TOPIC 11.3: THE KIDNEY

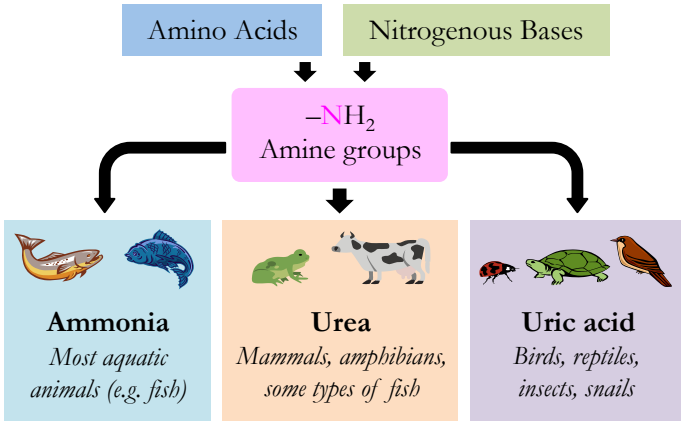
Excretion

Excretion is the removal of waste products from the body
- Wastes are produced as a consequence of metabolism

Excretory systems perform two functions:
- Removes nitrogenous wastes (toxic) from the body
- Removes excess water (maintains osmolarity)

Nitrogenous Wastes

The type of nitrogenous waste produced differs according to an animal's evolutionary history and predominant habitat
- Aquatic animals excrete **ammonia** *(toxic but water soluble)*
- Birds and reptiles excrete **uric acid** *(requires minimal water)*
- Mammals excrete **urea** *(can store at high concentrations)*



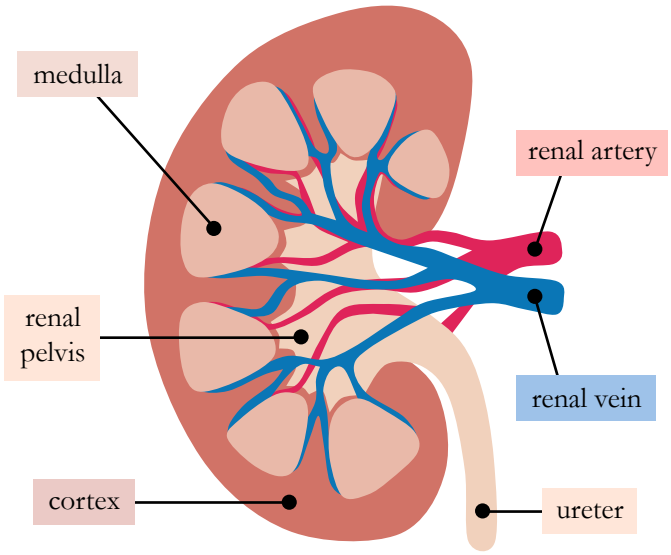
Osmotic Conditions

Animals maintain internal osmotic conditions in two ways:
- *Osmoconformers* match their osmolarity to the environment
- *Osmoregulators* maintain a constant internal osmolarity

Osmoregulation is a more energy intensive process, but it also provides independence from environmental conditions

Animals possess certain structures to enable osmoregulation:
- Insects use a Malpighian tubule system for water balance
- Mammals (e.g. humans) possess kidneys for water balance

Human Kidney



Blood Composition

Blood composition in the renal artery (*before* the kidneys) is different to that in the renal vein (*after* excretory processes)

The renal vein will have:
- Less urea (large amounts are excreted)
- Less water (variable amounts are excreted)
- Similar amounts of nutrients (mostly reabsorbed)
- The same amount of proteins (not filtered)

Urinary Analysis

Kidneys filter waste products from the bloodstream
- Hence, the presence of non-waste substances in the urine is a potential indicator of a disease condition

Urinary analysis can be used to test for:
- **Glucose:** Presence in urine may indicate diabetes
- **Protein:** Indicate certain diseases / hormonal conditions
- **Blood cells:** Suggestive of infectious diseases or cancers
- **Drugs:** Indicates illicit use (e.g. performance enhancers)

Kidney Disease

Kidney diseases incapacitate the ability of the kidney to filter waste products from the bloodstream (leading to toxic build up)

Kidney failure can be treated by **hemodialysis** (a patient's blood is pumped through an external machine to remove wastes)
- Hemodialysis treatments typically last several hours (~4 hrs) and must be performed multiple times in a week (~3×)

Kidney failure can alternatively be treated via **kidney transplant** with a compatible donor (donor *can* survive with one kidney)