

# Metabolic waste

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**Metabolic wastes** or **excretes** are substances left over from metabolic processes (such as cellular respiration), which cannot be used by the organism (they are surplus or toxic), and must therefore be excreted. This includes nitrogen compounds, water, CO<sub>2</sub>, phosphates, sulfates, etc. Animals treat these compounds as excretes. Plants have chemical "machinery" which transforms some of them (primarily the nitrogen compounds) into useful substances, and it has been shown by Brian J. Ford that abscissa leaves also carry wastes away from the parent plant. In this way, Ford argues that the shed leaf acts as an *excretory* (an organ carrying away excretory products).

All the metabolic wastes are excreted in a form of water solutes through the excretory organs (nephridia, Malpighian tubules, kidneys), with the exception of CO<sub>2</sub>, which is excreted together with the water vapor throughout the lungs. The elimination of these compounds enables the chemical homeostasis of the organism.

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## Nitrogen wastes

The nitrogen compounds through which excess nitrogen is eliminated from organisms are called **nitrogenous wastes** (/naɪˈtrɒdʒɪnəs/) or **nitrogen wastes**. They are ammonia, urea, uric acid, and creatinine. All of these substances are produced from protein metabolism. In many animals, the urine is the main route of excretion for such wastes; in some, the feces is.

### Ammonotelism

Ammonia (NH<sub>3</sub>) forms with the oxidation of amino groups (NH<sub>2</sub>), which are removed from the proteins when they convert into carbohydrates. It is a very toxic substance and only one nitrogen atom is removed with it. A lot of water is needed for the excretion of ammonia. Thus, the marine organisms excrete ammonia directly into the water and are called ammonotelic.

### Ureotelism

Land animals mainly amphibians and mammals convert ammonia into urea, a process which occurs in the liver and kidney. Urea is a less toxic compound than ammonia; two nitrogen atoms are eliminated through it and less water is needed for its excretion. Urea is a protein metabolism product of vertebrates and some invertebrates, and these organisms are called ureotelic.

## Uricotelism

Uric acid is a protein metamorphosis product of terrestrial invertebrates, birds, and diapsids. Such animals are called uricotelic organisms. In humans and anthropoids, this acid is a purine metabolism product. Uric acid is less toxic than ammonia or urea; it contains four nitrogen atoms and a small amount of water is needed for its excretion. Out of solute, it precipitates and forms crystals.

## Water and gases

These compounds form during the catabolism of carbohydrates and lipids in condensation reactions, and in some other metabolic reactions of the amino acids. Oxygen is produced by plants and some bacteria in photosynthesis, while CO<sub>2</sub> is a waste product of all animals and plants. Nitrogen gases are produced by denitrifying bacteria and as a waste product, and bacteria for decaying yield ammonia, as do most invertebrates and vertebrates. Water is the only liquid waste from animals and photosynthesizing plants.

[1]

## Solids

Nitrates and nitrites are wastes produced by nitrifying bacteria, just as sulfur and sulfates are produced by sulfur-reducing bacteria and sulfate-reducing bacteria. Insoluble iron waste can be made by iron bacteria by using soluble forms. In plants, resins, fats, waxes, and complex organic chemicals are exuded from plants, e.g., the latex from rubber trees and milkweeds. Solid waste products may be manufactured as organic pigments derived from breakdown of pigments like hemoglobin, and inorganic salts like carbonates, bicarbonates, and phosphate, whether in ionic or molecular form, are excreted as solids.<sup>[1]</sup>

Animals dispose of solid waste as feces.

## References

1. "excretion." Encyclopædia Britannica. Encyclopaedia Britannica Ultimate Reference Suite. Chicago: Encyclopædia Britannica, 2010.

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