動物生理恆定性的重要

• 動物身體內的水分和溶解物質的取得和排泄為什麼需要有相對的恆定性？
• 如何維持這些生理調節的恆定性？
• 水分、醣、鹽分和體溫是如何調節的？
KIDNEY (one of a pair)
Constantly filters water and all solutes except proteins from blood; reclaims water and solutes as the body requires and excretes the remainder, as urine

URETER (one of a pair)
Channel for urine flow from a kidney to the urinary bladder

URINARY BLADDER
Stretchable container for temporarily storing urine

URETHRA
Channel for urine flow between the urinary bladder and body surface
glomerulus (coded red)
proximal tubule (orange)
start of distal tubule (brown)
loop of Henle (yellow)

Bowman's capsule
glomerular capillaries at beginning of nephron

peritubular capillaries threading around the nephron's tubular parts
collecting duct

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Blood pumped from the heart travels to the renal artery, then into kidneys, where water and some solutes will be filtered from it. Most of the filtrate will return to the general circulation.

Filtration. At the start of the nephron, blood enters glomerular capillaries. Water and small solutes are filtered into Bowman’s capsule.

Tubular Secretion. Cells of the nephron’s tubular wall regions secrete excess $H^+$ and a few other solutes into the fluid inside the nephron’s lumen.

After its hairpin turn, the wall of the loop of Henle is impermeable to water. But its cells actively pump sodium and chloride ions out of the loop. Pumping makes the interstitial fluid saltier. As a result, even more water is drawn out of collecting ducts that also run through the medulla.

Excretion. What happens to water and solutes that were not reabsorbed or that were secreted into the tubule? They flow through a collecting duct to the renal pelvis, then are eliminated from the body by way of the urinary tract.

Hormonal action adjusts the urine concentration. ADH promotes water reabsorption, so the urine is concentrated. When controls inhibit ADH secretion, urine is dilute.

Aldosterone promotes sodium reabsorption by stimulating sodium pumps. Because more sodium is reabsorbed, the urine has little sodium. When controls inhibit secretion, more sodium is excreted in urine.
a) Sodium ions are pumped out of tubule.
b) Pumping is accompanied by the movement of other ions (such as chloride and bicarbonate ions) out of tubule.
c) Water follows passively, down the small osmotic gradient that the ion movements have produced.
a Freshwater bony fish (body fluids far saltier than surroundings)

b Marine bony fish (body fluids less salty than surroundings)
salmon avoiding grizzly while maintaining water-solute balance