Homeostasis

Maintenance of internal environment in constant state despite external changes.

Fluctuations within normal range.

Types of dynamic equilibrium:

Negative feedback	Works to reduce change (e.g. body temperature control)..
Positive feedback	Works to increase change (e.g. release of oxytocin in childbirth to increase frequency of contractions).

Endothermal and ectotherms

Endotherms	Rely on metabolic processes to provide heat.
Ectotherms	Rely on surroundings to provide heat.

Thermoregulation

Ectotherms:

Behavioural adaptations	Move to shade / Sun, press bodies to heated surfaces.
Physiological adaptations	Change colour, alter heart rate.

Endotherms:

Cooling down	Sweating, vasodilation, relaxed erector pili muscles.

Thermoregulation (cont)

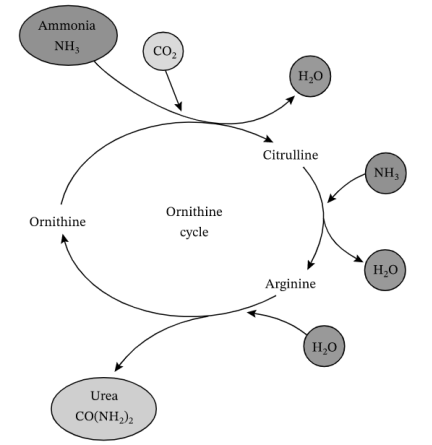
Heating up	Vasoconstriction, raising hair/feathers, shivering.

Functions of the liver

Carbohydrate metabolism	Control blood glucose, amino acid
Deamination	*Transamination* - Conversion of amino acids into another *Deamination* - Removal of amine groups from molecules because body cannot store amino acids and proteins (**ornithine cycle**).
Detoxification	Hydrogen peroxide (+ catalase) --> O_2 + H_2O

The liver has many functions (around 500 total) not listed here.

Ornithine cycle



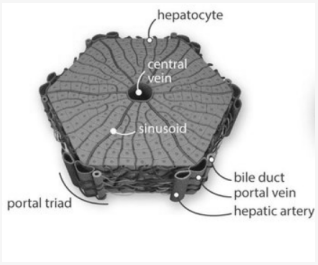
Amino acids undergo deaminating where they are spilt into amine groups and keto acids.
The amine groups are converted into a miniature and undergo the ornithine cycle as ammonia is toxic.
Urea is still toxic but less so, and is excreted by the kidney in urine.

Structure of the liver

Liver cells = hepatocytes with adaptations such as large nuclei and golgi, lots of mitochondria.

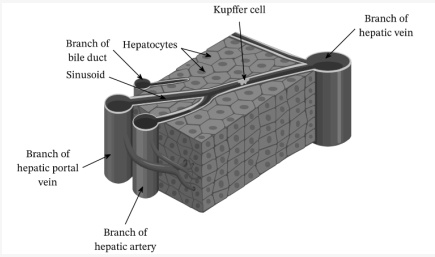
Blood from hepatic artery and portal vein mix in sinusoids to increase overall O_2 content of blood.

Lobule structure



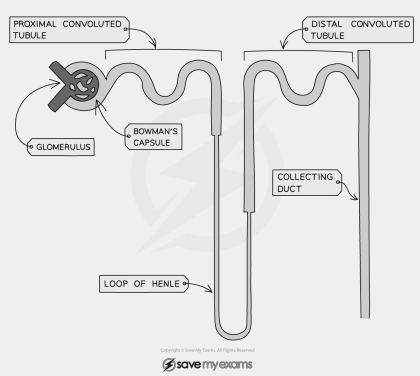
Lobules are made up of hepatocytes and have a high blood supply. The portal vein is the only vein to carry both oxygenated and deoxygenated blood.

Cross-section of lobule



Kupffer cells: macrophages for lobule.
Bile ductules: drains into the fall bladder.

The kidney



The loop of Henle is found in the medulla of the kidney.

Ultrafiltration

Happens in the *glomerulus*.

Blood comes from vein into narrower afferent arteriole which creates high pressures, so blood goes through capillary walls.

Arterioles surrounded by cells called podocytes with arm-like structures called pedicels.
These create slots to ensure molecules such as platelets that got through the epithelial and basement later do not enter the PCT (proximal convoluted tubule).

Selective reabsorption

In the *PCT*.

Glucose, amino acids, vitamins and hormones actively cotransported from filtrate back into blood.

Adaptations:

Microvili

Mitochondria - ATP for active transport.

Osmoregulation

In *loop of Henle* - ***descending limb***

Top = impermeable to water, lower part = permeable to water.

Concentration of Na and Cl increases lower down the descending limb.

Water therefore moves out into capillaries.

Filtrate is very concentrated.

- ***ascending limb***

Permeable to Na and Cl. Actively pumped out to medulla.

Impermeable to water, so more dilute.

Selective reabsorption in the DCT

Permeability varies with ADH.

Na^+ can also actively be pumped out.

Osmoregulation in the collecting duct

ADH (primary messenger) binds to receptors which trigger cAMP production.

cAMP triggered realise of aquaporin-containing vesicles.

Facilitates diffusion of water back into blood i.e. reabsorption of water.

Water potential of blood detected by hypothalamus in brain.
Low water potential leads to release of ADH which affects water permeability in collecting duct.

Kidney summary