WJEC (England) Biology AS-Level

2.4: Adaptations to Nutrition

Notes

Multicellular organisms have different feeding behaviours:

- **Autotrophic** - organisms which carbon dioxide and water (inorganic molecules) to synthesise organic compounds.
  - Photoautotrophic - organisms which obtain their nutrition through photosynthesis.
  - Chemoautotrophic - organisms which obtain their nutrition through inorganic molecules, such as sulphur.
- **Heterotrophic** - organisms which feed on organic compounds produced by other organisms.
  - **Saprotrophic**/saprobiotic - organisms which secrete enzymes, externally digest food substances and then absorb the products of digestion into the organism e.g. fungi.
  - **Holozoic** - organisms which internally digest food substances e.g. animals.
  - **Parasitic** - lives on or in a host.

The digestive systems of multicellular organisms are adapted for nutrition in different ways:

- Simple, **undifferentiated sac-like gut** e.g. ***Hydra***.
- **Tube guts** with different openings for ingestion and egestion and specialised regions for the digestion of different food substances.

Unicellular organisms e.g. ***Amoeba*** absorb food particles and digestion is carried out **intracellularly**.

Digestion of different foods requires **different enzymes** (e.g. protease, lipase) and **different conditions** (e.g. different pH, as different enzymes have different optimum pHs).

The **human gut** is adapted to an **omnivorous** diet, which includes both plant and animal materials:

- Amylase is present in the saliva of (most) humans to digest carbohydrates - this is a characteristic usually found in herbivores
- The gut is long (like herbivores)
- The gut lacks fermentation vents (like carnivores)

The first section of the small intestine is called the **duodenum**. It is where proteins and lipids are broken down, and contains **Brunner's glands**. Brunner's glands produce mucus which protects the duodenum and maintains an alkaline pH. This is optimal for lipase and protease activity.

The last section of the small intestine is called the **ileum**. There aren't any Brunner's glands in the ileum. All sections of the small intestine have **folded walls and villi** to increase surface area.

Herbivore guts and dentition (arrangement and condition of the teeth) are also adapted to their entirely **plant-based** diet:

- Strong, flat molars for grinding leaves
- Small or non-existent canines
- Teeth grow continuously to help with grinding down food
- Longer gut

An example of this are **ruminants**, which are mammals who digest food by fermentation in their stomachs prior to digestion via microbe action. This is necessary because of a high-cellulose diet - cellulose is difficult to digest. Their stomachs have four areas - the rumen, reticulum, omasum and abomasum. In the **rumen and reticulum**, food is digested via microbe action. Food is then regurgitated, where it mixes with salvia and particles break down, and received by the **omasum**, where fatty acids are digested. The **abomasum** is the 'true' stomach where further digestion occurs via stomach acid and enzymes.

Carnivore guts and dentition are also adapted to their entirely **meat** diet:

- Large canines
- Much smaller, less bridged molars
- Eye sockets located to best catch prey (on the side for ambush predators, on the front for persistence predators)
- Much shorter gut
- More acidic stomach
- No amylase in saliva

Parasites - highly specialised organisms which obtain their nutrition at the expense of the **host species**. For example, tapeworms (***Taenia spp.***) live in small intestines and feed off the food the host eats. In addition, sucking lice (***Pediculus spp.***) live on fibres (e.g. of hair, fur, or clothing) and feed off their host's blood.