**Excretion in Vertebrates:**

Among the vertebrates the main organ that performs the function of excretion is the kidney. Kidney can function with modification in fresh water, in the sea and oh land. The ancestors of vertebrates, the invertebrate chordate have segmental-shaped arranged excretory structures throughout the body like the metanephridia in earthworm. The primitive vertebrate hag fishes have kidney with segmental-form arranged tubules. Kidneys contain numerous tubules not arranged segmental.

**Excretion in Man**

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| Excretory organs in man |

Metabolic wastes: Metabolic wastes are the substances produced within the body by various chemical processes. The wastes of the digestive process are removed i.e. eliminated. The only true excretory products that are removed from the body during elimination are bile pigment and salts of certain minerals. Bile pigments are called bilirubin produced by breakdown of old worn out red blood cells and metabolites of various hormones. Nitrogen containing molecules or nitrogenous wastes includes urea, produced from deamination of amino acids. Uric acid is formed from the breakdown of nucleic acids. Creatinine is derived from a nitrogen containing molecule called creatine in the muscle cells.

Toxin substances such as pesticides, drugs, food additives ingested into the body, and carbon dioxide and water vapor produced during respiration are also metabolic wastes. The waste present in the body cause serious hazards, thus are eliminated by excretory system.

**Excretory Organs:**

 Kidneys, lungs, skin and liver are the structures for the elimination of metabolic waste products.

Urea: Urea is the primary nitrogenous waste product of humans and other living mammals. The advantages of using urea as a nitrogenous waste product are:

(i) Non-toxic: It can therefore be carried round the body in the blood from the liver until it is removed by the kidneys.

(ii) Very soluble: It does not require a great deal of water to get rid of it and it is easily transported.

(iii) A small molecule: It is easily filtered in the kidneys. Ammonia is converted into urea in the liver by a cyclic reaction known as ornithine cycle.

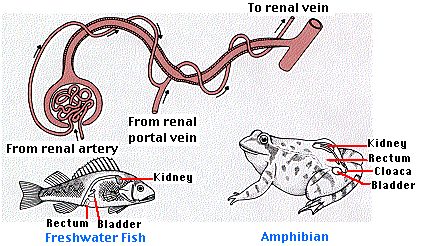
In ornithine cycle, two molecules of ammonia and one molecule of carbon dioxide are used. One ammonia molecule combines with CO2 and already available precursor from previous cycle ornithine to form citrulline, subsequently ammonia combines to form arginine. One molecule of water is made (two made, one used). The arginine is split by arginase to form one molecule of urea. Ornithine is regenerated ready for the next cycle.

Urea is transported in the blood plasma from the liver to the kidneys. The metabolic pathways involved in the production of urea are called urea cycle.

In Animals:

In animals, the main excretory products are carbon dioxide, ammonia (in ammoniotelics), urea (in ureotelics), uric acid (in uricotelics), guanine (in Arachnida) and creatine. The liver and kidneys clear many substances from the blood (for example, in renal excretion), and the cleared substances are then excreted from the body in the urine and feces.

Aquatic animals usually excrete ammonia directly into the external environment, as this compound has high solubility and there is ample water available for dilution. In terrestrial animals ammonia-like compounds are converted into other nitrogenous materials as there is less water in the environment and ammonia itself is toxic.



In birds:

Birds excrete their nitrogenous wastes as uric acid in the form of a paste. Although this process is metabolically more expensive, it allows more efficient water retention and it can be stored more easily in the egg. Many avian species, especially seabirds, can also excrete salt via specialized nasal salt glands, the saline solution leaving through nostrils in the beak.

