PHYSIOLOGY

Gizem Kaykı Mutlu, PhD
Department of Pharmacology
gkayki@ankara.edu.tr

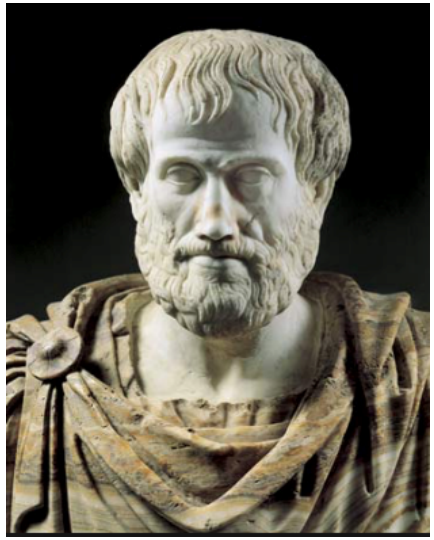
Physiology (physo = nature; logos = study)

Knowledge of the nature

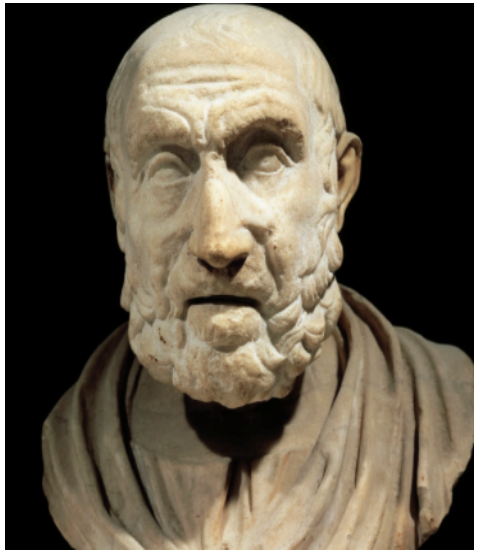
The study of human body

Study of how the body works to maintain life

Today we benefit from centuries of work by physiologists who constructed a knowledge about how human body functions.



Aristotle (384-322 BC)
the functioning of all
living organisms



Hippocrates (460-377 BC)
healing power of nature

In Physiology most knowledge is derived from animal experimentation.

Sometime human experimentation necessary.

Difficulties of Human Experimentation:

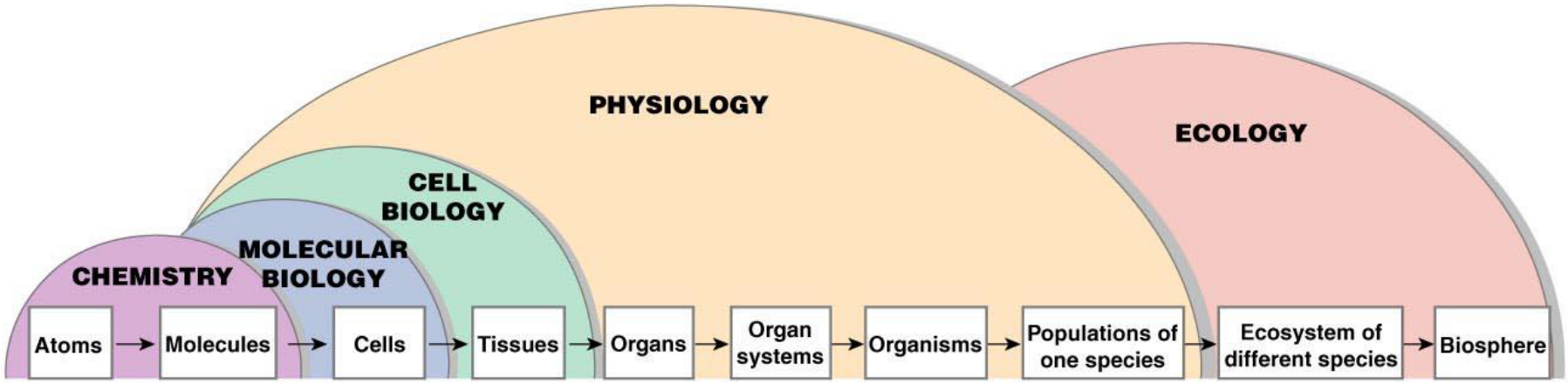
Very dissimilar test subjects

Psychological aspects

Ethical questions

Physiology is

- the study of the normal functioning of a living organism and its component parts.
- an integrative science.



Function and Mechanism

Function:

Why does something exist? What is purpose or function?

Cells need O_2 and RBC bring it to them.

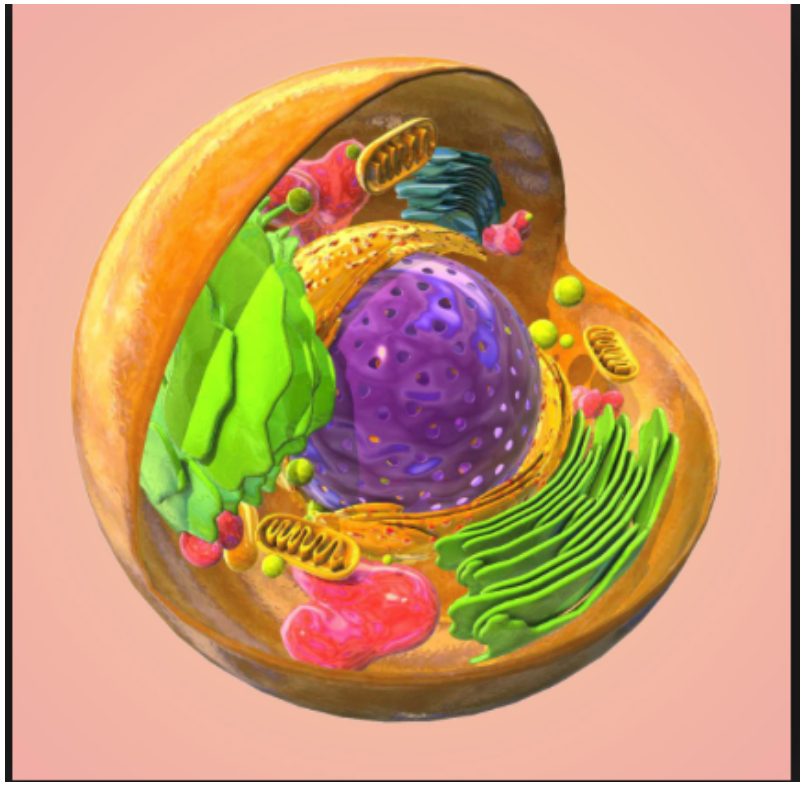
Mechanism:

How does something work? What are processes involved?

O_2 binds to Hb molecules in the RBC.

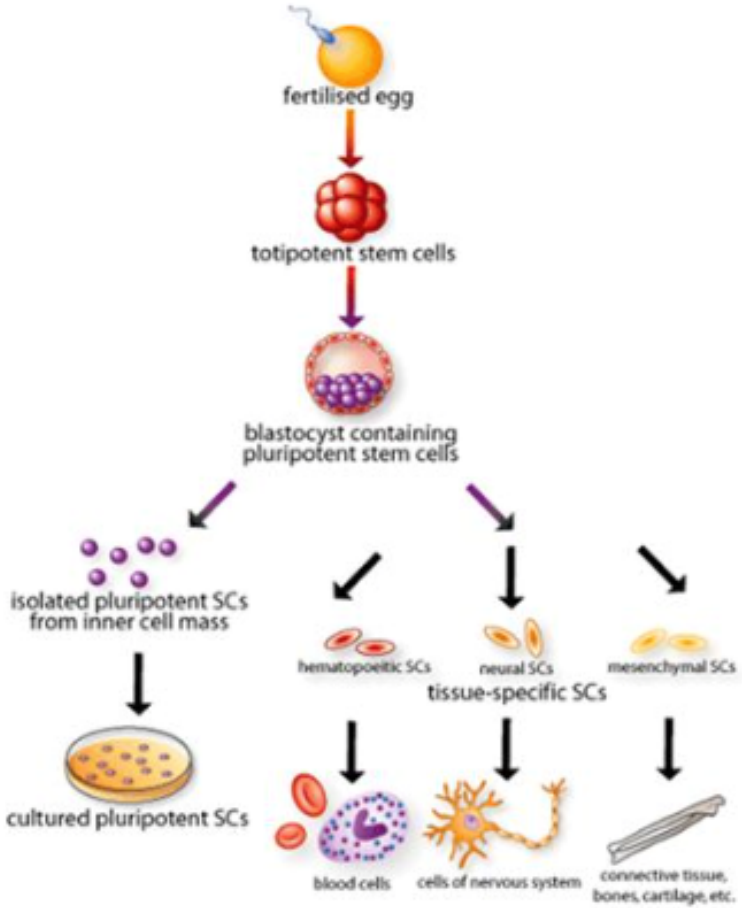
Cells

- Basic living units
- Smallest subdivision able to carry out all life processes
- Contain *organelles*
  - Structures that have specific functions
- Specialized for specific physiological roles



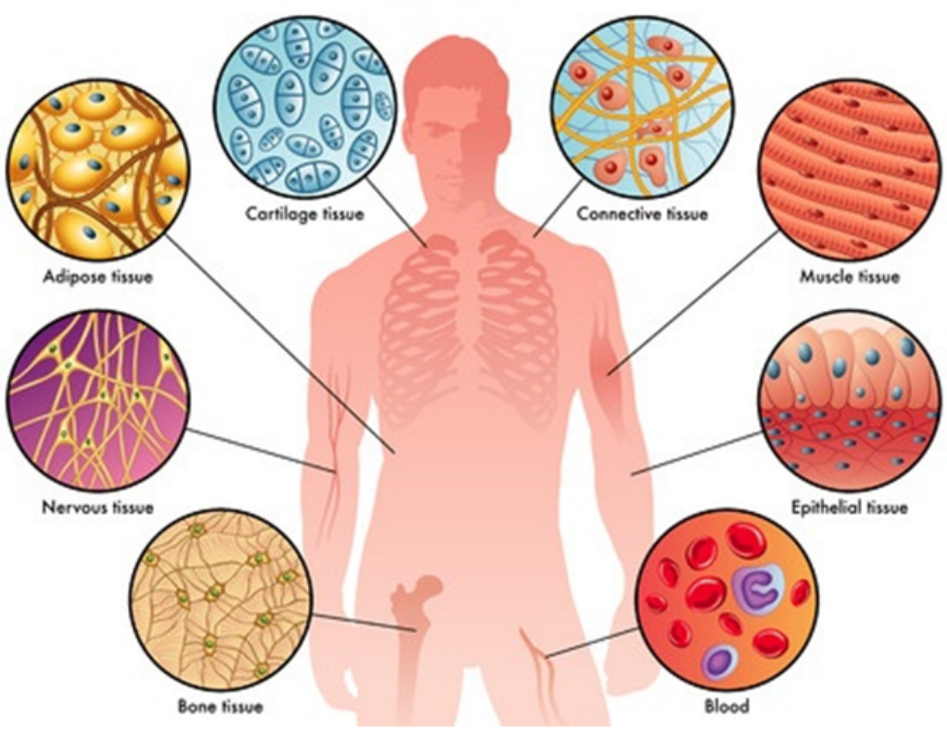
Cell Differentiation:

- the process by which cells become specialized for different functions;
- we all started as an individual fertilized egg cell ➔ embryo ➔ adult organism
- cell differentiation is controlled by a number of interacting factors in an embryo…many of which we still don't completely understand!



Tissues

- Groups of cells of similar structure
- Interaction among cells leads to functions single cells cannot effectively do alone

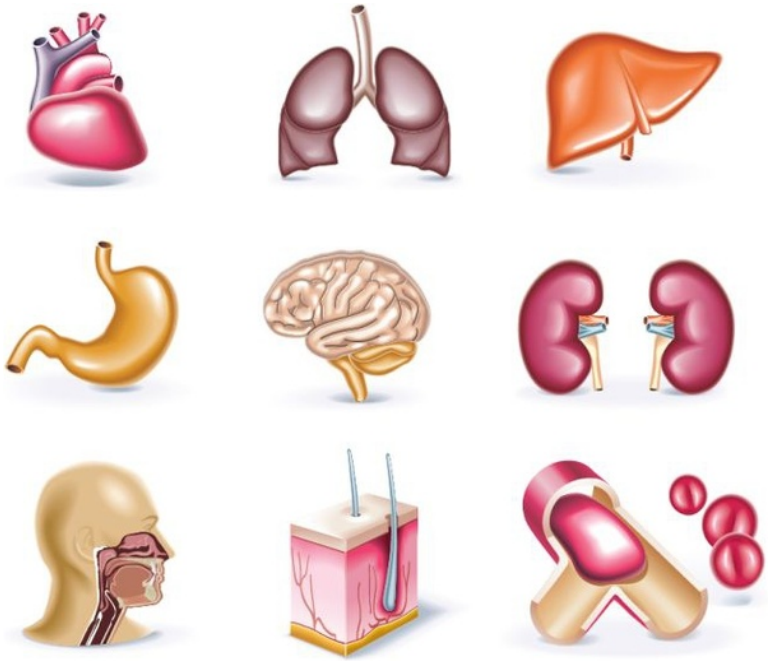


Types of Tissues

- Epithelial tissues
  - Form body surfaces
- Connective Tissues
  - Extracellular matrix
  - Connection, Structure, and Protection
- Muscle Tissue
  - Contraction
  - Generates Tension, Movement and Heat
- Nerve tissue
  - High speed communication
  - Control/Integration

Organs

- structures consisting of at least two tissue types
- performs a specific function related to the whole body



Molecular interaction

The ability of individual molecules to bind to or react with other molecules for biological function.

A molecule's function is dependent on its structure and shape and even a small change may have significant effect on the function.

Compertmentation

is the division of space into separate compartments.

(A) ANATOMICAL: The Body Cavities

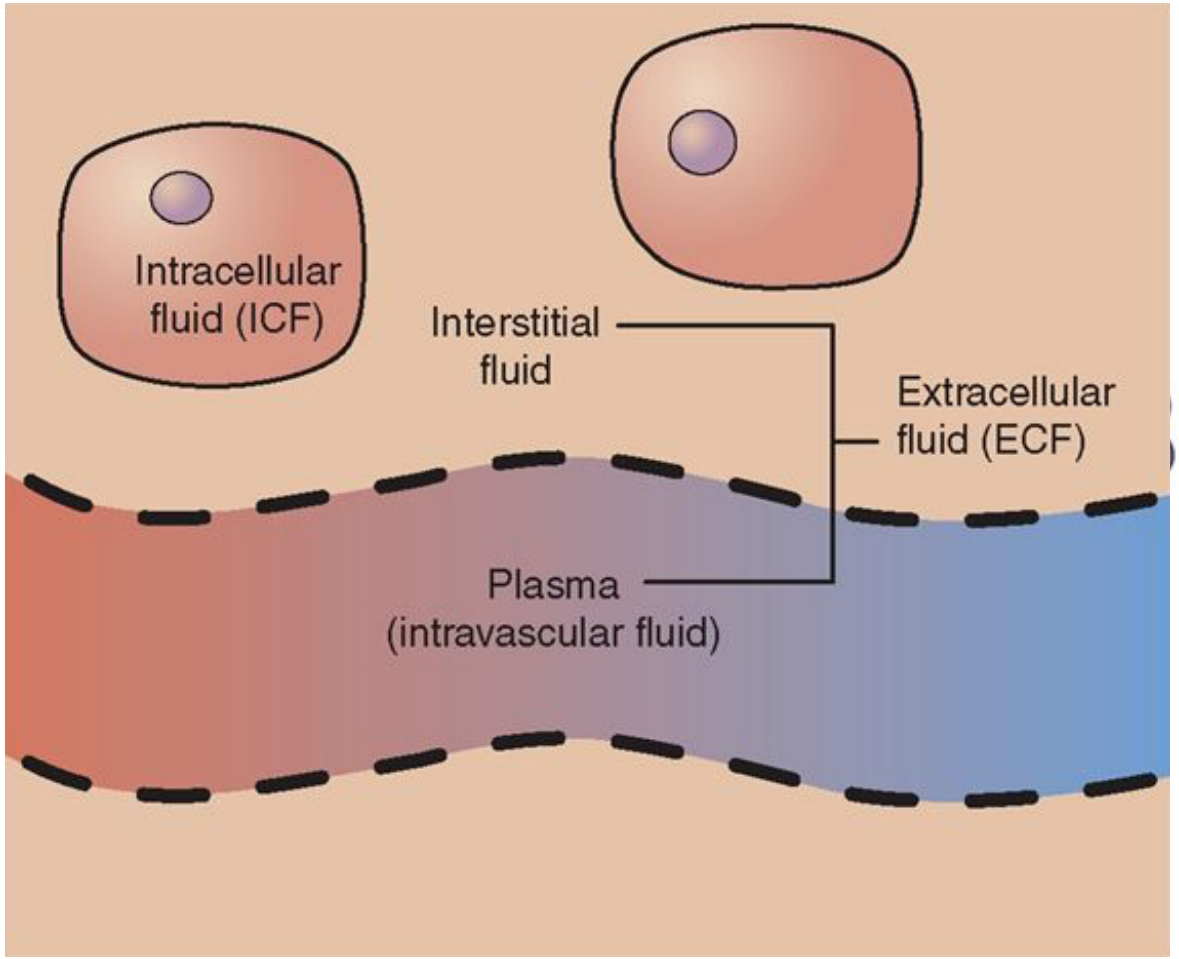
Cranial cavity contains the brain, the control system

Thorax contains the heart and lungs

Stomach, intestines, pancreas, bladder, spleen are located in abdominopelvic cavity.

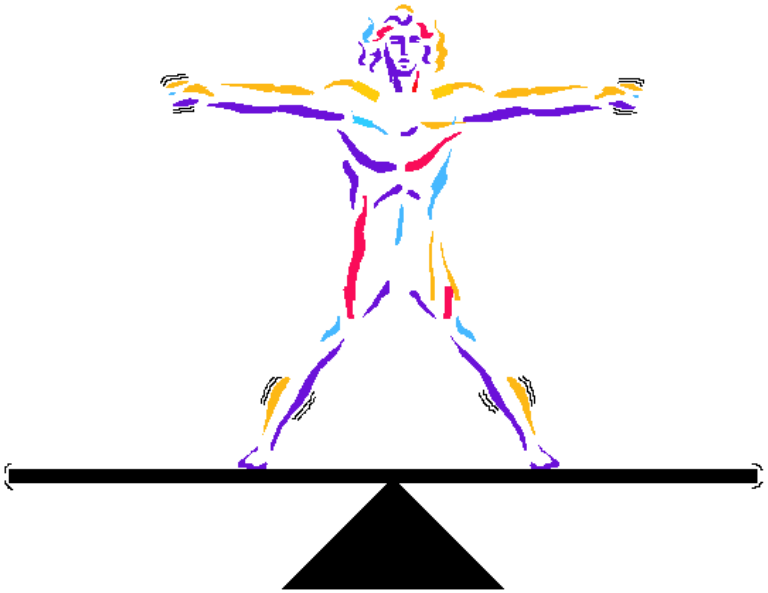
(B) FUNCTIONAL: The Body Fluid Compartments

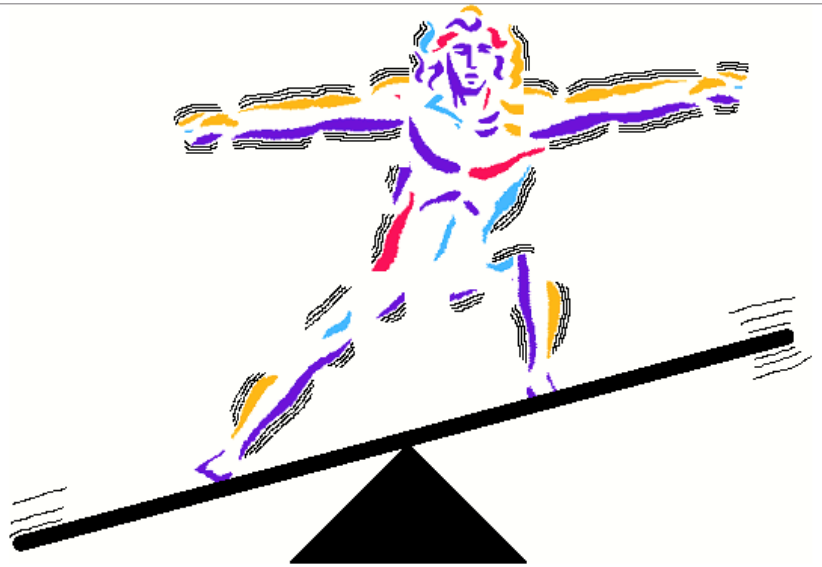
- Intracellular (ICF)
- Extracellular (ECF)
  - Interstitial
  - Plasma



(C) Compartments are separated by membranes.

These barriers determine what can move between compartments. So the composition of each compartment is different.





Homeostasis

= state of constancy of conditions within the body

Organisms that survive in challenging habitats cope with external variability by keeping their internal environment relatively stable.

•Our cells are not very tolerant of changes in their surroundings.

•ECF serves as the transition between an organism's external environment and ICF.

•When extracellular fluid composition varies outside its normal range, compensatory mechanisms activate and try to return the fluid to its normal state.

The body must maintain mass balance.

Any gain must be offset by an equal loss.

Successful compensation

Homeostasis reestablished

Failure to compensate

Pathophysiology

Illness

Death

Homestasis,

- Defined as maintenance of a relatively stable internal environment
- Does not mean that composition, temperature, and other characteristics are absolutely unchanging
- Homeostasis is essential for survival and function of all cells
- Each cell contributes to maintenance of a relatively stable internal environment

Homeostatic Control Systems

is a collection of body components that functions to keep a physical or chemical property of the internal environment relatively constant.

Regulatory Mechanism Components

- *sensor*
  - monitors internal conditions, detects changes
- *integrating center (controller)*
  - receives & integrates information
- *effector*
  - responds to changes
  - activity of effectors results in return of condition to normal levels.

Feedforward control

Body predicts that a change is about to occur and start the response loop in anticipation of the change.

A physiological example of feedforward control is the salivation reflex.

The sight, smell, or even the thought of food is enough to start our mouths watering in expectation of eating the food and even the secretion of hydrochloric acid as the stomach anticipates food on the way.

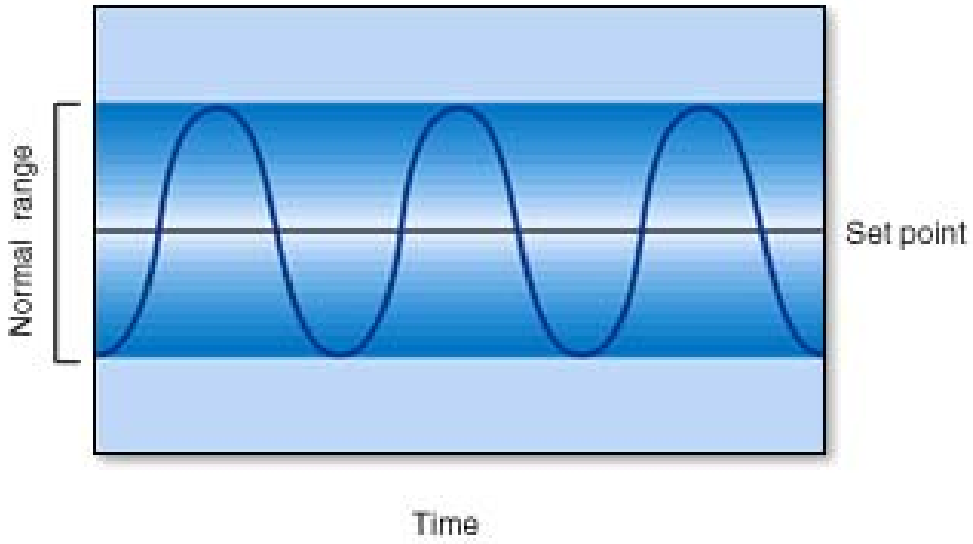
- Sight

- Smell

- Thinking of food

In physiological systems, the setpoints for many regulated variables are different from person to person, or may change for the same individual over a period of time.

Regulated variables that change predictably and create repeating patterns or cycles of change are known as biological rhythms, or **biorhythms**. The timing of many biorhythms coincides with a predictable environmental change, such as daily light-dark cycles or the seasons.



Daily biological rhythm is called a circadian rhythm.