

# Tubular processes

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Tubular processes include several actions taking place in the renal tubules. That is, in the proximal tubule, the renal tubule of Henle, the distal tubule and the collecting duct. These are several functions that ensure the maintenance of homeostasis in our body. In particular, the excretion of waste products and unwanted substances, as well as the regulation of the body's hydration, the regulation of the correct level of ions, osmolality and, last but not least, the regulation of pH. The filtrate produced by glomerular filtration (primary urine) is further modified by the cells of the tubules. Some substances are reabsorbed back into the blood, while others are secreted into the tubule lumen and then excreted in the final urine. Thus, we distinguish between tubular reabsorption and tubular secretion. The amount of substance excreted in the urine is then determined by the sum of glomerular filtration - tubular reabsorption + tubular secretion of the substance.

## Cells of tubules

Epithelial cells of tubules have different structures in different parts of the tubule. Their membranes contain different channels and transporters, so different substances are transported in different parts of the tubule, or the same substances but in different ways. On all cells, however, we recognize a baso-lateral and an apical (luminal) surface. These two surfaces are separated by so-called tight junctions. The junctions prevent to some extent the free passage of substances from the lumen between the cells.

## Tubular reabsorption

By reabsorption is meant the reabsorption of substances from the primary urine. Thus, it is the transport from the tubule lumen through the epithelial membranes to the interstitium and then to the peritubular capillaries. Substances can pass either through cells or, to a limited extent, between cells through tight junctions.

### Primarily active reabsorption

A model example for primarily active reabsorption is the transport of  $\text{Na}^+$  ions. It is driven by the  $\text{Na}^+/\text{K}^+$ ATPase. These transporters are located in the baso-lateral membrane of cells. They pump  $\text{Na}^+$  from the cells into the interstitium under direct cleavage of ATP. Thus, they produce a low concentration of  $\text{Na}^+$  ions in the cells. As a result,  $\text{Na}^+$  transport from the tubule lumen to the cells occurs passively along a concentration gradient.  $\text{Na}^+$  transport across the apical membrane is often coupled with transport of other substances.

### Secondarily active reabsorption

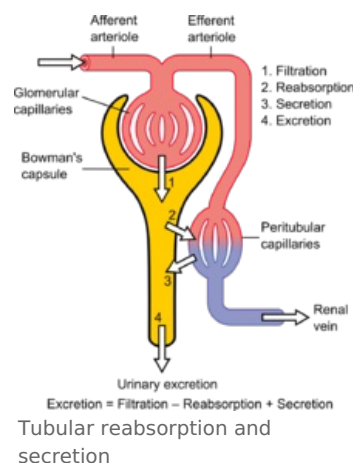
Here, glucose transport is a model example. Transporters on the apical membrane transport one glucose molecule and one  $\text{Na}^+$  molecule simultaneously. Thus, glucose transport is driven by the  $\text{Na}^+$  concentration gradient generated by the  $\text{Na}^+/\text{K}^+$ ATPase on the basolateral side of the epithelium. It thus drives transport secondarily.

### Passive reabsorption

In this case, urea transport is the model example. The urea is reabsorbed passively along with water in the proximal tubule. In the collecting ducts, it is transported passively by carriers into the interstitium. Regulation of this transport is one of the ways in which water absorption is affected.

## Tubular secretion

Tubular secretion is the active transport of substances from the blood through the epithelial membranes into the tubule lumen. In this way, some substances affecting the pH or creatinine are removed from the body. Tubular secretion facilitates faster elimination of substances that are not completely filtered out by glomerular filtration. Sometimes, however, it may be the only way of eliminating a substance from the body.



# Links

## Related articles

- Kidney
- Nephron
- Kidney function
- Regulatory mechanisms of renal circulation

## Reference

## Used literature

- GUYTON, Arthur C – HALL, John E. *Textbook of medical physiology*. 11. edition. Philadelphia : Elsevier Saunders, 0000. 1116 pp. ISBN 0-8089-2317-X.