

Counter current exchange system

A **counter-current exchange system** is a system in which **two fluids of different properties** flow parallel and against each other in semi-permeable tubes, which allow **equalization** of these differences. In humans, this mechanism is significantly used in the process of maintaining the hyperosmolarity of the kidney medulla.

Layout

Countercurrent exchange in the kidney medulla is made possible thanks to the hairpin parallel arrangement of the individual medulla formations. These are the descending and ascending arms of the loop of Henle, the descending and ascending parts of the vasa recta, and the collecting ducts.

Mechanism

Vasa recta are permeable to water and blood flows slowly in them, so that osmotic gradients between the blood and the interstitial fluid of the medulla may occur.

- In the descending part of the vessel, NaCl and urea move from the interstitium to the blood, while water moves from the blood to the interstitium.
- At the top of the capillary loop, the blood reaches its highest osmotic concentration.
- In the ascending part of the vessel, NaCl and urea move back into the interstitium and water back into the blood.

As a result, water passes from the descending to the ascending part of the vasa recta and thus remains in the circulation, while the solutes recirculate from the ascending to the descending part of the vasa recta and thus remain in the medulla.

Meaning

A counter-current exchange system ensures **vascular supply** to the marrow without blood washing away solutes from the hyperosmotic interstitium. The hyperosmotic interstitium is then necessary for the **thickening of urine** in the collecting ducts.

There are other mechanisms based on countercurrent exchange. For example, the vascular supply of the peripheral parts of the body without large heat losses is ensured by the countercurrent exchange of heat between the supplying arteries and the parallel veins.

Links

Related resources

- Counter current multiplication system
- Nephron
- Kidneys

External resources

- Článek na anglické wikipedii (https://en.wikipedia.org/wiki/Countercurrent_exchange)

References

- SILBERNAGL, Stefan – DESPOPOULOS, Agamemnon. *Atlas fyziologie člověka*. 3. edition. Praha : Grada, 2004. 448 pp. ISBN 978-80-247-0630-6.
- TROJAN, Stanislav. *Lékařská fyziologie*. 4. edition. Grada, 2003. 772 pp. ISBN 80-247-0512-5.

