ANIMAL NUTRITION

Lesson Description

In this lesson, we:

- Look at nutrition in various animals
  - Herbivores, Carnivores and Omnivores
- Study the structure of the human digestive system
- Look at the two different types of digestion
  - Mechanical
  - Chemical

Key Concepts

Nutrition in Animals

- Nutrition is defined as the sum of the following processes – ingestion, digestion, absorption, assimilation and egestion.
- Some definitions that you need to know:
  - Ingestion is the process where food is taken in
  - Digestion is the process where large molecules are broken down into smaller molecules either mechanically or chemically.
  - Absorption is the process where the molecules move through the intestinal walls (small intestine) into the blood vessels.
  - Assimilation is the process where nutrients are moved into and used by the cell.
  - Egestion is the process whereby unused nutrients are eliminated from the digestive system.

- Human nutrition is a well studied subject. In Life Orientation and Naturals Sciences you would have discussed healthy diets and the correct nutrition for humans. Below is a reminder of human nutrition – a food pyramid.

![Food Pyramid](image)

*Fig. 5.1 A food pyramid of recommended daily servings*

*(Solutions for all Life Sciences, Grade 11, Macmillan, p145)*
Humans use carbohydrates for energy, proteins for amino acids and fats for protecting vital internal organs as well as acting as a reserve energy source.

- The important minerals we need are calcium, phosphorus, iodine and iron.

- Food is produced by plants (autotrophs) through the process of photosynthesis as we have learned in the last two weeks.

- **Herbivores** are mammals that consume plant material. Their dentition and digestive tract have adapted to consuming large amounts of plant material.

  ![Dental formula for sheep](image)

  *(Solutions for all Life Sciences, Grade 11, Macmillan, p146)*

  The dental formula for sheep is as follows:

  $\begin{align*}
  &0.0.3.3 \\
  &4.0.3.3
  \end{align*}$

  *(Remember that a dental formula only shows the teeth for half a jaw)*

- This formula shows that the sheep has 8 incisors on the lower jaw which meet the horny pad of the upper jaw. There is a large gap or diastema between the incisors and the premolars. There are 6 premolars and 6 molars.

- The herbivores must consume a large amount of plant material to gather enough energy and nutrients. This is because the carbohydrates in the plant are protected by cellulose which the digestive system has difficulty breaking down. There are enzymes and bacteria in the digestive system that break down the cellulose allowing access to the carbohydrates.

- **Carnivores** are meat eating mammals that have to hunt, kill and tear apart their prey to eat.

  ![Dental formula for carnivore](image)

  *(Solutions for all Life Sciences, Grade 11, Macmillan, p147)*
They have the following dental formula:

\[
\begin{align*}
3.1.4.3 \\
3.1.4.3
\end{align*}
\]

- The distinctive feature of carnivores is the carnassial teeth. The upper fourth molar and the lower first molar have sharp knife-like edges that slide past each other and slice through flesh.
- Carnivores are predators and they expend a large amount of energy hunting for their food. Meat is low in carbohydrate but rich in other nutrients. Meat is easier to digest than plant material so carnivores have shorter digestive systems than herbivores or omnivores.
- The size of an open jaw is fairly large in comparison to the head. The teeth are modified for grasping, tearing and chewing tough meat.
  - The canines are long and sharp and are used for the killing of prey and tearing of the flesh.
  - The molars are sharp and uneven and they are used for chewing the tough meat.
  - Finally, the carnassials teeth have knife-like serrated edges and they cut and slice the meat off the bone.
- Omnivores have digestive systems and dentition that is adapted to eating both plant and animal tissues.
- New world monkeys have slightly different dental formulæ to old world monkeys and humans. A new world monkey such as the Emperor Tamarin has the following dental formula:

\[
\begin{align*}
2.1.3.2 \\
2.1.3.2
\end{align*}
\]

- The old world monkeys and humans have the following dental formula:

\[
\begin{align*}
2.1.2.3 \\
2.1.2.3
\end{align*}
\]

(Solutions for all Life Sciences, Grade 11, Macmillan, p148)

- Because there are so many different omnivores, the dental formulas can vary slightly but each one will have the same basic pattern – incisors to cut meat, canines to grasp and tear meat and molars to crush and grind plant matter.
Structure of the Human Digestive System

- Humans eat for two reasons – energy and nutrients to keep the body healthy. Energy is consumed in the form of carbohydrates or lipids. The other nutrients absorbed contribute to the formation of proteins and enzymes as well as the general upkeep of the body e.g. calcium for bones and muscle.
- The diagram on the next page shows the digestive system or alimentary canal of a human. There are two distinct openings for ingesting (mouth) and egesting (anus) food materials.

- There are two types of digestion that the human digestive system uses:
  - Mechanical
  - Chemical

- **Mechanical digestion** starts in the mouth with the teeth chewing the food and the tongue working the food into a ball (bolus) for swallowing.
- The Biological name for chewing is mastication.
- The bolus is moved to the back of the mouth and pushed into the oesophagus where more mechanical digestion occurs in the form of peristalsis.
- Peristalsis in the process where muscles in the wall of the oesophagus contract and relax antagonistically. This means when one muscle contracts. The other muscle relaxes and so it continues alternating contracting and relaxing.
- Peristalsis also happens in the stomach and the rest of the digestive tract to push the food along.
- Another form of mechanical digestion occurs in the stomach where the stomach muscles churn the food into a liquid called chyme.
The process of chemical digestion is discussed in the next lesson.

**Questions**

**Question 1**

Below are skulls of various types of animals.

**A – SKULLS OF MAMMALS**

<table>
<thead>
<tr>
<th>SKULLS OF DIFFERENT TYPES OF MAMMALS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
</tr>
<tr>
<td>Dental formula: 0.0.2.3</td>
</tr>
<tr>
<td>D: 3.4.3.3</td>
</tr>
</tbody>
</table>

a.) In table form compare the four skulls above with respect to dentition and types of food consumed.

b.) Describe the process of mechanical digestion in the human from the moment of ingestion to egestion.