

PHYSIOLOGY



Lec: 1

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Lecture Objectives:

- Understand the concept of homeostasis, external and internal environments.
- Explain how organ systems contribute to the maintenance of the internal environment.
- Explain the difference between steady state and equilibrium.
- Describe how homeostatic mechanism monitors a particular aspect of the internal environment.
- Be familiar with the coordination of body systems in regulation of body functions

علم ال why

Physiology:

زي كانه فيزياء لكنہ بدرسي
الظواهر جسم الكائن الحي

وظائف The science that explains the
function of cells, tissues, and
organs; and how they are
integrated to maintain body
optimal health and survival.

تكاملاً الخلية
والطبقات الخلوية و الأعضاء
(اي إنهم كلام يكملو بعض)

The internal environment (Extracellular fluid-ECF)



- Also called milieu interieur by the French physiologist Claude Bernard (1813-1878). The **internal environment** is the fluid environment in which the cells live. Note that the external environment is outside the body.
- The ECF constitutes **one third** of body fluid. ECF **consists** of the **blood plasma** and **interstitial fluid**.
- **The ECF is in constant motion**. It is rapidly transported in the circulating blood and then mixing between the blood and tissue fluids occurs by diffusion through the capillary walls.
- The composition of the ECF is maintained by **body systems**
- It contains the ions and nutrients needed by the cells for maintenance of cellular life. It also contains CO_2 plus other cellular waste products

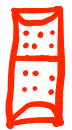
Extracellular fluid

ECF

in constant motion

(بما إنه وسط للتبادل)

blood (contains plasma) ← يدخل الوعاء الدموي



interstitial fluid

جزء يدخل القديم
وجزء يطلع الجديد

capillary
ترس البلازما من خلال

الثقوب
للخارج

السائل الجديد (يدفع)
يخرج من الثقوب

اجزاء

plasma → داخل الوعاء الدموي

capillar

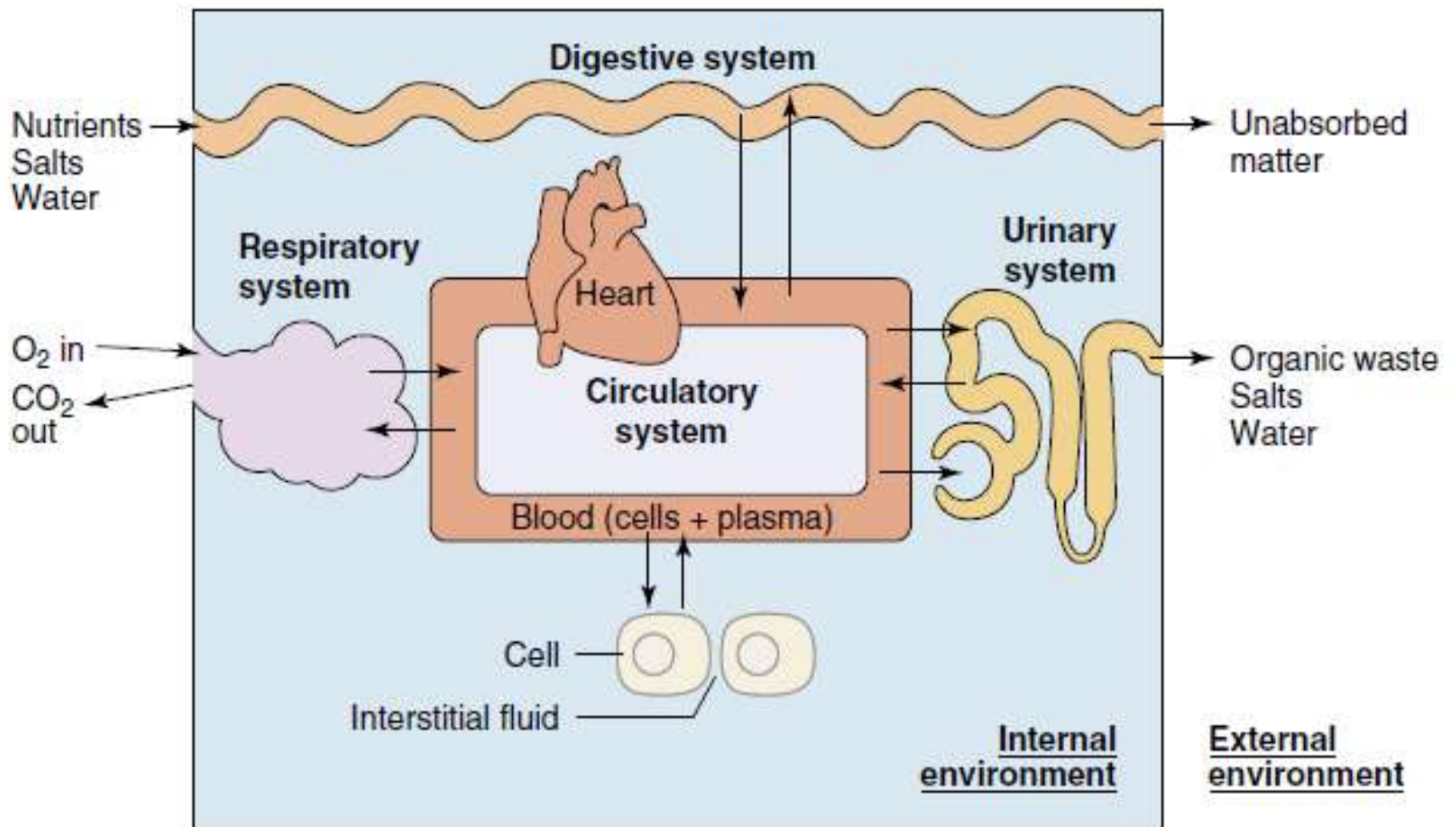
interstitial fluid → بين الخلايا

(السائل)

90% من القديم

يرجع لل capillary

10% يذهب للقنوات اللمفاوية



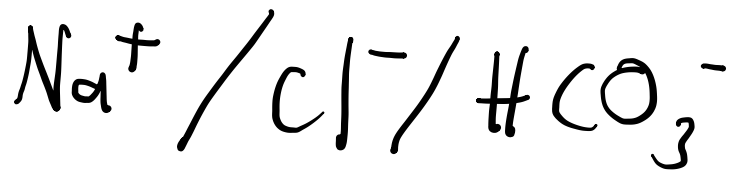
The internal environment (Cont.)

- The level and concentrations of O_2 , glucose, different ions, water, pH, amino acids, fatty substances, and other constituents are **held relatively constant** in this internal environment so as cells are capable of living, growing, and performing their special functions
- The **concentration of ions** and other substances in the extracellular fluid may differ from that of the intracellular fluid (e.g. high Na^+ , Cl^- , and HCO_3^- ions extracellularly) → *بدا الخلية*
- Intracellular fluid (ICF) has **higher concentration of K^+ , Mg^{2+} , and phosphate ions**. The composition of the ICF is maintained by the cell membrane which has special mechanisms for transporting of ions and molecules through it by **diffusion, osmosis, active transport, and vesicular transport** *1 2 3 4* PO_4^{3-} *طرق النقل*

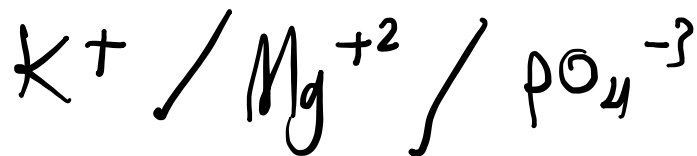
- تركيز المواد ثابت ولا يعني ذلك أنه متساوي

- تركيز المواد داخل الخلية يختلف عن داخلها

* ايونات تركيزها اكبر في ال
extracellular
fluid



* ايونات تركيزها اكبر في ال
intracellular
fluid



يتم الحفاظ على تركيز ال ICF عن طريق الفواقل

تركيزه اعلى داخل
الخلية

Na⁺

○○○○○○○○

رمال مضخة البوتاسيوم والصوديوم (

تركيزه → K⁺
اعلى داخل الخلية

لوزاد ال Na⁺
داخل الخلية المضخة
تضخه للخارج عنان
يرجع للوضع الطبيعي

المريض ← خلل في الحفاظ على البيئة الداخلية مهم :-

Homeostasis does not equal equilibrium

Homeostasis

الحفاظ

- Is the **maintenance** of the ECF and the ICF composition (and their temperature) **relatively stable** in a **steady-state** condition, **distinct from equilibrium**, by a variety of regulatory processes called homeostatic mechanisms.
- **Homeo** means "the same"; **stasis** means "to stand or stay". Homeostasis is not a rigid, fixed state but a dynamic steady-state in which the changes that do occur are minimized by the homeostatic mechanisms.
- Maintenance of a steady-state occurs when water and a number of important solutes **input** into the body equals **output** from the body.
- Disease or death is often the result of dysfunction of homeostatic mechanisms.
- The discipline of **pathophysiology** explains how the various physiological processes are altered in diseases or injury.
- The effectiveness of homeostatic mechanisms varies over a person's lifetime.



الأنف

حالة مستقرة
تتغير مع الوقت

Homeostasis is not fixed, it can vary from creature to other

يختلف من كائن حي لآخر

There is homeostasis mechanisms
→ responsible for homeostasis

Homeostasis → A steady-status
كما حالة من التوازن

Contributions of the Body Systems to Homeostasis → cardiovascular system

زى ما شرحنا فوق
(سلايد 4 و 5)

- Role of CVS in homeostasis (mixing the plasma and extracellular fluid, thereby it maintains complete homogeneity of these fluids throughout the body).
- Role of respiratory system in homeostasis (supply of O_2 and removal of CO_2).
- Role of GIT in homeostasis (absorption of carbohydrates, fatty acids, and amino acids into the extracellular fluid). → Gastrointestinal tract → tract from mouth to the anus
- Role of liver and other organs in homeostasis (metabolic function, e.g. changing chemical composition, modifying the absorbed substances, and storing).
- Role of kidneys in homeostasis (excretion of waste products such as urea, uric acid, excesses of ions and water).

Contributions of the Body Systems to Homeostasis (cont.)

كيف تساهم
الأجهزة في الجسم لتحقيق التوازن

- Role of **musculoskeletal system** in homeostasis (provides **support** and protection for the soft tissues and organs; and enables **movement** toward food or away from threats).
- Role of **nervous system** in homeostasis (instant regulatory functions by its sensory part, central nervous system or integrative part, and the motor part). The autonomic system operates at a **subconscious** level to control many organs such as the heart pumping, GIT movement, glandular secretion, etc. The nervous system controls mainly the **muscular** and **secretory activities**.
- Role of **endocrine system** (hormonal system) in homeostasis (delayed and **prolonged regulatory function**; e.g. thyroid hormones, insulin hormone, parathyroid hormone, etc.). This system regulates mainly **metabolic functions**.

brain + spinal cord

يتحكم
بالحركة
إرادية

امتلاك
الوعي

تستمر لفترات طويلة

Contributions of the Body Systems to Homeostasis (cont.)

مسببات الأمراض

- Role of the immune system (white blood cells, the thymus, and lymph nodes) in homeostasis is the protection from pathogens. This function is achieved by distinguishing body own cells from harmful foreign cells and substances; and by destroying the invader by **phagocytosis** or by **antibodies**.
- The role of the integumentary system (skin and its various appendages) is to cover, cushion, and protect the deeper tissues and organs. This system is also important for **temperature regulation** and excretion of wastes, and it provides a **sensory interface** between the body and the external environment.
- Role of reproductive system is to maintain homeostasis (maintains continuity of life by generating new beings to replace those that are dying).

Sweating

تحافظ على استمرارية الحياة