

2

Chapter

Nutrition in Animals

We'll cover the following key points:

- Holozoic Nutrition
- Digestion in Humans and Absorption of Digested Food
- Digestion in Grass-eating Animals
- Nutrition in Amoeba



Hi, I'm EeeBee

Do you Remember:

Fundamental concept in previous class.

- In class 4th we learnt
- The Digestive System

Still curious?
Talk to me by scanning the QR code.



Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of holozoic nutrition and its importance in living organisms.
- Explain the process of digestion and absorption of digested food in humans.
- Describe the unique adaptations and processes involved in digestion in grass-eating animals, such as the ruminant digestive system.
- Understand the mechanism of nutrition in amoeba, focusing on phagocytosis and intracellular digestion.

Guidelines for Teachers

The teacher can begin the chapter by explaining holozoic nutrition as a process involving ingestion, digestion, absorption, assimilation, and egestion. Use diagrams or models to illustrate the human digestive system and its functioning. Provide real-life examples, such as grass-eating animals, to explain the adaptations in their digestive systems. Demonstrate nutrition in amoeba using animations or microscopic images to make it engaging. Linking these concepts to the broader biological processes in ecosystems can make the topic relatable and informative.

NCF Curricular Goals and Competencies

This chapter addresses the following learning objectives:

- CG-1 (C 1.3): Understands the role of nutrition and digestion in sustaining life processes and energy transfer in living organisms.
- CG-3 (C 3.1): Explores adaptations in digestive systems across different organisms, fostering curiosity and inquiry.
- CG-6 (C 6.3 and C 6.4): Investigates the processes of digestion and absorption in humans and other animals to develop critical thinking and scientific analysis.



Mind Map

NUTRITION IN ANIMALS

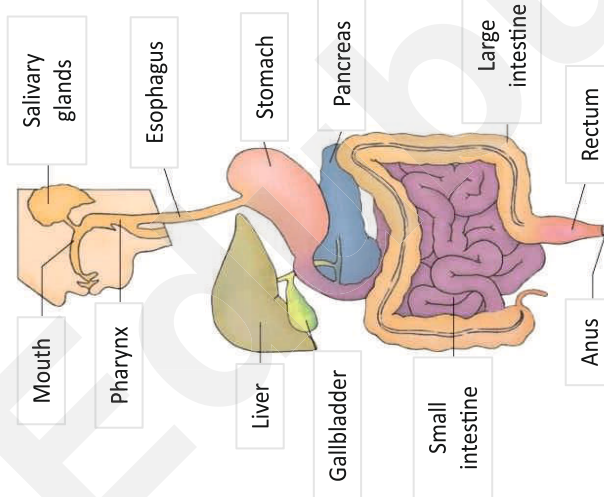
Different ways of taking food

- ❖ Scraping
- ❖ Chewing
- ❖ Siphoning
- ❖ Capturing
- ❖ Swallowing
- ❖ Sponging
- ❖ Sucking

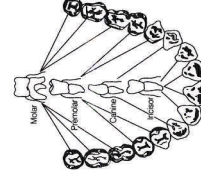
Note:- Starfish feeds on animals covered by hard shells of calcium carbonate. After opening the shell, the starfish pops out its stomach through its mouth to eat the soft animal inside the shell. The stomach then goes back into the body and the food is slowly digested.



Digestion in humans

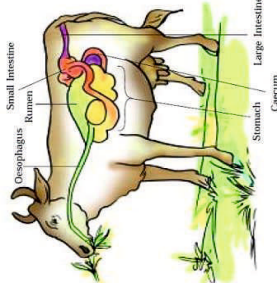


Types of teeth



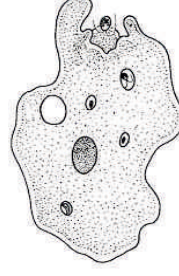
Digestion in grass eating animals

- ❖ Cows, buffaloes and other grass-eating animals chewing continuously even when they are not eating.
- ❖ They quickly swallow the grass and store it in a part of the stomach called rumen.



Feeding and digestion in Amoeba

- Amoeba is a microscopic single-celled organism found in pond water.
- It pushes out one, or more finger-like projections, called pseudopodia or false feet for movement and capture of food.
- The food becomes trapped in a food vacuole.



Introducton : All living things need food to survive. Food contains nutrients which give us energy, help in the growth and prepares the body tissues.

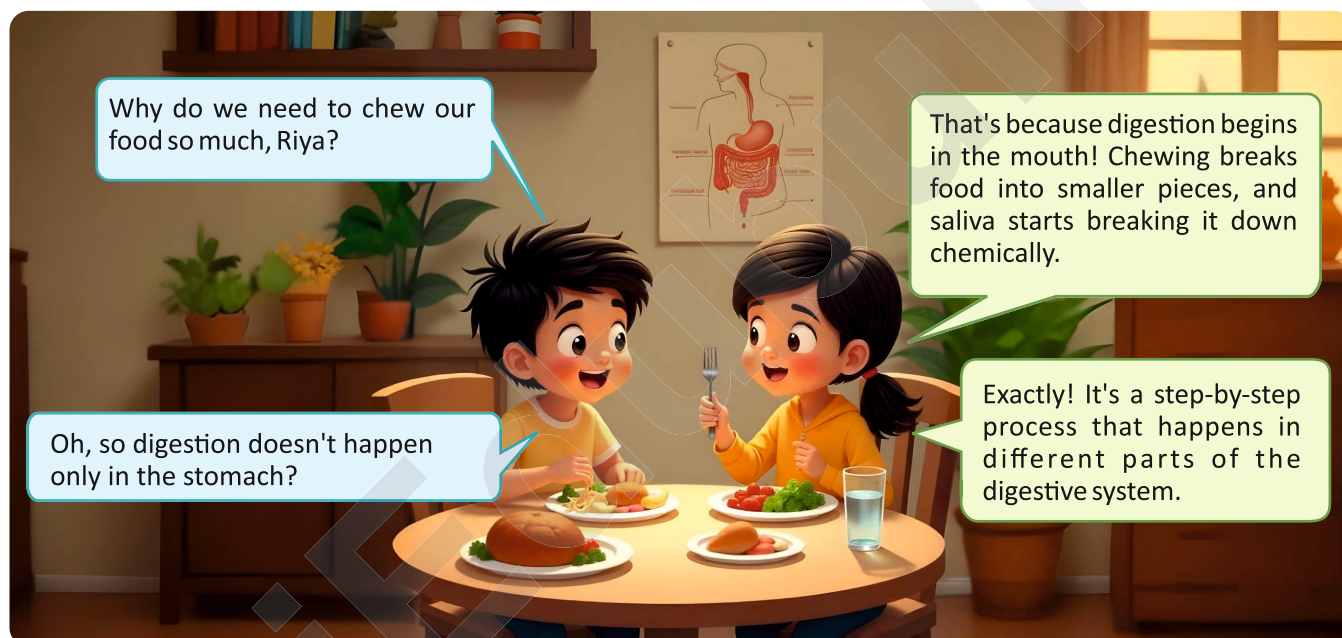
In History...

William Beaumont's Experiment (1825): William Beaumont studied the digestion process by observing the stomach of a soldier with a gastric fistula. His work laid the foundation for understanding human digestion and the role of gastric juices.

Discovery of Ruminant Digestion (19th Century): Scientists studied grass-eating animals and discovered the rumen, a specialized stomach chamber for digesting cellulose-rich food with the help of microbes.

Holozoic Nutrition

Riya and Kabir are eating lunch.

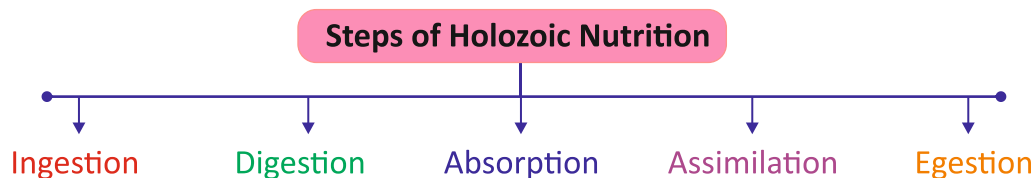


Modes of Nutrition

Plants prepare their own food by photosynthesis. Animals obtain all their food from either plants or other animals. All organisms need food to survive. According to their body structure, function and need, different animals eat different types of foods. What an organism needs to eat, how it eats food and how that food is used up in the body is together called nutrition. It can be defined as, the requirement, the mode of intake and utilisation of nutrients by an organism.

Since the food eaten by an organism to be obtained from another living organism (plant or animal), it is mixture of complex substances. It may not be useful for an organism in its complex form. Hence, after eating, food gets broken down into simple substances needed by the body of the organism.

The process of holozoic nutrition involves the following steps: Ingestion, digestion, absorption, assimilation and egestion.



Ingestion

It is a process of taking food.

Digestion

Digestion is the process of breaking down of complex insoluble organic compounds into simple soluble molecules by the action of digestive enzymes.

Absorption

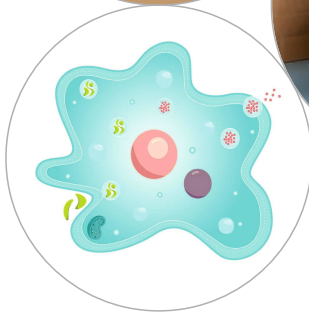
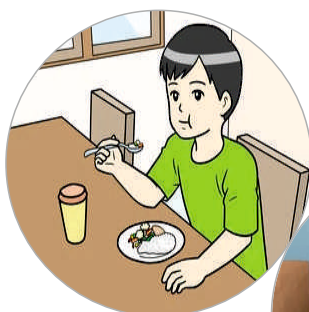
Absorption is the process by which simple molecules of digested food are absorbed through the intestinal walls and are transported to all the cells of the body through the blood stream.

Assimilation

It is the process of utilisation of absorbed nutrients by the body cells for energy and synthesis of new cells.

Egestion

It is the process of getting rid of undigested solid part of the food.



DIFFERENT WAYS OF TAKING FOOD

Different organisms have different ways of eating food.

- Infants of humans and many other animals feed upon their mother's milk by sucking them.
- Snakes swallow the animals or their prey without chewing them.
- A frog captures a prey with its sticky tongue.
- Human beings use their hands to put food into their mouth and swallow the food after chewing.
- A humming bird sucks nectar of plants.
- Some aquatic animals filter their tiny particles floating nearby and feed upon them.
- Spiders weave sticky web in which small insects get stuck.
- An earthworm uses its muscular pharynx to swallow its food.
- Amoeba, a unicellular animal, engulfs tiny particles of food by using pseudopodia. Amoeba surrounds the food by pseudopodia and then makes a food vacuole to engulf the food.

Let's recall what we know

Apply Concept in Context

Apply

How does the structure of the digestive system relate to the type of food an animal consumes?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking

Examine Further

Analyse

Research the role of enzymes in the digestion of different types of food (e.g., carbohydrates, proteins, fats).

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

Identify animals in your surroundings with unique digestive adaptations. How do these adaptations help them?

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

List ten animals from your surroundings or studies and categorize them based on their digestive adaptations (e.g., ruminants, carnivores, omnivores). Present this information creatively in a table or chart with columns for animal type, diet, and digestive adaptations.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Observation

SCAN TO ACCESS



Take a Task



Watch Remedial

**Bloom's
Taxonomy**

Digestion in Humans and Absorption of Digested Food

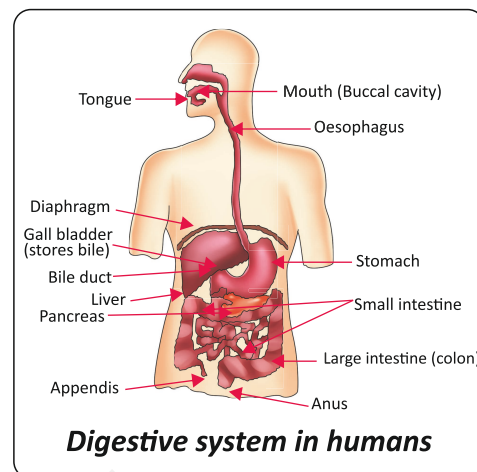
Riya and Kabir are sitting on a bench.



The digestive system of humans is well developed. It consists of the gut or alimentary canal, along with many associated digestive glands. The alimentary canal is divided into mouth, oesophagus, stomach, small intestine, large intestine and rectum.

In the mouth (Or Buccal Cavity)

The mouth leads the food into the buccal cavity or oral cavity. The buccal cavity contains teeth, tongue and salivary glands. The teeth cut the food into small pieces, chew and grind it. The salivary glands secrete a watery juice called saliva. The tongue helps in mixing the saliva with the food. Saliva is a digestive juice, which helps to digest the starch present in the food partially. The slightly digested food is swallowed by the tongue and goes down into the oesophagus (or food pipe).



The food pipe/oesophagus

Oesophagus is a tube-like structure connecting the mouth and the stomach. It is about 30 cm long. It has powerful muscles which gently push the food down to the stomach. The oesophagus contracts and relaxes in a rhythmic fashion to facilitate the forward movement of food. This movement happens in other parts of the alimentary canal as well and is known as peristalsis. No digestion takes place in oesophagus.

Activity

Ask one of your friends to open his/her mouth. Count the number of each type of teeth in the upper and lower jaw and complete the table given below:

Teeth type	Number of teeth in the lower jaw	Number of teeth in the upper jaw
Incisors		
Canines		
Premolars		
Molars		

The Stomach

Stomach is a muscular J-shaped thick walled bag. It is the widest part of the alimentary canal. One end of the stomach is connected to the oesophagus to receive food and the other end is connected to the small intestine where food is passed from the stomach. It churns the food to mix digestive juices. The food in the stomach is churned into semi solid. The churned semi-solid food is known as chyme. Gastric juices are secreted from the walls of the stomach and mixed with the food. Gastric juice contains some enzymes and hydrochloric acid. The enzymes present in the gastric juices break down proteins from the food. The hydrochloric acid kills the harmful bacteria present in the food and helps the gastric enzymes to work.

The Small Intestine

From the stomach, partially digested food transfers to the small intestine. It is about 20 feet or 7 metres long in an adult human. It is a highly coiled tube and consists of three parts: duodenum, jejunum and ileum.

The digestion of food is completed in the small intestine. Small intestine receives bile from liver and pancreatic juice from pancreas and also secretes several digestive juices of its own.

- **Bile** makes the food alkaline and helps in the digestion of fat.
- Pancreatic juice helps in the digestion of proteins and carbohydrates.
- Intestinal juice helps and complete digestion of proteins, carbohydrates and fats.
- Proteins are broken down to **amino acids**.
- Carbohydrates are broken down to simple sugars, such as glucose and fructose.
- Fats are broken into fatty acids and glycerol.

Did You Know ?

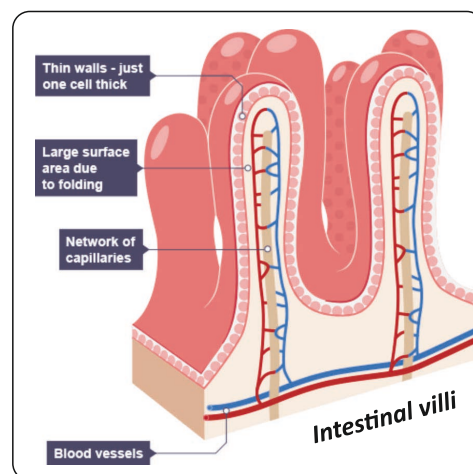
The small intestine is the longest part of the digestive system.

Absorption of Digested Food

Absorption in small intestine

The digested food is absorbed mainly in small intestine. The absorbed substances are passed into the blood vessels and transported to different parts of the body.

- The inner wall of small intestine contains numerous finger-like projections called villi.
- The villi increase surface area of small intestine to about five times for the absorption of digested food.



KEYWORDS

Bile: It is a digestive fluid produced by the liver and stored in the gallbladder, essential for breaking down fats.

Amino acids: These are the building blocks of proteins, absorbed in the small intestine. They play a crucial role in repairing tissues, enzyme production, and overall body growth.

The Large Intestine

In large intestine, excess of water from the materials is absorbed. The semi-solid residue is stored in the last part of the large intestine called rectum and finally thrown out of the body through from time to time. The throwing out of waste of digested food from rectum is known as egestion. It is also known as defecation.

Let's recall what we know

Apply Concept in Context

Apply

- Provide two examples of organs in the human digestive system responsible for nutrient absorption. How do these organs perform their function?
- How does the type of food consumed by humans influence the efficiency of digestion and nutrient absorption?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking

Examine Further

Analyse

- Research the role of the small intestine in the absorption of nutrients and explain its structural adaptations for efficient absorption.
- Compare the digestion process in humans with that of another omnivore, like a bear.

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define absorption of nutrients and explain why it is essential for the human body.
- What common foods in your diet promote better digestion and absorption? Why?

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

List ten foods and categorize them based on how they are digested and absorbed in the human body (e.g., carbohydrates, proteins, fats). Create a table or chart with columns for food type, nutrients, and site of absorption in the digestive system.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Observation, Organization

SCAN TO ACCESS



Take a Task



Watch Remedial

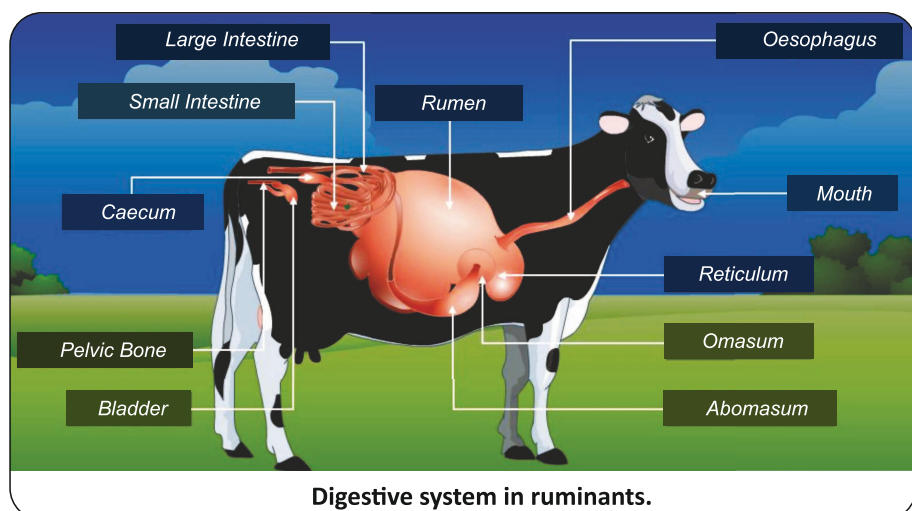
**Bloom's
Taxonomy**

Digestion in Grass-eating Animals

Riya and Karan are walking through a grassy field, observing some grazing animals.



The plant-eating animals are also called ruminants. They cannot digest cellulose which is present in all plants. The digestion in these animals takes place as follows. Their stomach is divided into four chambers— the rumen, reticulum, omasum and abomasum. First of all, half chewed food is swallowed and it then goes from the mouth to the rumen, the first chamber of the stomach. Here, the bacteria break down the cellulose. This half digested food goes to the second muscular chamber; the reticulum. From the reticulum the food is sent back to the mouth to be chewed again. This half digestion food is called cud. Chewing of the cud is known as rumination and such animals are known as ruminating animals or ruminants. Cows, goats, buffaloes, sheep, bison, etc. are good example of ruminating animals. The rechewed food is swallowed for the second time. After passing the first two chambers it enters the third chamber; the omasum. Here the food is further broken down into smaller pieces and finally enters the fourth chamber, the abomasum. Here, all enzymes act upon the food and the digestion is completed. The process of rechewing the cud to further break down plant matter and stimulate digestion is known as ruminating. The food then passes to the small intestine where it gets absorbed.



After digestion and absorption, nutrients from the food are taken to the cells in all parts of the body. The cells oxidise the food to release energy.

The undigested food then passes to the large intestine, from where it is egested through the rectum and anus.

Let's recall what we know

Apply Concept in Context

Apply

- Provide two examples of grass-eating animals that have special adaptations for digestion.
- How does the digestive system of grass-eating animals help them survive on a plant-based diet?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking

Examine Further

Analyse

- Research how the digestive systems of herbivores, like cows and goats, are adapted to process grass.
- What role do microorganisms play in the digestion process in grass-eating animals?
- How do the multi-chambered stomachs of ruminants aid in the digestion of tough plant fibers like cellulose?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define digestion in grass-eating animals and explain the importance of their multi-chambered stomachs.
- Compare the digestive system of a grass-eating animal with that of a carnivore.

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

Create a diagram of the digestive system of a cow. Label each stomach chamber and explain its function in breaking down plant material.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Observation, Organization

SCAN TO ACCESS



Take a Task



Watch Remedial

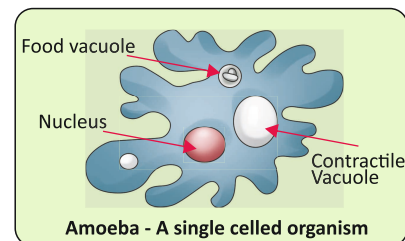
**Bloom's
Taxonomy**

Nutrition in Amoeba

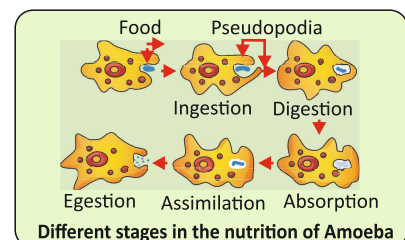
Riya and her father are observing pond water under a microscope.



Amoeba, a unicellular microorganism found in pond water, is the simplest living organism. It has a cell membrane and a round dense nucleus which controls all its functions. There are many bubble-like vacuoles in its cytoplasm which help in the digestion. Amoeba feeds on other microorganisms found in its surroundings. When it senses any food, it sends out its finger-like projections, called pseudopodia, around the food particle to engulf it.



1. **Ingestion:** Amoeba eats tiny microscopic plants and animals as food, which float on water in which it lives. When an amoeba, encounters a suitable organism, it pushes out two pseudopodia around the organism. Gradually, the tips of the pseudopodia fuse with each other. As a result, the food is engulfed with a little surrounding water to form a food vacuole inside it.



2. **Digestion:** The enzymes from the surrounding cytoplasm enter the food vacuole and break down the food into simple soluble substances.
3. **Absorption:** The digested food present in the food vacuole is absorbed directly into the cytoplasm.
4. **Assimilation:** The digested food absorbed by the cytoplasm is stored or utilized for its growth, development, multiplication and release of energy.
5. **Egestion:** The undigested food gets stored inside the vacuole. The cell membrane of the amoeba suddenly ruptures at any places and the undigested food is thrown outside the body by the vacuole.

Let's recall what we know

Apply Concept in Context

Apply

- Provide two examples of how amoeba acquires its nutrients through phagocytosis under different conditions.
- How does the mode of nutrition in amoeba relate to its habitat and the availability of food?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking

Examine Further

Analyse

- Research how amoeba's mode of nutrition (phagocytosis) differs from other microorganisms in terms of food intake and digestion.
- What are the key features of amoeba that help it in phagocytosis and digestion of food?
- How does the nutrition process in amoeba adapt to environments where food availability is uncertain?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define phagocytosis and explain how it helps amoeba in obtaining food.
- How does the amoeba interact with its environment to obtain nutrients, and how does it adapt to different conditions?

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

List ten examples of microorganisms or cells that use unique modes of nutrition, similar to amoeba, and categorize them (e.g., phagocytosis, absorption, symbiosis). Create a table or chart with columns for organism name, habitat, and mode of nutrition.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Observation, Organization

SCAN TO ACCESS



Take a Task



Watch Remedial

**Bloom's
Taxonomy**

SUMMARY



Animals, as consumers in ecosystems, rely on various modes of nutrition to obtain the energy and nutrients they need for survival. This chapter covers holozoic nutrition, digestion in humans, the digestive process in grass-eating animals, and nutrition in amoeba.

Holozoic Nutrition

Most animals, including humans, exhibit holozoic nutrition, where they ingest solid food, digest it internally, and absorb the nutrients. The process involves the intake, breakdown, and absorption of food to meet energy and growth needs.

Steps of Digestion in Humans:

- **Ingestion:** Food enters the mouth and is mechanically broken down by chewing.
- **Digestion:** In the stomach and small intestine, enzymes break down food into absorbable nutrients.
- **Absorption:** Nutrients are absorbed into the bloodstream in the small intestine.
- **Egestion:** Waste is expelled from the body through the anus.

Absorption of Digested Food

After digestion, nutrients are absorbed in the small intestine. Villi, tiny finger-like projections, increase the surface area for absorption, allowing efficient transport of nutrients (like amino acids, glucose, vitamins, and minerals) into the bloodstream.

Digestion in Grass-Eating Animals

Grass-eating animals, like cows and other herbivores, have specialized digestive systems to break down cellulose in plant materials, which is difficult to digest.

Key Steps:

- **Ingestion:** Grass is consumed and enters the rumen.
- **Fermentation:** Bacteria in the rumen ferment the cellulose, producing gases and nutrients.
- **Regurgitation:** The partially digested food (cud) is regurgitated and chewed again.
- **Digestion and Absorption:** The food moves through other stomach chambers, where enzymes further break it down and nutrients are absorbed in the small intestine.

Nutrition in Amoeba

Amoeba, a single-celled organism, uses phagocytosis to obtain nutrients. It engulfs food particles using pseudopodia, forms a food vacuole, and digests the food with enzymes. The nutrients are absorbed into the cytoplasm, where the amoeba uses them for energy.

EeeBee: Your AI Buddy

Explore! **Nutrition in Animals** with EeeBee AI Buddy.

Hi Friend! Use prompts to ask me questions about the chapter we just finished! eeee, lets go!

Start by Scanning this QR Code:





EXERCISE

That turn curiosity into confidence—let's begin!



Gap Analyzer™
Take a Test

A. Choose the correct answer.

- Which of the following best describes holozoic nutrition?
(a) Absorbing from environment ☐ (b) Ingesting and digesting food ☐
(c) Absorbing through roots ☐ (d) Photosynthesis ☐
- In humans, where does the majority of nutrient absorption occur?
(a) Stomach ☐ (b) Small intestine ☐
(c) Large intestine ☐ (d) Mouth ☐
- What is the role of the villi in the small intestine?
(a) Increase absorption area ☐ (b) Break down food ☐
(c) Produce enzymes ☐ (d) Transport nutrients ☐
- Which of the following is true about digestion in grass-eating animals?
(a) No bacteria needed ☐ (b) Single-chambered stomach ☐
(c) Fermentation breaks down cellulose ☐ (d) Absorb nutrients from air ☐
- Which of the following organisms uses phagocytosis for nutrition?
(a) Human ☐ (b) Amoeba ☐
(c) Cow ☐ (d) Rabbit ☐

B. Fill in the blanks.

- The process of ingesting and digesting food internally is called _____ nutrition.
- In humans, food is primarily digested in the _____ and absorbed in the _____.
- Grass-eating animals rely on _____ to break down plant material.
- The _____ in the small intestine increase surface area for nutrient absorption.
- Amoeba uses _____ to engulf food and obtain nutrients.

C. Write True or False.

- Holozoic nutrition involves absorbing nutrients directly from the environment. _____
- Digestion in humans occurs only in the stomach. _____
- Villi in the small intestine help in the absorption of nutrients. _____
- Amoeba digests food using enzymes in the food vacuole. _____
- Grass-eating animals have a simple digestive system for breaking down plant fibers. _____

D. Define the following terms.

1. Holozoic nutrition
2. Phagocytosis
3. Absorption in humans
4. Digestion in grass-eating animals
5. Villi

E. Match the columns.

Column A

1. Holozoic nutrition
2. Digestion in humans
3. Amoeba
4. Grass-eating animals
5. Villi

Column B

- (a) Process of engulfing food by pseudopodia
- (b) Multi-chambered stomach to break down cellulose
- (c) Absorption of nutrients in small intestine
- (d) Ingests and digests food internally
- (e) Finger-like projections in the small intestine

F. Give reasons for the following statements.

1. Holozoic nutrition is essential for most animals.
2. Villi are important in the absorption of nutrients in humans.
3. Amoeba uses phagocytosis to obtain nutrients.
4. Grass-eating animals have specialized digestive systems to digest tough plant fibers.
5. Digestion in grass-eating animals requires fermentation by bacteria.

G. Answer in brief.

1. What is holozoic nutrition?
2. How does digestion in humans occur, and where is most of the absorption done?
3. How does phagocytosis help amoeba obtain nutrients?
4. Why do grass-eating animals have a multi-chambered stomach?
5. How do nutrients get absorbed in the small intestine of humans?

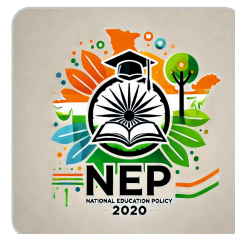
H. Answer in detail.

1. Explain the process of holozoic nutrition with examples.
2. Describe the process of digestion in humans, including all major organs involved.
3. Explain how amoeba uses phagocytosis to obtain and digest food.
4. Discuss the adaptations of grass-eating animals to their digestive system for breaking down plant material.
5. How does the absorption of digested food occur in the small intestine of humans?



**Study What You Love!**

You can now choose subjects across streams. Like Math and Music together? It's possible under NEP 2020!



Skill-based Activity

**Curious Minds at Work****STEM**

Observe the feeding process of an animal, such as a cow or amoeba. Write a question about how its digestive system adapts to the food it consumes. Using the scientific method, describe the steps you would take to answer your question.

Skills Covered: Critical and logical thinking, Brainstorming, Analytical thinking, Problem-solving, Curiosity, Observation, Decision-making skills

Wonders of Digestion**Art**

Create a detailed sketch showing the digestive system of a grass-eating animal or the process of phagocytosis in amoeba. Write a description explaining how food is processed in the digestive system. Present your work to the class.

Skills Covered: Creativity, Critical and logical thinking, Applicative thinking

Digestive System in Action**Group Activity**

In groups, create a chart comparing the digestive systems of different animals (e.g., humans, cows, amoeba). Present your findings, highlighting similarities and differences.

Skills Covered: Critical and logical thinking, Brainstorming, Teamwork, Communication, Applicative thinking, Decision-making skills

Technology in Focus**Case to Investigate**

Research how digestive processes in animals are applied in technology, such as in improving livestock digestion or designing better waste treatment systems. Write a short report on how these processes benefit agriculture or environmental management.

Skills Covered: Critical and logical thinking, Brainstorming, Research, Applicative thinking

Sustainable Nutrition

Aligning with SDGs

Research a program or initiative that focuses on sustainable animal nutrition (e.g., improving grass-fed livestock digestion). Highlight its key features and how it aligns with sustainable development goals. Present your findings to the class.

Aligned with: SDG 2 – Zero Hunger, SDG 12 – Responsible Consumption and Production

Skills Covered: Critical and logical thinking, Brainstorming, Research, Problem-solving, Ethics

Mapping Digestion

Integrated Learning

Using the Internet, create a map showing regions where different animals (e.g., grass-eating or carnivorous) have adapted digestive systems. Explain how these adaptations help them survive in their specific environments.

Integrated Learning: Geography and Biology

Skills Covered: Critical and logical thinking, Brainstorming, Analytical thinking, Applicative thinking