



تَوِير

BIOLOGY

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وَقُلْ رَبِّ زِدْنِي عِلْمًا



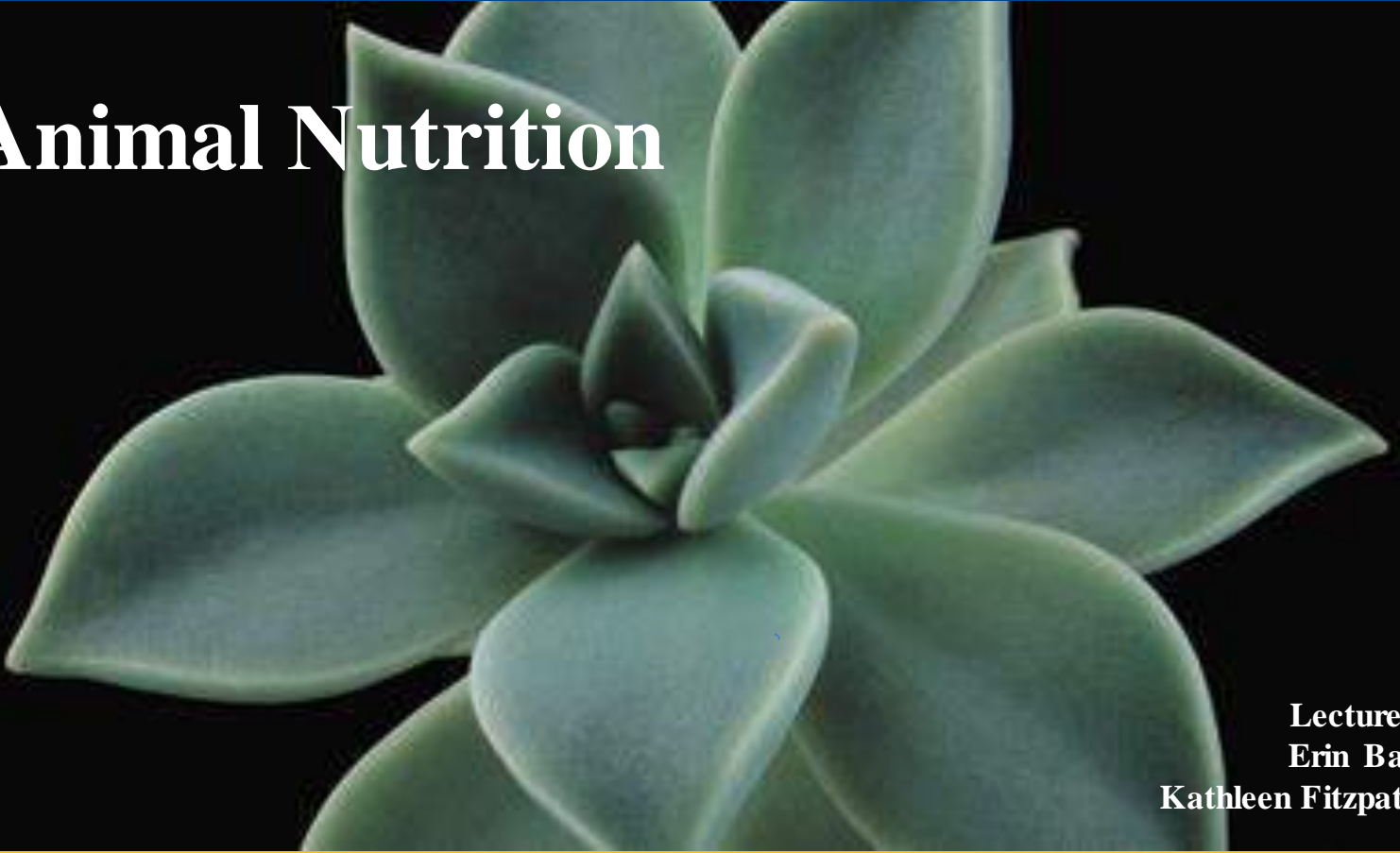
LECTURE PRESENTATIONS

For **CAMPBELL BIOLOGY, NINTH EDITION**

Jane B. Reece, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Robert B. Jackson

Chapter 41

Animal Nutrition



**Lectures by
Erin Barley
Kathleen Fitzpatrick**

Overview: The Need to Feed

- Food is taken in, taken apart, and taken up in the process of animal **nutrition** ^{تعريفه}
- In general, animals fall into three categories: ^{تصنيف}
 - 1) – **Herbivores** ^{أكل الأعشاب} eat mainly plants and algae
 - 2) – **Carnivores** ^{أكلات اللحوم} eat other animals
 - 3) – **Omnivores** ^{خليل بين اللحوم والأعشاب} regularly consume animals as well as plants or algae
- Most animals are also opportunistic feeders

• Most animals are also opportunistic feeders: eating food outside their standard diet. Deer are herbivores but occasionally eat insects.

يأخذ إلى نعمة تغذية ليس نعمة ولكن للضرورة؛ مثل الخزال

Figure 41.1



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Video: Lobster Mouth Parts



Video: Shark Eating a Seal

Concept 41.1: An animal's diet must supply chemical energy, organic molecules, and essential nutrients

- An animal's diet provides:
 - 1) – Chemical energy, which is converted into ATP to power cellular processes
 - 2) – Organic building blocks, such as organic carbon and organic nitrogen, to synthesize a variety of organic molecules
 - 3) – Essential nutrients, which are required by cells and must be obtained from dietary sources
→ that we need it in our body but we can't synthesize, so we can get it in to diet

اسْتَغْفِرُ اللَّهَ
الْعَظِيمَ الَّذِي لَا إِلَهَ
إِلَّا هُوَ
الْحَيُّ الْقَيُّومُ وَأَتُوبُ إِلَيْهِ

Essential Nutrients

• There are four classes of essential nutrients:

- 1) Essential amino acids
- 2) Essential fatty acids
- 3) Vitamins
- 4) Minerals

- Essential nutrients have key functions in cells, including serving as substrates of enzymes, as coenzymes, and as cofactors in biosynthetic reactions (Figure 41.2).
- Needs for particular nutrients vary among species. For instance, some animals (including humans) must get ascorbic acid (vitamin C) from their diet, whereas most animals can synthesize it from other nutrients.

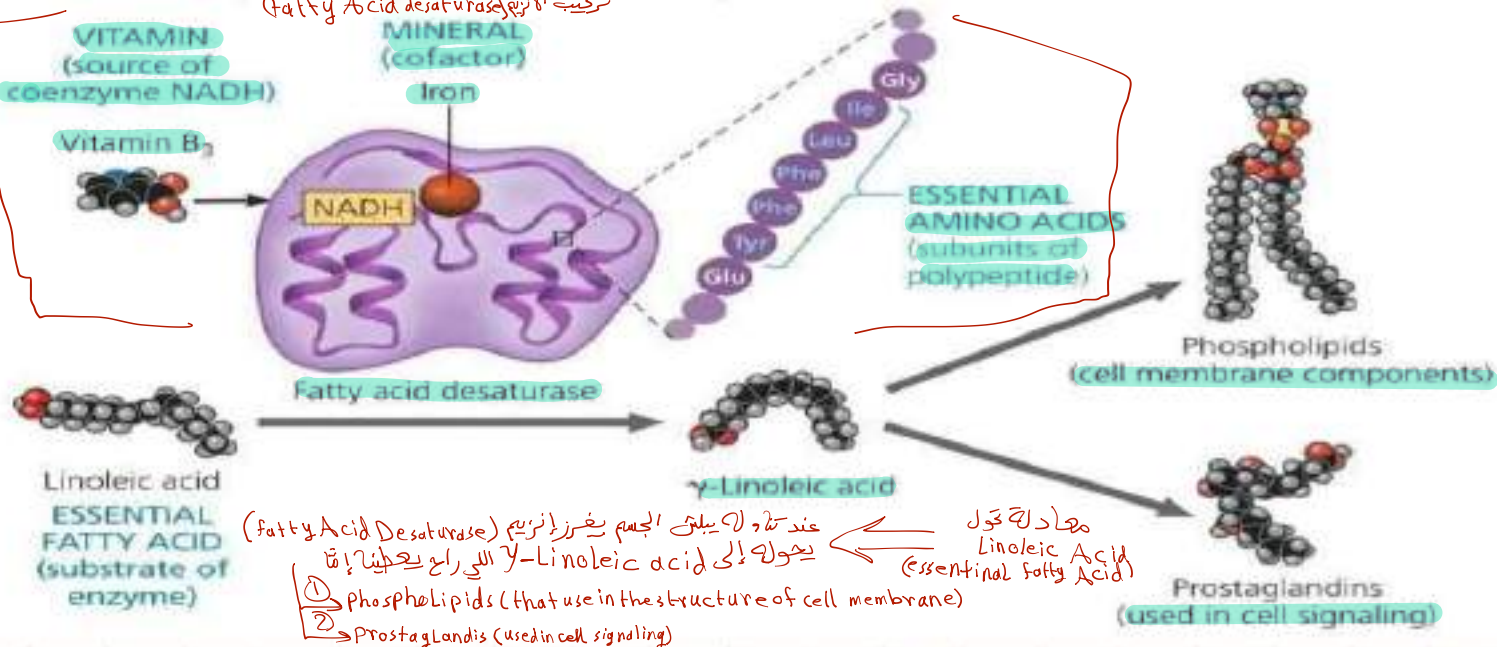
مع العلم أن معظم الحيوانات قادرة على تصنيعه

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هذا المثال يتلخص أن ربح مجموعة من Essential nutrients

▼ **Figure 41.2 Roles of essential nutrients.** This example of a biosynthetic reaction illustrates some common functions for essential nutrients. The conversion of linoleic acid to γ -linoleic acid by the enzyme fatty acid desaturase involves all four classes of essential nutrients, as labeled in blue. Note that almost all enzymes and other proteins in animals contain some essential amino acids, as indicated in the partial sequence shown for fatty acid desaturase.

تركيب Fatty Acid desaturase



Essential Amino Acids

- Animals require 20 amino acids and can synthesize about half from molecules in their diet
- The remaining amino acids, the **essential amino acids**, must be obtained from food in preassembled form
- Meat, eggs, and cheese provide all the essential amino acids and are thus "complete" proteins

in Adult 8
in infant 9
في الجنين الرضغ

The remaining amino acids, the essential amino acids, must be obtained from food in preassembled form 8 in adults: isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. and 9 in infants, Histidine

ال 8 التي فوق Histidine

* عند ما يكبر الطفل يصبح قادراً على تصنيع ال-Histidine
* أما في الجنين الأميني ليست حفظ (و لكن للإحتياط في معرفة الحوض الأميني الذي لا يستطيع تصنيعه Histidine)

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Individuals who eat only plant proteins need to eat specific plant combinations to get all the essential amino acids (corn and legumes for example) (in complete proteins)

Some animals have adaptations that help them through periods when their bodies demand extraordinary amounts of protein. E.g. Penguins,

• Muscle protein provides a source of a.a's for making new proteins when feathers are replaced.

(هو عبارة عن بروتين كبير)

(وهي عملية متعبة الحيوان وتعتبر عملية استثنائية)

* مثل البطريق يبدأ بغير الريش يحتاج إلى كميات كبيرة من البروتين ولا يستطيع الحصول عليها من خلال الطعام فقط ، فيلجأ إلى البروتين الموجود في العضلات لتحويل البروتين الذي يحتاجه ليغير ريشه ويسعدى هذى الحالة يرجع إلى وفرة البروتين الطبيعي

- Most plant proteins are incomplete in amino acid ^{تكوين} composition
- Individuals who eat only plant proteins need to eat specific plant combinations to get all the essential amino acids
 لا يوجد نبات يحتوي على كل مشتقات الحيوانات
 الحينية بالبروتين لذلك يحتاج إلى أن يأكل أنواع مختلفة من
 النباتات للحصول على جميع البروتينات الأساسية
- Some animals have adaptations that help them through periods when their bodies demand extraordinary amounts of protein

Figure 41.2



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Essential Fatty Acids

- Animals can synthesize most of the fatty acids they need
- The **essential fatty acids** must be obtained from the diet and include certain **unsaturated fatty acids** (i.e., fatty acids with one or more double bonds)
- Deficiencies in fatty acids are rare

- The essential fatty acids must be obtained from the diet and include certain unsaturated fatty acids (i.e., fatty acids with one or more double bonds). Humans require linoleic acid to make membrane phospholipids.
 - Deficiencies in fatty acids are rare
 - Animals require fatty acids to synthesize a variety of cellular components, including membrane phospholipids, signaling molecules, and storage fats.



Vitamins

- **Vitamins** are organic molecules required in the diet in small amounts (0.01 - 100 mg per day)
- * Thirteen vitamins are essential for humans
- Vitamins are grouped into two categories: fat-soluble and water-soluble

Vitamins are organic molecules required in the diet in small amounts (0.01-100 mg per day, depending on the vitamin).

Table 41.1

Vitamin	Major Dietary Sources	Major Functions in the Body	Symptoms of Deficiency
Water-Soluble Vitamins يذوب بالماء			
B₁ (thiamine)	Pork, legumes, peanuts, whole grains	Coenzyme used in removing CO ₂ from organic compounds	Beriberi (tingling, poor coordination, reduced heart function)
B₂ (riboflavin)	Dairy products, meats, enriched grains, vegetables	Component of coenzymes FAD and FMN	Skin lesions, such as cracks at corners of mouth
B₃ (niacin)	Nuts, meats, grains	Component of coenzymes NAD ⁺ and NADP ⁺	Skin and gastrointestinal lesions, delusions, confusion
B₅ (pantothenic acid)	Meats, dairy products, whole grains, fruits, vegetables	Component of coenzyme A	Fatigue, numbness, tingling of hands and feet
B₆ (pyridoxine)	Meats, vegetables, whole grains	Coenzyme used in amino acid metabolism	Irritability, convulsions, muscular twitching, anemia
B₇ (biotin)	Legumes, other vegetables, meats	Coenzyme in synthesis of fat, glycogen, and amino acids	Scaly skin inflammation, neuromuscular disorders
B₉ (folic acid)	Green vegetables, oranges, nuts, legumes, whole grains	Coenzyme in nucleic acid and amino acid metabolism	Anemia, birth defects
B₁₂ (cobalamin)	Meats, eggs, dairy products	Production of nucleic acids and red blood cells	Anemia, numbness, loss of balance
C (ascorbic acid)	Citrus fruits, broccoli, tomatoes	Used in collagen synthesis; antioxidant	Scurvy (degeneration of skin and teeth), delayed wound healing
Fat-Soluble Vitamins لا يذوب بالماء			
A (retinol)	Dark green and orange vegetables and fruits, dairy products	Component of visual pigments; maintenance of epithelial tissues	Blindness, skin disorders, impaired immunity
D	Dairy products, egg yolk	Aids in absorption and use of calcium and phosphorus	Rickets (bone deformities) in children, bone softening in adults
E (tocopherol)	Vegetable oils, nuts, seeds	Antioxidant; helps prevent damage to cell membranes	Nervous system degeneration
K (phylloquinone)	Green vegetables, tea; also made by colon bacteria	Important in blood clotting	Defective blood clotting

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* الكيمياء الكبيرة من Fat-soluble vitamins يكون خطير على الإنسان، لأنه لا يذوب في الماء، فيتراكم في الجسم

* Moderate overdoses of water soluble vitamins are probably harmless because excesses are excreted in urine.
-However, excesses of fat-soluble vitamins are deposited in body fat, so overconsumption may cause them to accumulate to toxic levels.

* المطلوب حفظه من الجدول كل ما هو محدد عليه باللون الأصفر، وبنقرة التي فوقه

Minerals

- **Minerals** are simple inorganic nutrients, usually required in small amounts
- Ingesting large amounts of some minerals can upset homeostatic balance

E.g. ingesting large amounts of salt (sodium chloride) can contribute to high blood pressure.

- Excessive iron leads to liver damage

Table 41.2

→ important

Mineral	Major Dietary Sources	Major Functions in the Body	Symptoms of Deficiency
Calcium (Ca)	Dairy products, dark green vegetables, legumes	Bone and tooth formation, blood clotting, nerve and muscle function	Impaired growth, loss of bone mass
Phosphorus (P)	Dairy products, meats, grains	Bone and tooth formation, acid-base balance, nucleotide synthesis	Weakness, loss of minerals from bone, calcium loss
Sulfur (S)	Proteins from many sources	Component of certain amino acids	Impaired growth, fatigue, swelling
Potassium (K)	Meats, dairy products, many fruits and vegetables, grains	Acid-base balance, water balance, nerve function	Muscular weakness, paralysis, nausea, heart failure
Chlorine (Cl)	Table salt	Acid-base balance, formation of gastric juice, nerve function, osmotic balance	Muscle cramps, reduced appetite
Sodium (Na)	Table salt	Acid-base balance, water balance, nerve function	Muscle cramps, reduced appetite
Magnesium (Mg)	Whole grains, green leafy vegetables	Enzyme cofactor; ATP bioenergetics	Nervous system disturbances
Iron (Fe)	Meats, eggs, legumes, whole grains, green leafy vegetables	Component of hemoglobin and of electron carriers; enzyme cofactor	Iron-deficiency anemia, weakness, impaired immunity
Fluorine (F)	Drinking water, tea, seafood	Maintenance of tooth structure	Higher frequency of tooth decay
Iodine (I)	Seafood, iodized salt	Component of thyroid hormones	Goiter (enlarged thyroid gland)

*Additional minerals required in trace amounts are chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), molybdenum (Mo), selenium (Se), and zinc (Zn). All of these minerals, as well as those in the table, are harmful when consumed in excess.

Greater than 200 mg per day required

*المطلوب من جدول حفظ المعادن والتخزين بينها وبين الفيتامينات (يعني تعطيك اهم ابي وانت تقول هذا معدن ولا فيتامين)

رحتابهم الجسم
و لكن ليس بقدر الذي فوق

Dietary Deficiencies

- Malnourishment is the long-term absence from the diet of one or more essential nutrients

* يكون بقرار شخصي و ليس بعدم القدرة على شرائه.

اللهم صل وسلم على
نبينا محمد

Deficiencies in Essential Nutrients

- ^{تشوه} Deficiencies in essential nutrients can cause deformities, disease, and death
- “Golden Rice” is an engineered strain of rice with beta-carotene, which is converted to vitamin A in the body

Like other animals, humans sometimes have diets lacking in essential nutrients. A diet with insufficient amounts of one or more essential amino acids causes protein deficiency, the most common type of malnutrition among humans.

• In children, protein deficiency may arise if their diet shifts from breast milk to foods that contain relatively little protein, such as rice. Such children, if they survive infancy, often have impaired physical and mental development.



For example, deer or other herbivores that feed on plants growing in phosphorus-deficient soil can develop fragile bones

Undernutrition (زَقْفُ، لَيْقُوسٌ)

مشكلة! قتل وبيع

- Undernutrition results when a diet does not provide enough chemical energy
- An undernourished individual will
 - Use up stored fat and carbohydrates
 - Break down its own proteins
 - Lose muscle mass
 - Suffer protein deficiency of the brain
 - Die or suffer irreversible damage

In this situation, the body first uses up stored carbohydrates and fat. It then begins breaking down its own proteins for fuel. An undernourished individual will

Inadequate nourishment in humans is most common when drought, war, or another crisis severely disrupts the food supply.

Assessing Nutritional Needs

- Genetic defects that disrupt food uptake provide information about human nutrition
 - For example, hemochromatosis causes iron buildup without excessive iron intake
- Insights into human nutrition have come from epidemiology, the study of human health and disease in populations
- Neural tube defects were found to be the result of a deficiency in folic acid in pregnant mothers

RESULTS

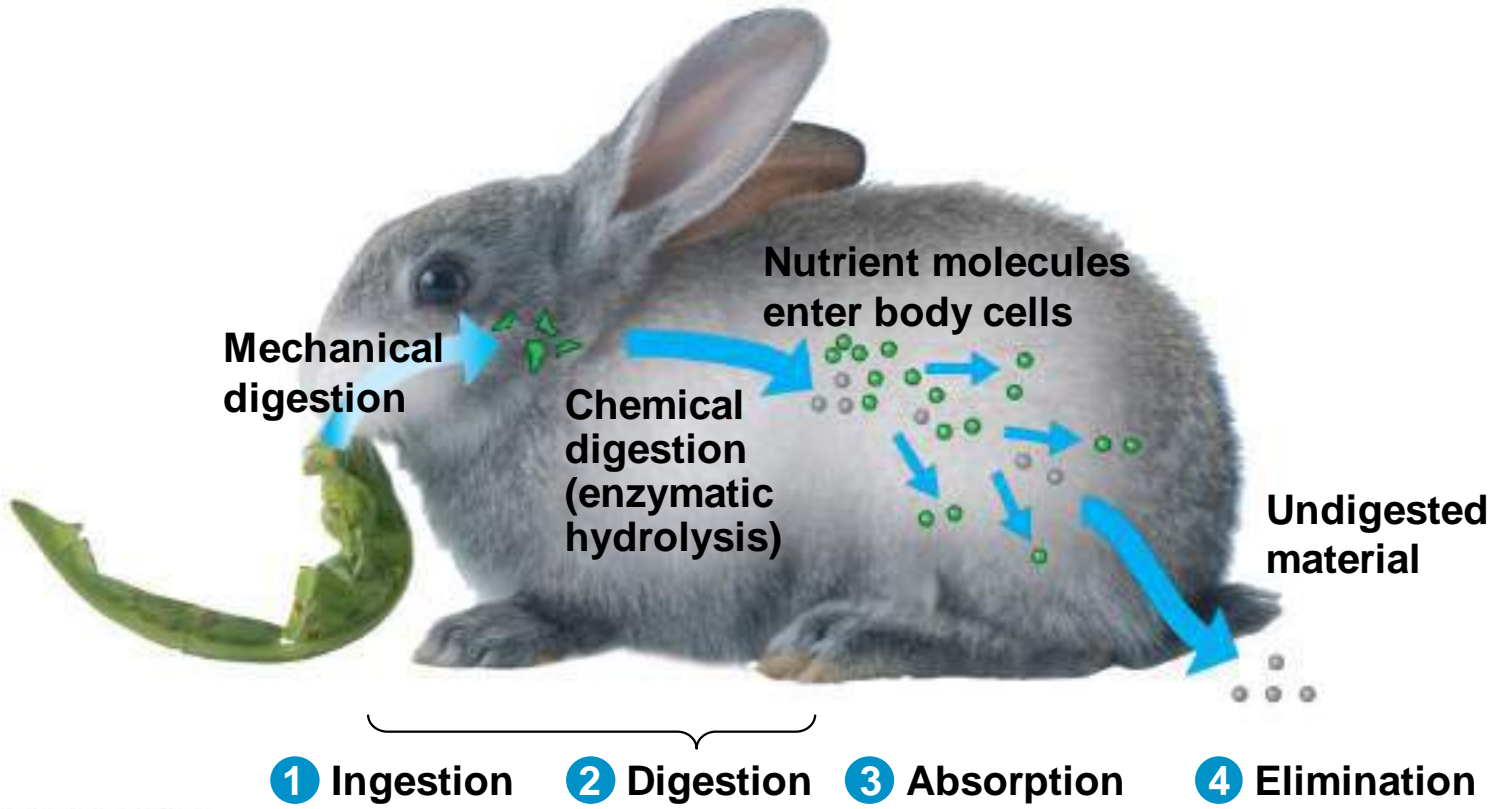
Group	Number of infants/fetuses studied	Infants/fetuses with a neural tube defect
Vitamin supplements (experimental group)	141	1 (0.7%)
No vitamin supplements (control group)	204	12 (5.9%)

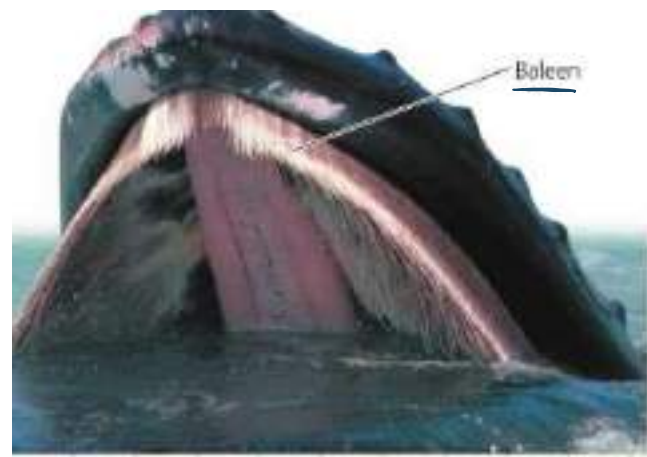
Concept 41.2: The main stages of food processing are ingestion, digestion, absorption, and elimination

A. **Ingestion** is the act of eating

أمرعة تناول الأكل

Figure 41.5

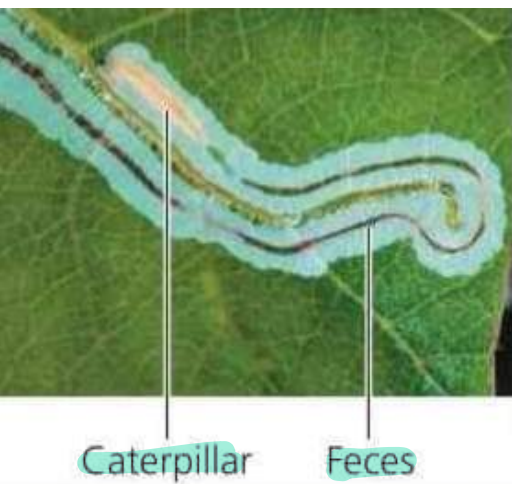




1. Suspension Feeders

- Many aquatic animals are **suspension feeders**, which sift small food particles from the water
- The **humpback whale**, shown above, is one example. Attached to the whale's upper jaw are comb like plates called **baleen**, which remove small invertebrates and fish from enormous volumes of water and sometimes mud

* يتغذى الحوت عن طريق العوالق التي تكون موجودة في الماء baleen



2. Substrate Feeders

- Substrate feeders are animals that live in or on their **food source**.
- This leaf miner **caterpillar**, the larva of a moth, is eating through the soft tissue of an oak leaf, leaving a dark trail of feces in its wake.



3. Fluid Feeders

- Fluid feeders suck nutrient-rich fluid from a living host.
- This tsetse fly has pierced the skin of its human host with hollow, needlelike mouthparts and is consuming a blood meal.

4 : Bulk Feeders

- Bulk feeders eat relatively large pieces of food.
- Their adaptations include tentacles, pincers, claws, venomous fangs, jaws, and teeth that kill their prey or tear off pieces of meat or vegetation. In this amazing scene, a rock python is beginning to ingest a gazelle it has captured and killed.



لا إله إلا أنت
سبحانك إني
كنت من
الظالمين

- B.
- **Digestion** is the process of breaking food down into molecules small enough to absorb
 - **Mechanical digestion**, including chewing, increases the surface area of food
 - **Chemical digestion** splits food into small molecules that can pass through membranes; these are used to build larger molecules
 - In chemical digestion, the process of **enzymatic hydrolysis** splits bonds in molecules with the addition of water

عطية الامتصاص

C • **Absorption** is uptake of nutrients by body cells

التخلص من الفضلات

D • **Elimination** is the passage of undigested material out of the digestive system

the animal's cells take up (absorb) small molecules such as amino acids and simple sugar

Digestive Compartments

- Most animals process food in specialized compartments
- These compartments reduce the risk of an animal digesting its own cells and tissues

Intracellular Digestion → الهضم داخل الخلية

- In intracellular digestion, food particles are engulfed by phagocytosis
- Food vacuoles, containing food, fuse with lysosomes containing hydrolytic enzymes

2) *Extracellular Digestion*

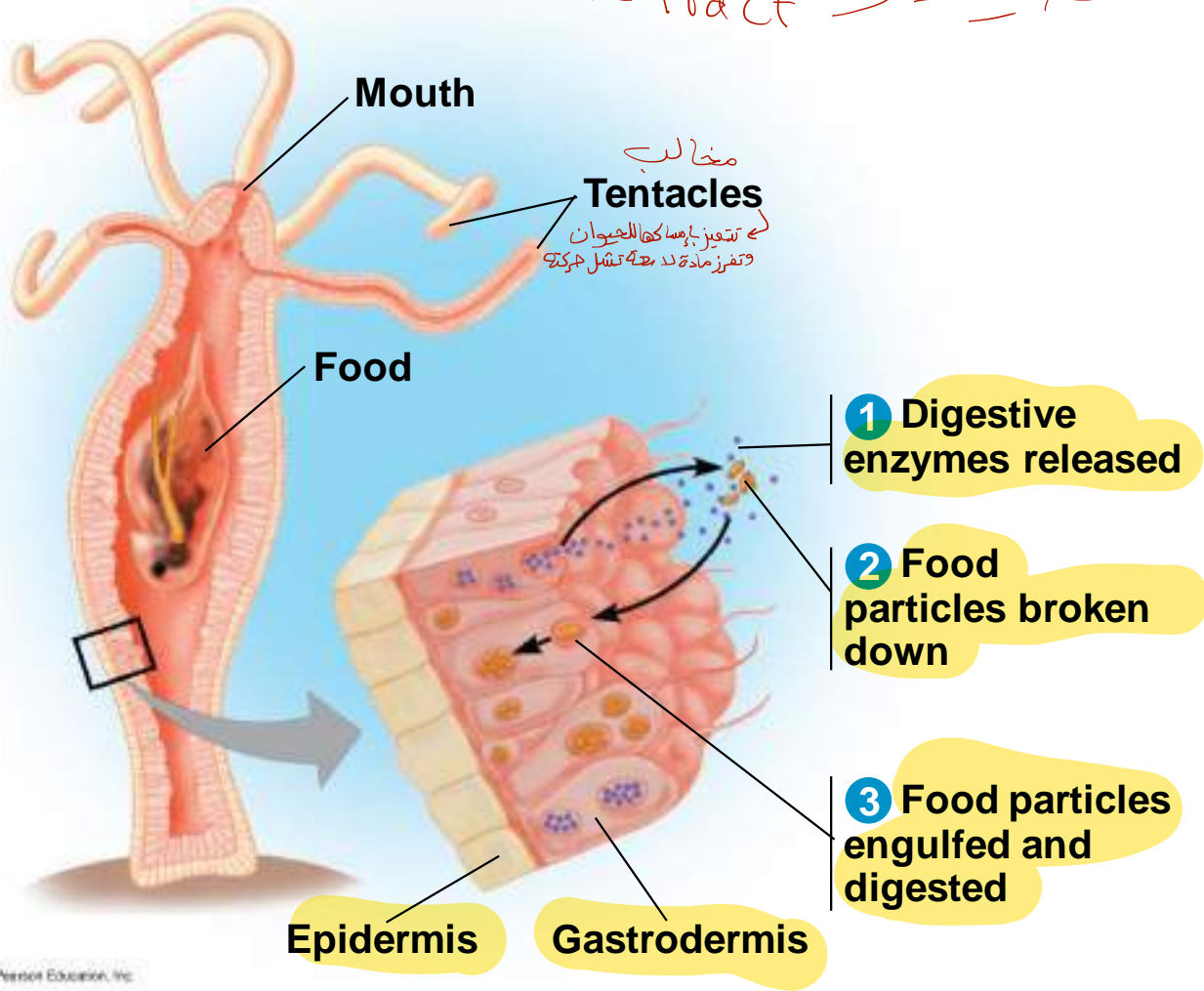
- **Extracellular digestion** is the breakdown of food particles outside of cells
- It occurs in compartments that are continuous with the outside of the animal's body
- Animals with simple body plans have a **gastrovascular cavity** that functions in both digestion and distribution of nutrients



Video: Hydra Eating Daphnia

Figure 41.7

in complete digestive tract هيدرا



أبواب هاضمة

- More complex animals have a digestive tube with two openings, a mouth and an anus
- This digestive tube is called a **complete digestive tract** or an **alimentary canal**
- It can have specialized regions that carry out digestion and absorption in a stepwise fashion

* عند وجود فتحتين Mouth & Anus هي complete digestive tract أو alimentary canal
* أنواع digestive system تختلف، تختلف البيئة التي يعيش فيها الحيوان

