34.E: Animal Nutrition and the Digestive System (Exercises)

34.1: Digestive Systems

Animals obtain their nutrition from the consumption of other organisms. Depending on their diet, animals can be classified into the following categories: plant eaters (herbivores), meat eaters (carnivores), and those that eat both plants and animals (omnivores). The nutrients and macromolecules present in food are not immediately accessible to the cells. There are processes that modify food within the animal body to make the nutrients and organic molecules needed for cellular function.

Review Questions

Which of the following is a pseudo-ruminant?

1. cow
2. pig
3. crow
4. horse

D

Which of the following statements is untrue?

1. Roughage takes a long time to digest.
2. Birds eat large quantities at one time so that they can fly long distances.
3. Cows do not have upper teeth.
4. In pseudo-ruminants, roughage is digested in the cecum.

B

The acidic nature of chyme is neutralized by ________.

1. potassium hydroxide
2. sodium hydroxide
3. bicarbonates
4. vinegar

C

The digestive juices from the liver are delivered to the ________.

1. stomach
2. liver
3. duodenum
4. colon

C

Free Response

How does the polygastric digestive system aid in digesting roughage?

Animals with a polygastric digestive system have a multi-chambered stomach. The four compartments of the stomach are called the rumen, reticulum, omasum, and abomasum. These chambers contain many microbes that break down the cellulose and ferment the ingested food. The abomasum is the “true” stomach and is the equivalent of a monogastric stomach chamber where gastric juices are secreted. The four-compartment gastric chamber provides larger space and the microbial support necessary for ruminants to digest plant material.

How do birds digest their food in the absence of teeth?

Birds have a stomach chamber called a gizzard. Here, the food is stored, soaked, and ground into finer particles, often using pebbles. Once this process is complete, the digestive juices take over in the proventriculus and continue the digestive process.

What is the role of the accessory organs in digestion?

Accessory organs play an important role in producing and delivering digestive juices to the intestine during digestion and absorption. Specifically, the salivary glands, liver, pancreas, and gallbladder play important roles. Malfunction of any of these organs can lead to disease states.

Explain how the villi and microvilli aid in absorption.
The villi and microvilli are folds on the surface of the small intestine. These folds increase the surface area of the intestine and provide more area for the absorption of nutrients.

### 34.2: Nutrition and Energy Production

Given the diversity of animal life on our planet, it is not surprising that the animal diet would also vary substantially. The animal diet is the source of materials needed for building DNA and other complex molecules needed for growth, maintenance, and reproduction; collectively these processes are called biosynthesis. The diet is also the source of materials for ATP production in the cells. The diet must be balanced to provide the minerals and vitamins that are required for cellular function.

### Review Questions

Which of the following statements is not true?

1. Essential nutrients can be synthesized by the body.
2. Vitamins are required in small quantities for bodily function.
3. Some amino acids can be synthesized by the body, while others need to be obtained from diet.

A

Which of the following is a water-soluble vitamin?

1. vitamin A
2. vitamin E
3. vitamin K
4. vitamin C

D

What is the primary fuel for the body?

1. carbohydrates
2. lipids
3. protein
4. glycogen

A

Excess glucose is stored as ________.

1. fat
2. glucagon
3. glycogen
4. it is not stored in the body

---

**Free Response**

**What are essential nutrients?**

Essential nutrients are those nutrients that must be obtained from the diet because they cannot be produced by the body. Vitamins and minerals are examples of essential nutrients.

**What is the role of minerals in maintaining good health?**

Minerals—such as potassium, sodium, and calcium—are required for the functioning of many cellular processes, including muscle contraction and nerve conduction. While minerals are required in trace amounts, not having minerals in the diet can be potentially harmful.

**Discuss why obesity is a growing epidemic.**

In the United States, obesity, particularly childhood obesity, is a growing concern. Some of the contributors to this situation include sedentary lifestyles and consuming more processed foods and less fruits and vegetables. As a result, even young children who are obese can face health concerns.

There are several nations where malnourishment is a common occurrence. What may be some of the health challenges posed by malnutrition?

Malnutrition, often in the form of not getting enough calories or not enough of the essential nutrients, can have severe consequences. Many malnourished children have vision and dental problems, and over the years may develop many serious health problems.

---

**34.3: Digestive System Processes**

Obtaining nutrition and energy from food is a multi-step process. For true animals, the first step is ingestion, the act of taking in food. This is followed by digestion, absorption, and elimination. In the following sections, each of these steps will be discussed in detail.

---

**Review Questions**

Where does the majority of protein digestion take place?

1. stomach
2. duodenum
3. mouth
4. jejunum

A

Lipases are enzymes that break down ________.

1. disaccharides
2. lipids
3. proteins
4. cellulose

B

Free Response

Explain why some dietary lipid is a necessary part of a balanced diet.

Lipids add flavor to food and promote a sense of satiety or fullness. Fatty foods are sources of high energy; one gram of lipid contains nine calories. Lipids are also required in the diet to aid the absorption of lipid-soluble vitamins and for the production of lipid-soluble hormones.

34.4: Digestive System Regulation

The brain is the control center for the sensation of hunger and satiety. The functions of the digestive system are regulated through neural and hormonal responses.

Review Questions

Which hormone controls the release of bile from the gallbladder

1. pepsin
2. amylase
3. CCK
4. gastrin

C

Which hormone stops acid secretion in the stomach?

1. gastrin
2. somatostatin
3. gastric inhibitory peptide
4. CCK

B
Free Response

Describe how hormones regulate digestion.

Hormones control the different digestive enzymes that are secreted in the stomach and the intestine during the process of digestion and absorption. For example, the hormone gastrin stimulates stomach acid secretion in response to food intake. The hormone somatostatin stops the release of stomach acid.

Describe one or more scenarios where loss of hormonal regulation of digestion can lead to diseases.

There are many cases where loss of hormonal regulation can lead to illnesses. For example, the bilirubin produced by the breakdown of red blood cells is converted to bile by the liver. When there is malfunction of this process, there is excess bilirubin in the blood and bile levels are low. As a result, the body struggles with dealing with fatty food. This is why a patient suffering from jaundice is asked to eat a diet with almost zero fat.