

TOPIC I: INTRODUCTION TO PHYSIOLOGY:

Learning Outcomes: Upon completion of Topic I (1), you should be able to

- a) Define homeostasis.
- b) Define the following terms as they relate to homeostasis: set point, variable, receptor, effector and control (integrating) centre.
- c) List the main physiological variables for which the body attempts to maintain homeostasis.
- d) Explain anticipatory responses, giving examples, and explain their importance in maintaining homeostasis.
- e) List the steps in a feedback mechanism and explain the function of each step.
- f) Compare and contrast positive and negative feedback mechanisms in terms of the relationship between stimulus and response, and describe examples of each.
- g) Explain why negative feedback is the most common mechanism used to maintain homeostasis.

A) What is physiology?

- study of how the body functions

B) Homeostasis

- the ability to maintain relatively stable conditions in the internal environment (despite changes in the external environment)
 - cells can only survive within a narrow range of conditions
 - ∴ body conditions must be maintained within physiological limits
 - conditions controlled include:
 - 1) pH
 - 2) temperature
 - 3) blood gases (CO₂, O₂)
 - 4) blood pressure (b.p.)
 - 5) intracellular + extracellular (ICF + ECF) fluid volumes
 - 6) etc.
- organ systems function together to maintain homeostasis
- disease = failure to maintain homeostasis
- nervous and/or endocrine system(s) control all other systems (control centres)
- act to:
 - 1) maintain homeostasis
 - 2) permit departures from homeostasis in a controlled manner e.g. pregnancy, growth, sudden fright

C) Homeostatic Regulation:

- Change in internal environment must be detected or anticipated
 - then nervous and/or endocrine system responds, altering system(s) responsible for that condition

- Types of NS/Endocrine responses:

1) Anticipatory Responses

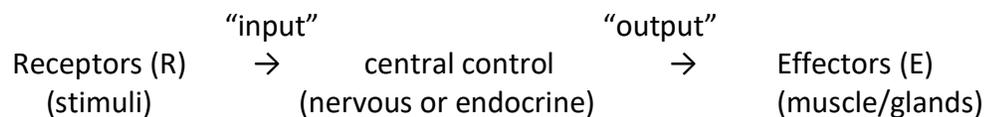
e.g. ↑ respiratory rate at start of exercise → proprioceptors (NS sensory receptors) signal movement before a change in internal conditions occurs (gases in blood)

- may also be learned or behavioral

e.g. put on coat

2) Feedback Mechanisms

- mechanisms that respond to a change in the system
- consist of set points, receptors, control areas and effectors
- Set point = range of values of variable (e.g. body temperature) that does not bring about a response (i.e. “normal range”)
- Variable is monitored by receptors → info (input) *fed back* to control area (NS, endocrine gland) → output to effector → response



- Types:

- a) Negative Feedback
- b) Positive Feedback

a) Negative Feedback

- most common homeostatic control mechanism
- result of “output” - variable moves back toward the set point i.e. in opposite (negative) direction to the change that triggered the response (“input”)

- e.g. 1: body temp. (= variable): set point = 36 - 37.8°C. If ↑ temp. (e.g. 40°C):

Hypothalamus thermostat cells (R) detect high
temp. (stimulus)
↓ “input”

Brain (NS) (central area)

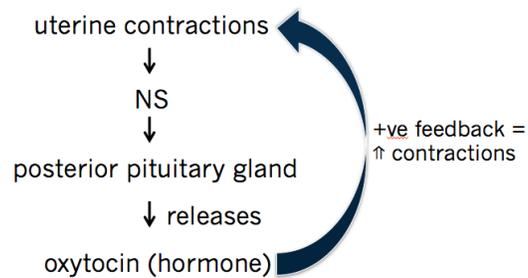
↓ (“output”)

E = smooth muscle in blood vessels of skin relax
(causing dilation) + sweat glands secrete sweat

- result = core blood to skin surface and sweat evaporates
= ↑ heat loss & ↓ temp. (opposite direction of stimulus)
- e.g. 2: ↓ temp. → shiver → ↑ temp.
- set point can change e.g. in fever

b) Positive Feedback

- less common - NOT homeostatic
- output intensifies the input
- e.g. childbirth – labour



- continues until endpoint (= baby born)