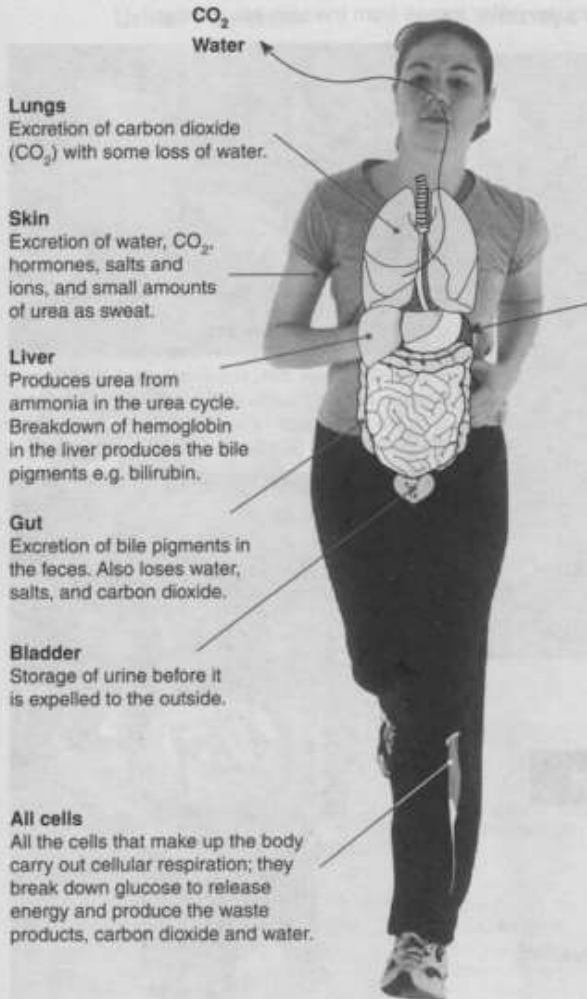


Waste Products in Humans

In humans, a number of organs are involved in the excretion of the waste products of metabolism: mainly the kidneys, lungs, skin, and gut. The liver is a particularly important organ in the initial treatment of waste products, particularly the breakdown of hemoglobin and the formation of urea from ammonia. Excretion

should not be confused with the elimination or egestion of undigested and unabsorbed food material from the gut. Note that the breakdown products of hemoglobin (blood pigment) are excreted in bile and pass out with the feces, but they are not the result of digestion.



Excretion in Humans

In humans, the kidney is the main organ of excretion, although the skin, gut, and lungs also play important roles. As well as ridding the body of nitrogenous wastes, the kidneys are also able to excrete many unwanted poisons and drugs that are taken in from the environment. Usually these are ingested with food or drink, or inhaled. As long as these are not present in toxic amounts, they can usually be slowly eliminated from the body.

Kidney

Filtration of the blood to remove urea. Unwanted ions, particularly hydrogen (H^+) and potassium (K^+), and some hormones are also excreted by the kidneys. Some poisons and drugs (e.g. penicillin) are also excreted by active secretion into the urine. Water is lost in excreting these substances and extra water may be excreted if necessary.

Substance	Origin*	Organ(s) of excretion
Carbon dioxide		
Water		
Bile pigments		
Urea		
Ions (K^+ , HCO_3^- , H^+)		
Hormones		
Poisons		
Drugs		

*Origin refers to from where in the body each substance originates

- Complete the table above summarizing the origin of excretory products and the main organ(s) of excretion for each.
- Explain the role of the liver in excretion, even though it is not primarily an organ of excretion: _____

- Tests for pregnancy are sensitive to an excreted substance in the urine. Suggest what type of substance this might be:

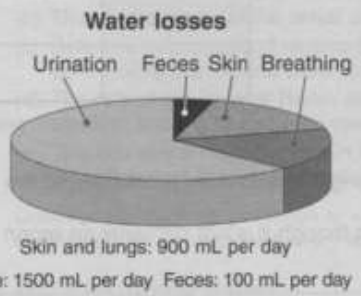
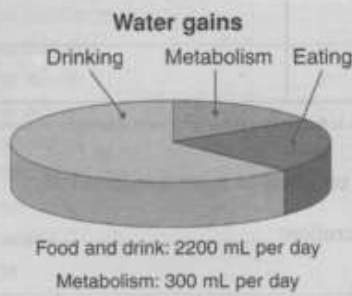
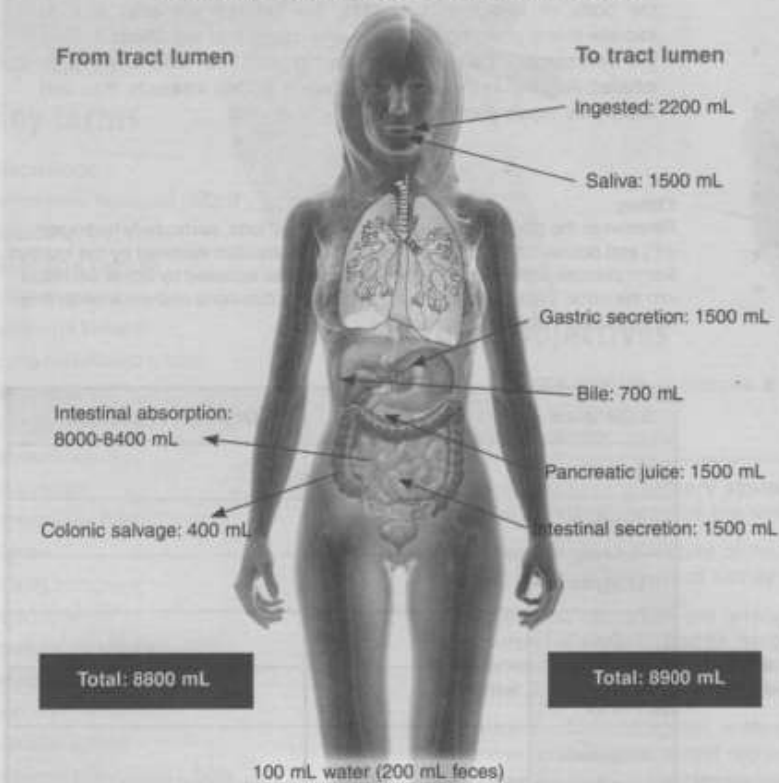
- In people suffering renal failure, the kidneys cease to produce filtrate. Based on your knowledge of the central role of the kidneys in fluid and electrolyte balance, as well as nitrogen excretion, describe the typical symptoms of kidney failure:

Water Budget in Humans

We cannot live without water for more than about 100 hours and adequate water is a requirement for physiological function and health. Body water content varies between individuals and through life, from above about 90% of total weight as a fetus to 74% as an infant, 60% as a child, and around 50-59% in adults, depending on gender and age. Gender differences (males usually have a higher water content than females) are the result of differing fat levels. Water intake and output are highly variable

but closely matched to less than 0.1% over an extended period. Typical values for water gains and losses, as well as daily water transfers are given below. Men need more water than women due to their higher (on average) fat-free mass and energy expenditure. Infants and young children need more water in proportion to their body weight as they cannot concentrate their urine as efficiently as adults. They also have a greater surface area relative to weight, so water losses from the skin are greater.

Daily Water Transfers in an Adult



About 63% of our daily requirement for water is met through drinking fluids, 25% is obtained from food, and the remaining 12% comes from metabolism (the oxidation of glucose to ATP, CO₂, and water).



Typically, we lose 60% of body water through urination, 36% through the skin and lungs, and 4% in feces. Losses through the skin and from the lungs (breathing) average about 900 mL per day or more during heavy exercise. These are called **insensible losses**.

1. Explain how metabolism provides water for the body's activities: _____
2. Describe four common causes of physiological dehydration:
 - (a) _____
 - (b) _____
 - (c) _____
 - (d) _____
3. Some recent sports events have received media coverage because athletes have collapsed after excessive water intakes. This condition, called **hyponatremia** or water intoxication, causes nausea, confusion, diminished reflex activity, stupor, and eventually coma. From what you know of fluid and electrolyte balances in the body, explain these symptoms: _____