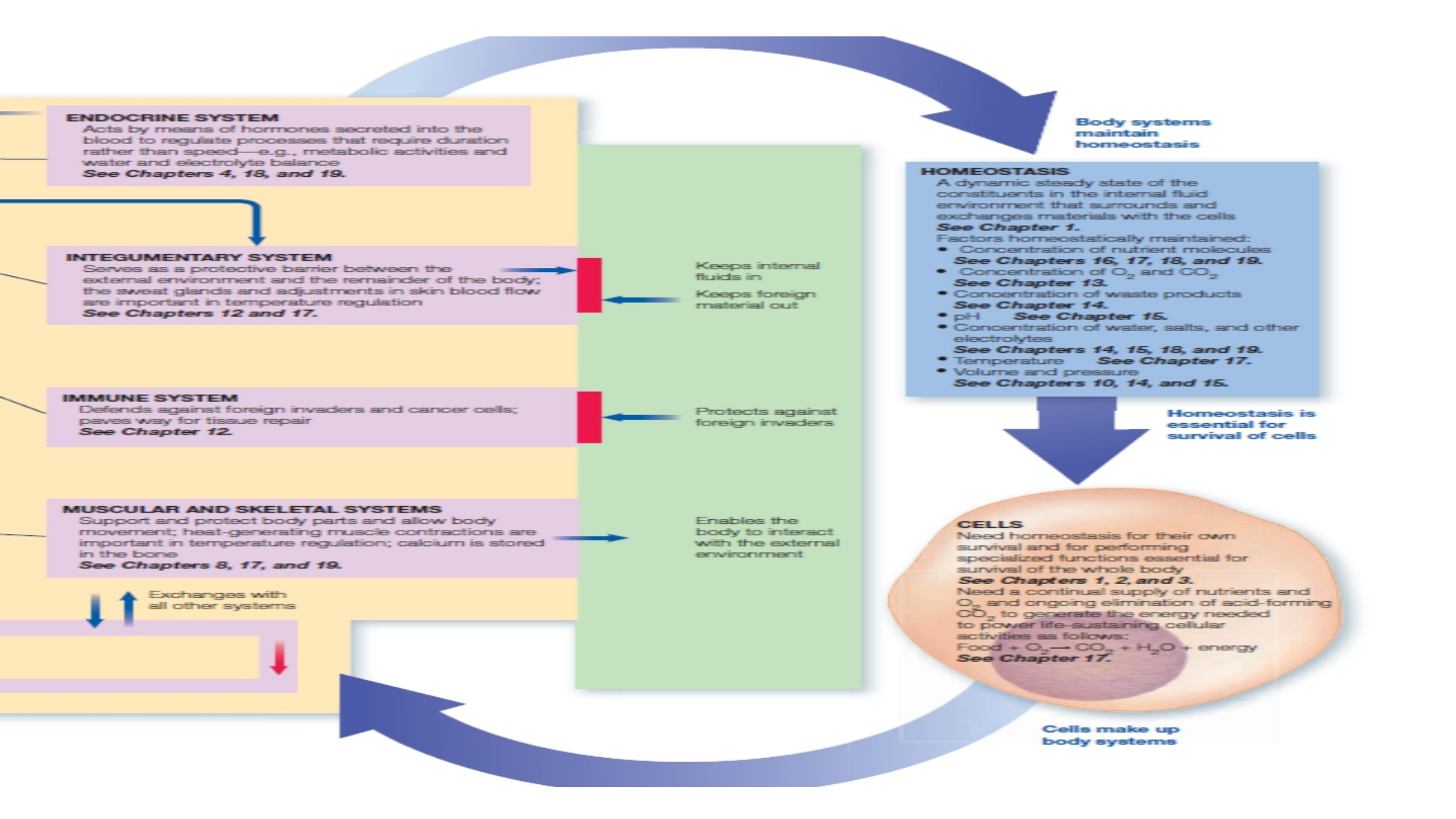
ECF consist ofplasma and interstitial fluid.

Transfer of material between external environment and internal environment to maintain constant internal environment.

How?

BODY SYSTEMS

- CVS
- GIT
- RS
- US
- MSS
- IMMUNE SYSTEM
- ENDOCRINE
- CNS



ENDOCRINE SYSTEM

Acts by means of hormones secreted into the blood to regulate processes that require duration rather than speed—e.g., metabolic activities and water and electrolyte balance
See Chapters 4, 18, and 19.

INTEGUMENTARY SYSTEM

Serves as a protective barrier between the external environment and the remainder of the body; the sweat glands and adjustments in skin blood flow are important in temperature regulation
See Chapters 12 and 17.

IMMUNE SYSTEM

Defends against foreign invaders and cancer cells; paves way for tissue repair
See Chapter 12.

MUSCULAR AND SKELETAL SYSTEMS

Support and protect body parts and allow body movement; heat-generating muscle contractions are important in temperature regulation; calcium is stored in the bone
See Chapters 8, 17, and 19.

Exchanges with all other systems

Keeps internal fluids in

Keeps foreign material out

Protects against foreign invaders

Enables the body to interact with the external environment

Body systems maintain homeostasis

HOMEOSTASIS

A dynamic steady state of the constituents in the internal fluid environment that surrounds and exchanges materials with the cells
See Chapter 1.

Factors homeostatically maintained:

- Concentration of nutrient molecules
See Chapters 16, 17, 18, and 19.
- Concentration of O₂ and CO₂
See Chapter 13.
- Concentration of waste products
See Chapter 14.
- pH
See Chapter 15.
- Concentration of water, salts, and other electrolytes
See Chapters 14, 15, 18, and 19.
- Temperature
See Chapter 17.
- Volume and pressure
See Chapters 10, 14, and 15.

Homeostasis is essential for survival of cells

CELLS

Need homeostasis for their own survival and for performing specialized functions essential for survival of the whole body
See Chapters 1, 2, and 3.
 Need a continual supply of nutrients and O₂ and ongoing elimination of acid-forming CO₂ to generate the energy needed to power life-sustaining cellular activities as follows:
 $\text{Food} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$
See Chapter 17.

Cells make up body systems

Factors or variables in internal environment must be maintained include;

- Concentration of nutrients,
Concentration of gases, oxygen and carbon di oxide,
Concentration of electrolytes,
Concentration of water,
pH,
temperature,
volume
and pressure.

Variables

- Normal value of each variable is called Set point.
- Any change in the normal value is called Stimulus.
- Stimulus is detected by a sensor called Receptor.
- Information about change goes to integrating center present in the brain.
- Center produces action called Response.
- Response is mediated via Effectors.

A home remedy:

*If you have a bad cough, take a large dose of laxatives.
Then you'll be afraid to cough.*

Warning:

Never, under any circumstances, take the laxatives and sleeping pills on the same night.

Homeostatic control system.

INTRINSIC

exercising muscles required more oxygen .. Why and how ?

EXTRINSIC

- Negative feedback.
- Positive feedback.
- Feed forward.

Negative feedback

- It is most commonly used mechanism.
- Always beneficial to the body.
- It opposes initial change.
- When any variable of the body is increased or decreased, homeostasis system tries to bring it back to the normal i,e it opposes the change and tries to minimize it.
- If the body temperature is increased, homeostatic system tries to decrease it back to the normal vice versa.
- So the initial stimulus (rise in body temprature) is opposite to the final response(decreased body temperature).

Hot

Vasodilation

Arterioles dilate (enlarge) so more blood enters skin capillaries and heat is lost.

Sweating

Sudorific glands secrete sweat which removes heat when water changes state.

Pilorelaxation

This means the hairs flatten.

Stretching Out

By opening up, the body has a larger surface area.

Cold

Vasoconstriction

Arterioles get smaller to reduce blood going to skin: keeping core warm.

Shivering

Rapid contraction and relaxing of skeletal muscles. Heat produced by respiration.

Piloerection

Hairs on skin stand up.

Curling Up

Making yourself smaller so smaller surface area.



Food is consumed and digested, causing blood level glucose to rise.

In response to higher glucose levels, the pancreas secretes insulin into the blood.

In response to higher insulin levels, glucose is transported into cells and liver cells store glucose as glycogen. As a result, glucose levels drop.

In response to the lower concentration of glucose, the pancreas stops secreting insulin.

Positive feedback

- Amplifies the initial change.
- It is uncommon in health and occurs mainly in diseases.
- Mostly harmful to the body. So the initial stimulus rise of blood pressure is in the same direction as the final response that is further rise in blood pressure.
- Few beneficial positive feedback mechanisms operate in body under normal condition.
- Example is birth of baby- contraction of pregnant uterus during delivery causes more powerful contraction instead of causing relaxation. This ultimately leads to birth of baby.

Vicious cycle

- Positive feedback mechanism occurring in pathological conditions can lead to death. This is called vicious cycle.
- For example if a person suddenly loses 2 lit of blood in an accident blood volume will decrease, blood pressure will decrease, heart will pump less blood and will get less blood, this cycle will be repeated until heart will not be able to pump and person will die.

- what is difference between....

positive feedback and vicious cycle..?

Feed forward

- It is less common but beneficial to the body.
- Response occurs before the arrival of actual stimulus.
- Homeostatic mechanism knows that stimulus will come soon, so it produces the response in advance.
- insulin secretion is increased after taking a meal before increasing the blood glucose level . This occurs because the homeostatic system knows that when the food will be digested blood glucose will rise and increased insulin will be needed.
- So response is produced in advance in anticipation of an expected stimulus.

Failure of homeostasis

- When some of body system fail to function properly homeostasis is disrupted.
- Factors that disturb homeostatic ability are called stressors. For example extremes of temperature, fasting, poisons ,infections etc.

Disease

If the homeostatic mechanism cannot overcome the forces that threaten it, then the system falls out of balance. The result is disease ("dis-ease") - a disruption in the ability of a body system or part to carry out its normal function.

Why extreme failure of homeostasis is ??????

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Provide further reading resources

- Guyton and Hall textbook of Medical Physiology

- LAUGHING IS THE BEST MEDICINE.....EXCEPT..?

THANK YOU