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# 1 Animals and Environments

## Introduction

- ▷ What is physiology?
  - Form and function of organisms; the study of how organisms work.
- ▷ Central questions of physiology: **mechanism** and **origin**.
  - Mechanism:
    - refers to the **components** of living organisms and understanding **how** components interact to enable the organism to function.
  - Origin:
    - asks why a mechanism exists, or **what** is the mechanistic **adaptive significance** of the mechanism.
  - Mechanism and adaptive significance are distinct concepts; knowing about one doesn't necessarily mean you know anything about the other.
- ▷ Krogh's principle:

"For such a large number of problems there will be some animal of choice or a few such animals on which it can be most conveniently studied."
- ▷ Krogh's principle central to disciplines that rely on the *comparative method*.

The key take away: there is unity in diversity; many organisms are very much alike at the most fundamental levels.
- ▷ Physiology subdisciplines:
  - Mechanistic: emphasizes the mechanisms by which organisms perform their life functions.
  - Evolutionary: emphasizes evolutionary origins and the adaptive significance of traits.
  - Comparative: emphasizes the way in which diverse phylogenetic groups resemble and differ from each other.
  - Environmental: emphasizes the ways in which physiology and ecology interact.
  - Integrative: emphasizes the importance of all levels of organization, from genes to proteins and tissues to organs in order to better understand whole physiological systems.

## Homeostasis

- ▷ Important ideas to remember:
  - Organisms are structurally dynamic; form stays relatively static while individual cells recycle frequently.
  - Most cells are exposed to the **internal** environment, not external.
  - Internal cells may vary or kept constant with the environment.
- ▷ Temperature regulation:
  - **Conformity**: organism's internal temperature **correlates** with external temperature in a particular range of temperatures.
  - **Regulation**: internal environment is held mostly **constant** using cellular mechanisms.
- ▷ **Homeostasis**: the coordinated physiological processes that maintain a relatively constant state in the organism.
  - **Positive feedback**: less common in homeostasis due difficulty in regulation; leads to runaway effect easily.
  - **Negative feedback**: more common in homeostasis due to self correcting nature.
  - **Effector**: executes the change in action that produces an effect, e.g. signals to increase temperature.
  - **Sensor**: sense changes in environment and sends information to the effector.

## Physiology and Time

- ▷ Timeframes of physiological change:
  - **Acute**: short-term, reversible, and quick to adapt to changes in environment. Usually minutes to hours.
  - **Chronic**: long-term after prolonged exposure to new environments. Changes are usually reversible, but often slower.
    - Chronic can be termed acclimation, or phenotypic plasticity/flexibility.
    - Repetitive acute responses usually lead to chronic responses.
  - **Evolutionary**: changes due to alteration in gene frequencies in **populations** exposed to new environments.
- ▷ Acclimation is **not** the same as adaption.

- *Adaption* is an evolutionary trait present at high frequency in a population due to survival/reproductive advantages.
- Not all traits are adaptations.
- The amount of natural variation in a trait must be considered across populations, species etc.

## 2 Molecules and Cells in Animal Physiology

### Cell Membrane Review

- ▷ Major cell membrane structures:
  - **Glycoproteins:** carbohydrate chain attached to a protein.
  - **Glycolipids:** similar to glycoproteins, but attached to lipid molecules.
  - *glycocalyx*: combination of glycoproteins and glycolipids on the surface of cell.
  - **Integral proteins:** embedded in phospholipid bilayer.
  - **Peripheral proteins:** associated with one side of the bilayer.
- ▷ **Unsaturated phospholipid:** when hydrocarbon tails contain double bonds (less hydrogen).
  - Increase membrane fluidity due to extra space created.
- ▷ The fluidity of the cell membrane allows proteins to form complexes and dynamically change shape.

### Enzyme Fundamentals

▷

### 3 Genomics and Proteomics



## 4 Physiological Development



## 5 Transport of Solutes and Water





## 27 Water and Salt Physiology: Mechanisms



## 7 Nutrition, Feeding, and Digestion

