



Fundamentals of Blood Biochemistry **(BCH 220)**

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Class 12:

Blood plasma: properties and composition

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Objectives for this lecture

- Discuss the properties of blood plasma.
- understand the composition of blood plasma.

Blood plasma

- Blood contains :
 - ✓ extracellular fluid (*fluid in plasma*)
 - ✓ intracellular fluid (*fluid in RBC*)
- The blood volume is important in the control of cardiovascular dynamics.
- Extracellular fluid (plasma) is a *delivery system*.

OUTPUT

- Kidneys
- Lungs
- Feces
- Sweat
- Skin

INTAKE

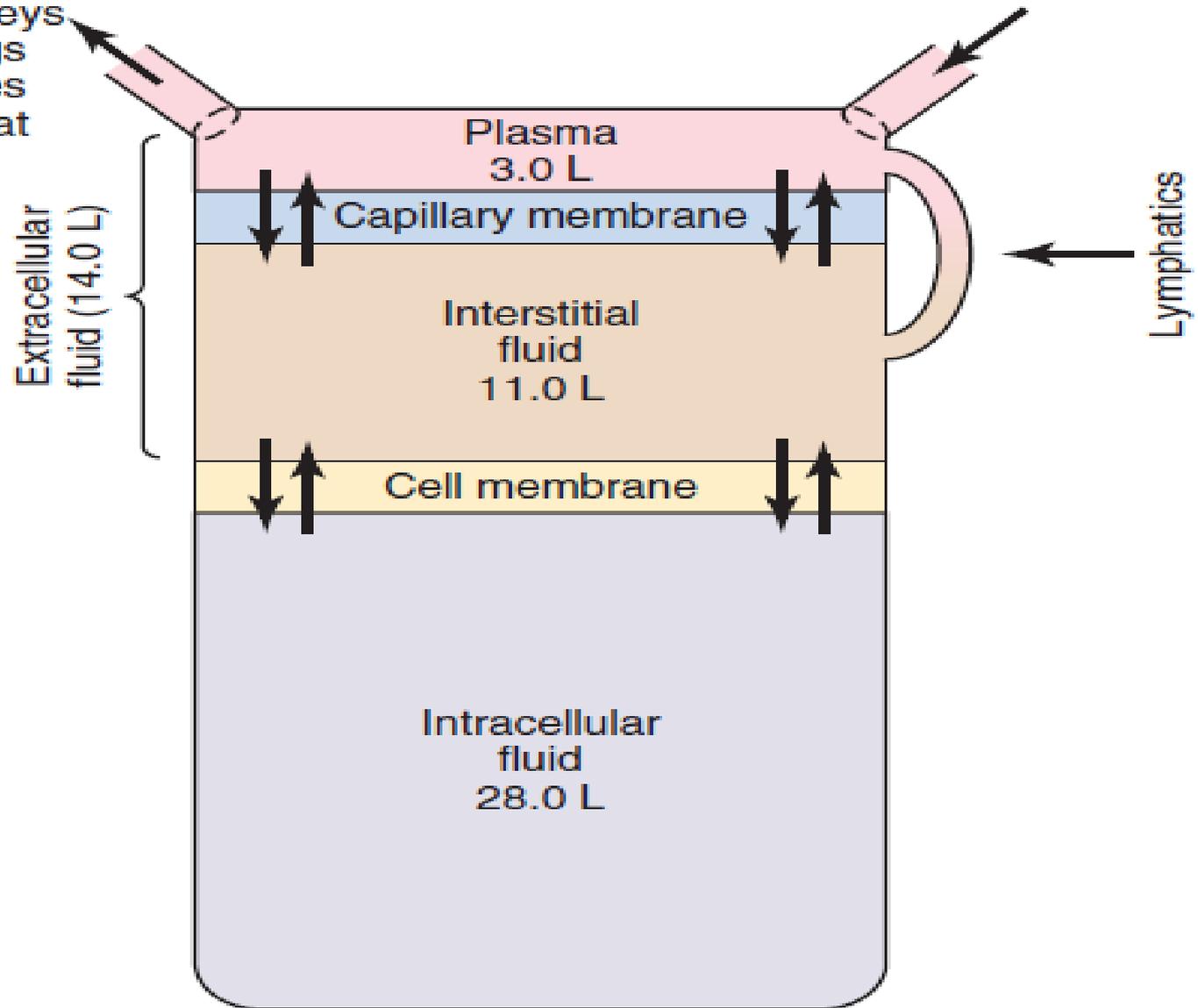


Figure 25-1. Summary of body fluid regulation,

Blood plasma

- **Average blood volume** of adults is 7 % of body weight (about 5 liters).....
 - ✓ *60 % is plasma*
 - ✓ *40 % is red blood cells*
- It vary in different people, depending on gender, weight, and other factors.
- Composition of plasma is regulated by the kidneys.

Plasma Composition

- plasma and interstitial fluid are separated by permeable membranes:
 - ✓ *Their ionic composition is similar.*
 - ✓ *higher concentration of protein in plasma.*

Plasma comprise:

- ✓ Water: 90%
- ✓ Organic substances 9.1%:
 - » Proteins (6-8% of plasma)
 - » Nutrients (a.a., glucose, lipids, vitamins)
 - » Waste products (creatinine, bilirubin, urea)
 - » Dissolved gases (O₂ and CO₂)
 - » hormones
- ✓ Inorganic substances: 0.9% (Na, Cl, others)

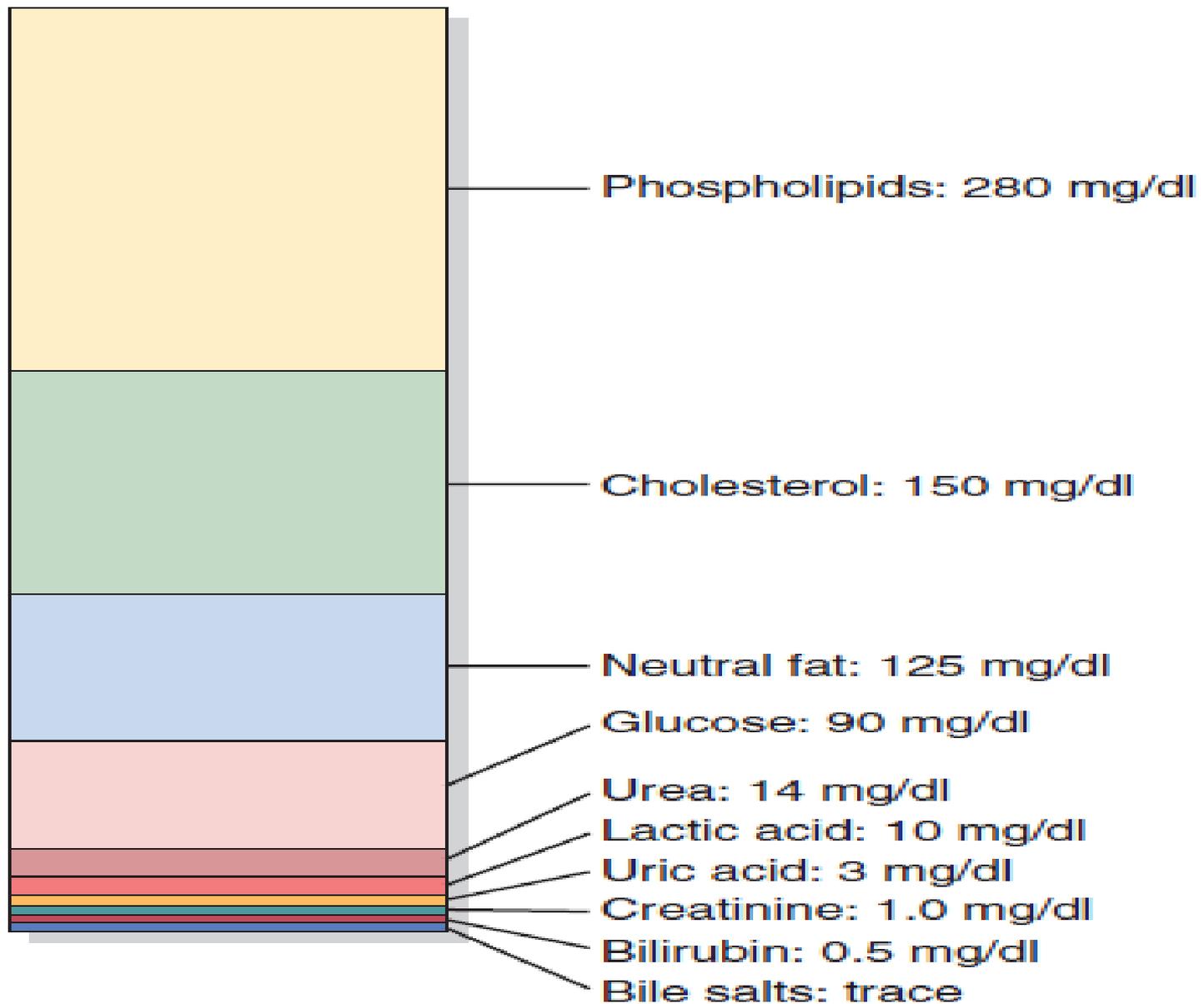


Figure 25-3. Nonelectrolytes of the plasma.

Plasma Composition

- Water concentration on plasma and RBC is equal (*OSMOSIS*), (controlled by water diffusion across the RBC membrane toward the region of higher solute concentration).

Plasma Composition

- **Ionic composition of plasma :**
 - *large* amounts : Na^+ , Cl^- , bicarbonate.
 - *small* amounts : K^+ , Ca^{++} , Mg^{++} , phosphate, and organic acid ions.

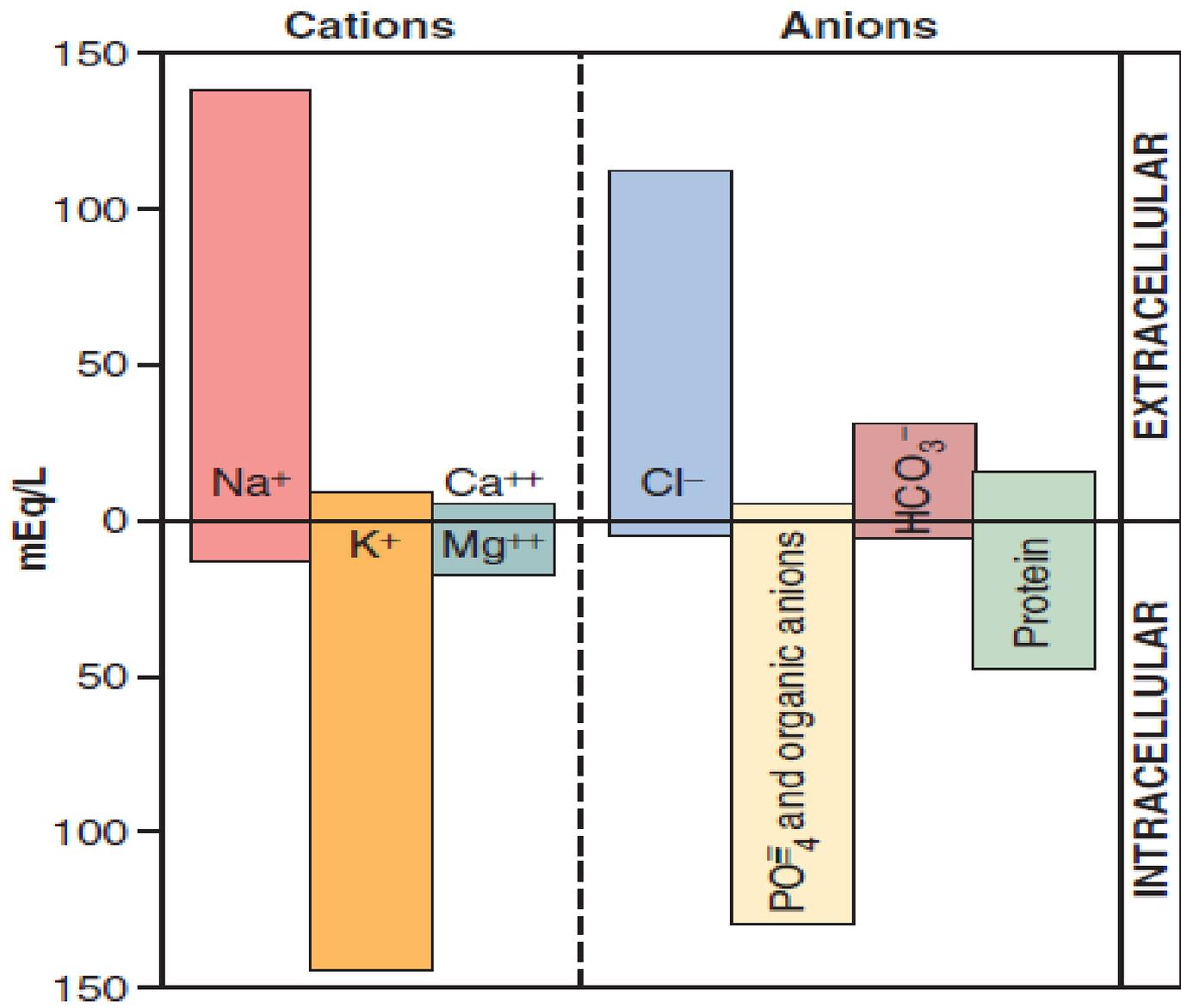


Figure 25-2. Major cations and anions

Plasma Composition

- **Plasma proteins** have a net negative charge, so it bind cations (Na^+ , K^+).
- Molecules that are being carried by plasma proteins will have:
 - *More solubility.*
 - *Longer half life.*

- ***Plasma viscosity*** is affected by the concentration of plasma proteins of large molecular size (fibrinogen and some immunoglobulins).
- Viscosity increases in the elderly as fibrinogen increases.
- no difference in values between men and women.

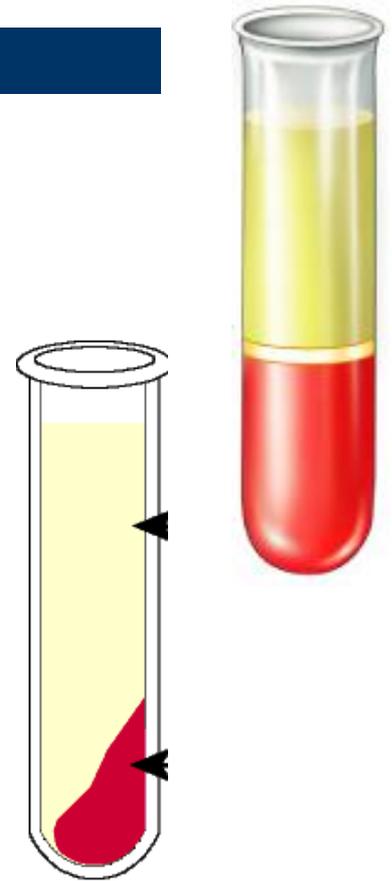
- laboratory tests in biochemistry, hematology, and immunology are performed using blood, plasma, or serum.
 - Elements of blood are suspended in an aqueous solution: *plasma*.
 - Plasma is the supernatant obtained after centrifugation of a blood sample collected into a test tube containing an *anticoagulant*.

Anticoagulants

- *Heparinate*: prevents clotting by binding to thrombin.
- *EDTA and citrate*: bind Ca^{2+} and Mg^{2+} ions, thus blocking the calcium- and magnesium-dependent enzymes in the clotting cascade.
- *Citrate*: is used for coagulation tests and also when blood is collected for transfusion.

Serum

- The supernatant obtained after a blood sample has been allowed to clot spontaneously.
- During clotting, fibrinogen is converted to fibrin.
 - *Therefore a major difference between plasma and serum is the **absence of fibrinogen in serum.***



References

- Victor A Hoffbrand, Paul Moss, J Pettit; ***Essential Haematology***. Essentials Series Blackwell Science, New York; 2008.
- John E. Hall, ***Guyton And Hall Textbook of Medical Physiology***. 13 ed., 2016.