

A. EXCRETION

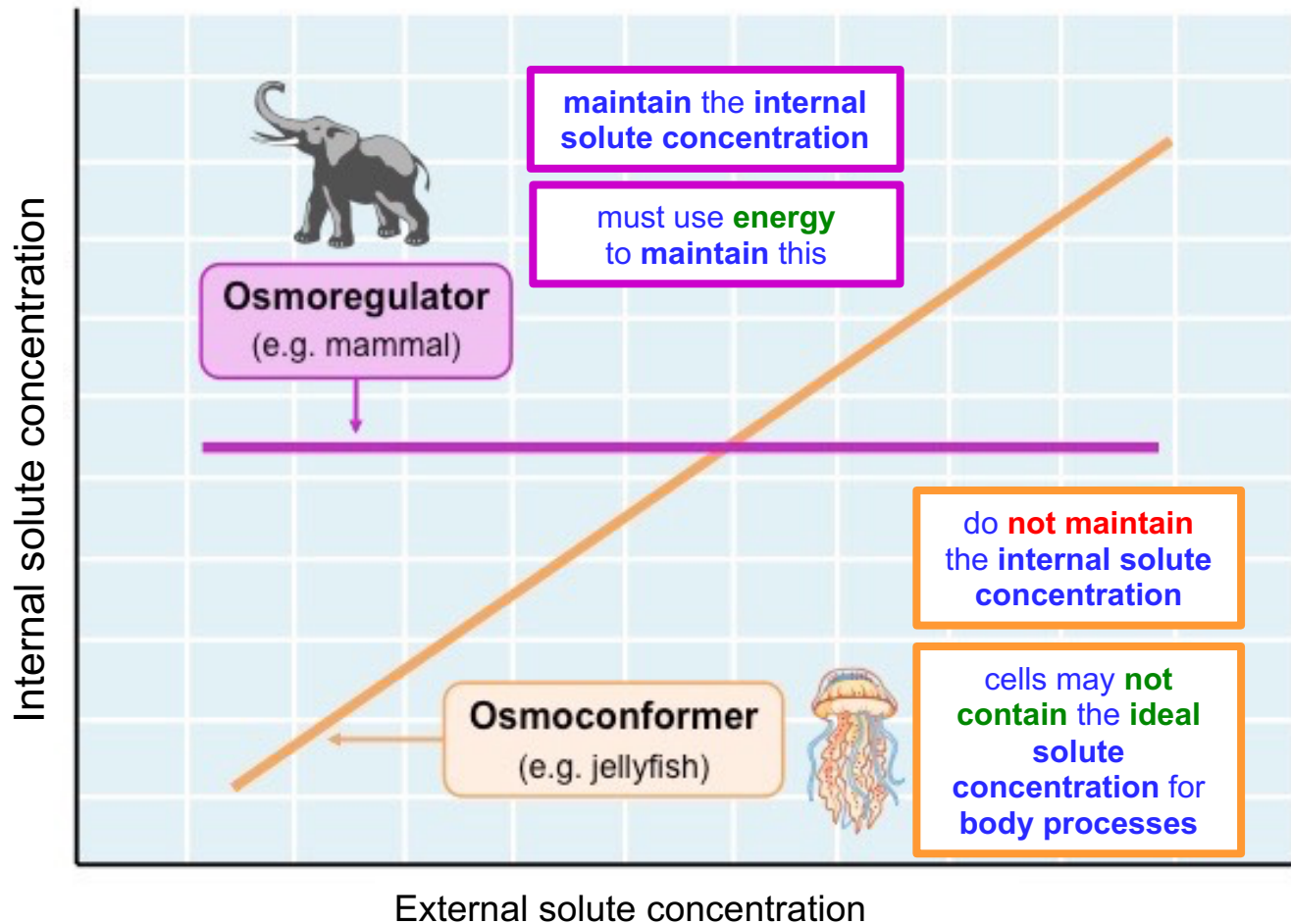
- The **removal** from the **body** of **toxic waste products** of **metabolic pathways**.

B. THREE DIFFERENT WASTE PRODUCTS THAT CAN BE EXCRETED

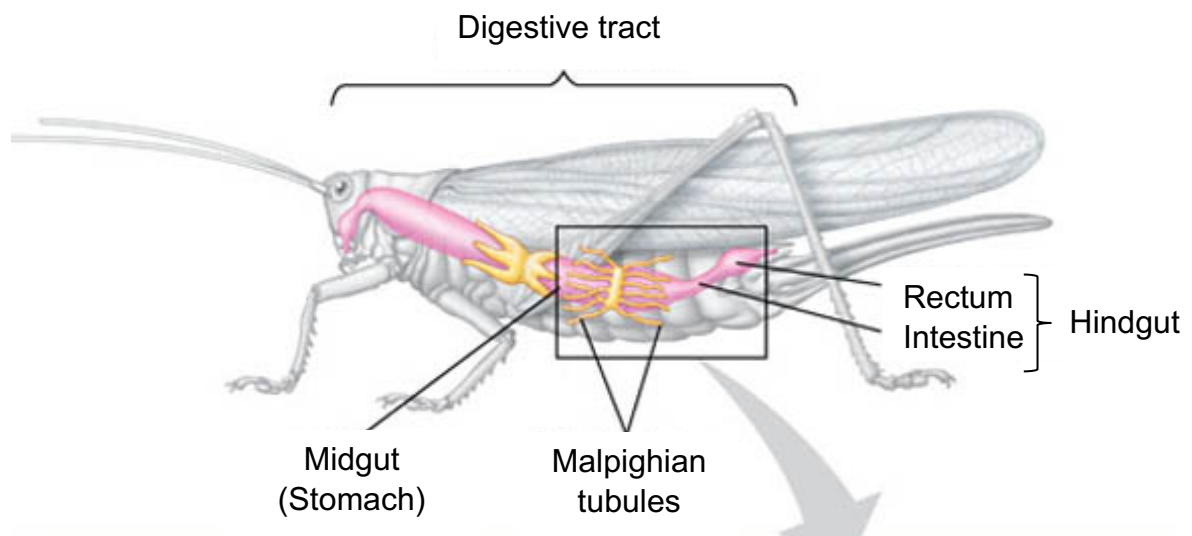
- Ammonia** – why do animals that live in **water** usually excrete this?
- Urea** – what is the **advantage** of excreting this, rather than **ammonia**?
- Uric acid** – why do animals that live in **very dry places** usually excrete this?

AMMONIA	UREA	URIC ACID
Freshwater fish Amphibian larvae	Marine mammals Terrestrial mammals Marine fish Adult amphibians	Birds Insects
TOXIC	LESS TOXIC	NON-TOXIC
Must be excreted as a very dilute solution	Can be excreted in a more concentrated solution	Can be excreted in a very concentrated solution
Large volume of water is needed to excrete it	Less water is needed to excrete it	Even less water is needed to excrete it
Only excreted by animals that live in water	Ammonia → Urea requires energy but worthwhile as animals conserve water	Ammonia → Uric acid requires more energy but worthwhile as animals conserve even more water

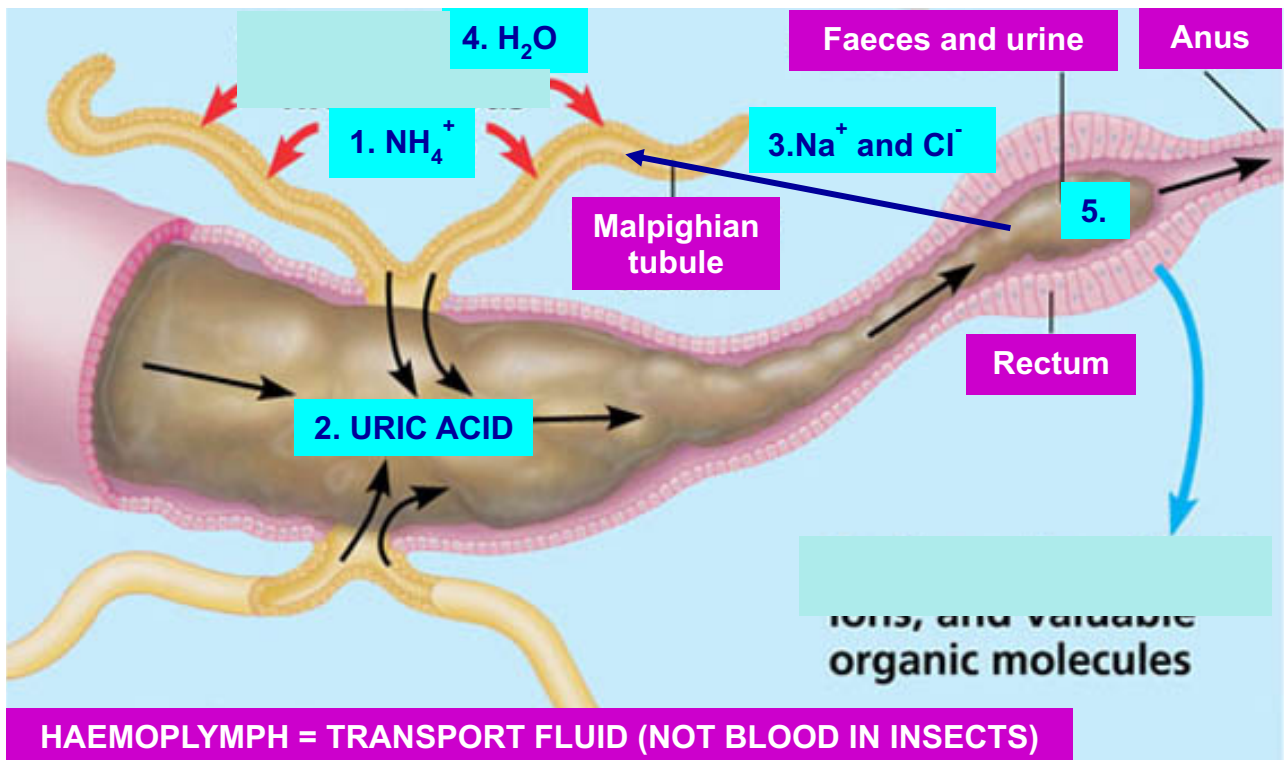
C. OSMOREGULATION (= CONTROL OF THE SOLUTE CONCENTRATION OF BLOOD)



D. INSECT STRUCTURE



E HOW INSECTS EXCRETE WASTE – THE MALPIGHIAN TUBULE SYSTEM



- **Nitrogenous waste/ammonia builds up** in the **haemolymph**;
- (And) is **absorbed** by **Malpighian tubules**;
- **Ammonia** converted to **uric acid** using **ATP**;
- (So) **nitrogenous waste** is excreted as **uric acid**;
- (As) it is **non-toxic**;
- **Uric acid** becomes a **solid/paste** so can be **excreted** with **little water**;
- **Uric acid** is **excreted** by **Malpighian tubules**;
- **Uric acid** is **egested** in **faeces**;
- (Rectum wall) **actively** transports **Na^+/Cl^-** into **Malpighian tubules**;
- (So) **water** absorbed by **osmosis** to **flush** nitrogenous waste to the **gut**;
- **Water/ions** then **reabsorbed** into **haemolymph** from **faeces**;