



تَوِير

# BIOLOGY

Lec no :

File Title : Chapter 41 part 1

Done By : Leen Al-Ashram

وَقُلْ رَبِّ زِدْنِي عِلْمًا



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فَللَّهِ الْحَمْدُ الَّذِي أَنزَلَ عَلَيْنَا الْكِتَابَ الْعَرَبِيَّ لَعَلَّ نَفْقَهُوا حُرُوفَهُ وَتَعْلَمُوا أَنَّ الْوَعْدَ بِاللَّهِ حَقٌّ لَعَلَّهُمْ يَرْجِعُونَ

صَدَقَ اللَّهُ الْعَظِيمَ

Biology : chapter 41, part 1

done by: leen Al-Ashraam

shayhaf 2023

# LECTURE PRESENTATIONS

For CAMPBELL BIOLOGY, NINTH EDITION

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## Chapter 41

# Animal Nutrition Digestive system



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 (food processing)
- In general, animals fall into three categories: according to nutrition
  - آكله الأعشاب **Herbivores** eat mainly plants and algae
  - آكله اللحوم **Carnivores** eat other animals
  - mixture **Omnivores** regularly consume animals as well as plants or algae [like us]
- Most animals are also opportunistic feeders

The terms *herbivore*, *carnivore*, and *omnivore* represent the kinds of food an animal usually eats. However, most animals are **opportunistic feeders**, eating foods outside their standard diet when their usual foods aren't available. For example, deer are herbivores, but in addition to feeding on grass and other plants, they occasionally eat insects, worms, or bird eggs.

يلجأ  
لنفظ  
تغذية  
غير  
نظمه  
المعتاد

يبيع  
في هذه  
أكله  
carnivore  
موتقنا



Figure 41.1



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

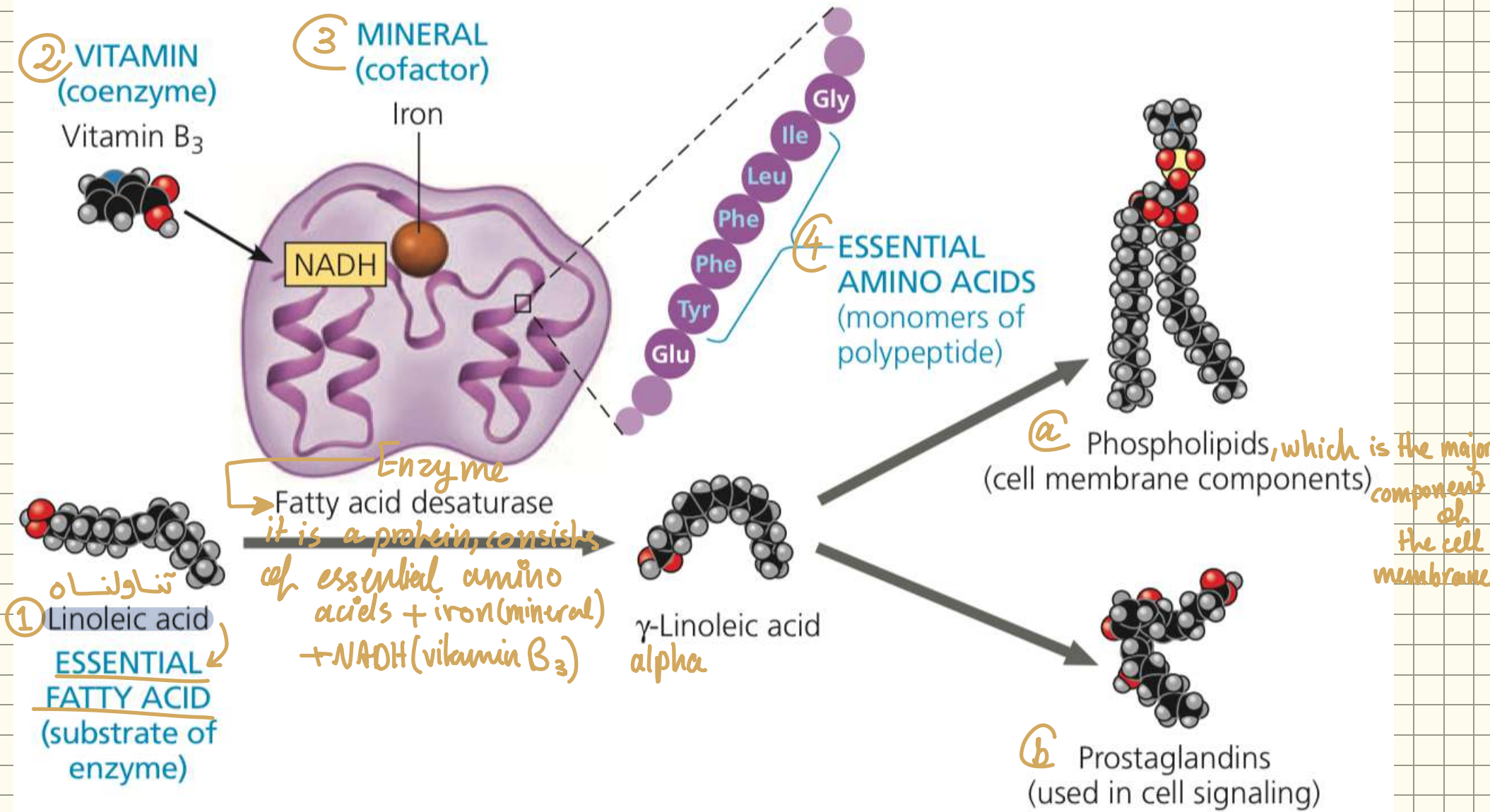
- An animal's diet provides:
  - ① **Chemical energy**, which is converted into ATP to power cellular processes
  - ② **Organic building blocks**, such as organic carbon and organic nitrogen, to synthesize a variety of organic molecules  
*مثلاً نأكل بروتينات خارجية لكي نستطيع بناء بروتيناتنا الخاصة كل شيء نأكله يجر عملية هضمه ليصبح raw material لبناء مكونات أفرغ.*
  - ③ **Essential nutrients**, which are required by cells and must be obtained from dietary sources  
*\* we need them but we CAN'T synthesize them فقط نحصل عليها من مصادر غذاء خارجية*

# Essential Nutrients

- There are four classes of essential nutrients:
  - Essential amino acids
  - Essential fatty acids
  - Vitamins
  - Minerals



# 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  $\gamma$ -linolenic 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.



# essential amino acids

## Essential

nutrients have key functions in cells, including serving as substrates of enzymes, as coenzymes, and as cofactors in biosynthetic reactions

## 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.

لا نستطيع تصنيعه، لذلك يعتبر essential لنا

\* هيش شرط اذا كان essential لفصيلة معينة ان يكون essential على الآخرين

عادي ممكن فصيلة اخرى تكون قادرة على تصنيعه.

# 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

The proteins in animal product such as →

Meat, eggs, and cheese provide all the essential amino acids and are thus “complete” proteins

Many animals, including adult humans, require eight amino acids in their diet: isoleucine,

leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. (Human infants also need a ninth, histidine.)

لا يدخلوا في بنا  
our own proteins

which means that they provide all the essential amino acids in their proper proportion

plant legumes (عدس، حمص) they are  
proteins ° البقوليات (فول، بازلاء) incomplete  
فاصوليا

فنبسوح نا كل ذرة  
مثلا "مع عشان  
يبيسر الوضع تمام وكامل

- Most plant proteins are incomplete in amino acid composition
- Individuals who eat only plant proteins need to eat specific plant combinations to get all the essential amino acids (corn & Legumes for example)  
*maize*
- Some animals have adaptations that help them through periods when their bodies demand extraordinary amounts of protein rei. Penguins  
amino acids

كناج  
كمية  
هائلة من  
amino acids  
والكمية  
التي تحصل عليها  
من الغذاء مش كافية

عشان هيك يلجا إلى

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

كيراتين (بروتين)

الجزء  
تتمتعها

→ omega 3/linoleen acid

# Essential Fatty Acids

من مصادر غذائية:  
مأكولات بحرية  
أفوكادو/حبوب صويا

① omega-3: important in general body growth, for the brain, nervous system

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

بالأغلب هي

Animals require fatty acids to synthesize a variety of cellular components, including membrane phospholipids, signaling molecules, and storage fats.

②

**essential fatty acids.** In mammals, they include linoleic acid

lipid ↓

Humans require it to make membrane phospholipid



# Vitamins

- **Vitamins** are **organic** molecules required in the diet in small amounts (0.01–100 mg per day, depending on the vitamin). كل فيتامين له جرعة محددة لليوم
- Thirteen vitamins are **essential** for humans
- Vitamins are grouped into two categories: fat-soluble and water-soluble

2. 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.

green vegetables) → فيتامينات  
مليان

**Table 41.1 Vitamin Requirements of Humans**

Vitamin	Major Dietary Sources	Major Functions in the Body	Symptoms of Deficiency
<b>Water-Soluble Vitamins</b> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">B + C</span>			
B <sub>1</sub> (thiamine)	Pork, legumes, peanuts, whole grains	Coenzyme used in removing CO <sub>2</sub> from organic compounds	Beriberi (tingling, poor coordination, reduced heart function)
B <sub>2</sub> (riboflavin)	Dairy products, meats, enriched grains, vegetables	Component of coenzymes FAD and FMN	Skin lesions, such as cracks at corners of mouth
B <sub>3</sub> (niacin)	Nuts, meats, grains	Component of coenzymes NAD <sup>+</sup> and NADP <sup>+</sup>	Skin and gastrointestinal lesions, delusions, confusion
B <sub>5</sub> (pantothenic acid)	Meats, dairy products, whole grains, fruits, vegetables	Component of coenzyme A	Fatigue, numbness, tingling of hands and feet
B <sub>6</sub> (pyridoxine)	Meats, vegetables, whole grains	Coenzyme used in amino acid metabolism	Irritability, convulsions, muscular twitching, anemia
B <sub>7</sub> (biotin)	Legumes, other vegetables, meats	Coenzyme in synthesis of fat, glycogen, and amino acids	Scaly skin inflammation, neuromuscular disorders
B <sub>9</sub> (folic acid)	Green vegetables, oranges, nuts, legumes, whole grains	Coenzyme in nucleic acid and amino acid metabolism	Anemia, birth defects
B <sub>12</sub> (cobalamin)	Meats, eggs, dairy products	Production of nucleic acids and red blood cells	Anemia, numbness, loss of balance
C ( <u>ascorbic acid</u> )	<u>مهنيات</u> <u>Citrus fruits</u> , broccoli, tomatoes	Used in collagen synthesis; antioxidant	Scurvy (degeneration of skin and teeth), delayed wound healing
<b>Fat-Soluble Vitamins</b> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">الباقين</span>			
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 (phyllloquinone)	Green vegetables, tea; also made by colon bacteria	Important in blood clotting	Defective blood clotting

تدرب في اطلو

تدرب في اطاء

هم للنظر كانه يدخل في تركيب عصب + مخاريط Rods & cones

# *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

موجودہ ذریعہ کی لاگت  
 البحری  
 seafood/meat  
 grains/eggs  
 green vegetables

**Table 41.2 Mineral Requirements of Humans\***

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)

کثیر بنتائج

More than 200 mg per day required

ذاتی تیزی کی وجہ سے انہا mineral

\*Additional minerals required in trace amounts include cobalt (Co), copper (Cu), manganese (Mn), molybdenum (Mo), selenium (Se), and zinc (Zn). All of these minerals, as well as those in the table, can be harmful in excess.



# Dietary Deficiencies

essential nutrients  
نقص في

① = malnutrition

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

سوء  
تغذية  
بإرادتي / أنا  
فشا عم  
أكل ولطنة  
الأكل موجود } → not an economic problem

# Deficiencies in Essential Nutrients

- 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

تشوهات

منتشر كثير  
في دول جنوب  
شرق آسيا  
أكل الرز بكثرة

أغذية التي لونها أصفر / برتقالي / أحمر

موجودة في  
carrot

↓  
اكتشفوا إنه صار عندهم مشاكل في النظر

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 entirely 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.

التقص في

amino acids

هو أكثر أسباب

بسوي مشاكل

محتوي كلسي

حماجه الطفل في مرحلة

النمو

ممكن بسبب

نقص ال amino acids

سوف يعاني منه

malnutrition وهذا الأسف

يكن حله بأن أكله يكون مليء بالبروتين/ + حليب غائب مد عم .

هشاشة عظام

For example, deer and other herbivores can develop fragile bones if the plants they consume grew in phosphorus-deficient soil.

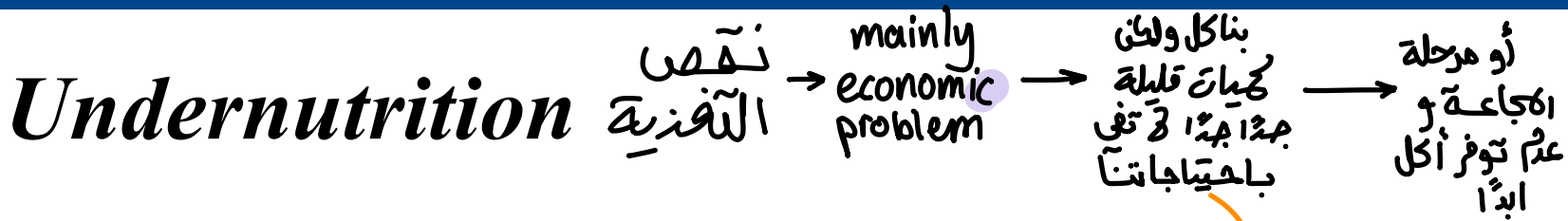
كل المشاكل بسبب

نقص phosphorus

الذي يدخل في بناء العظام

\*ببطل قادر  
يوقف :)





- 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

كيف يحل المشكلة؟  
 ما تبخل لفترة طويلة مخزنة ، أكثرها يوزن / وتخزن على شكل خلايا كوجيين في liver & muscle

Inadequate nourishment in humans is most common when drought, war, or other 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

Figure 41.4

## 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%)

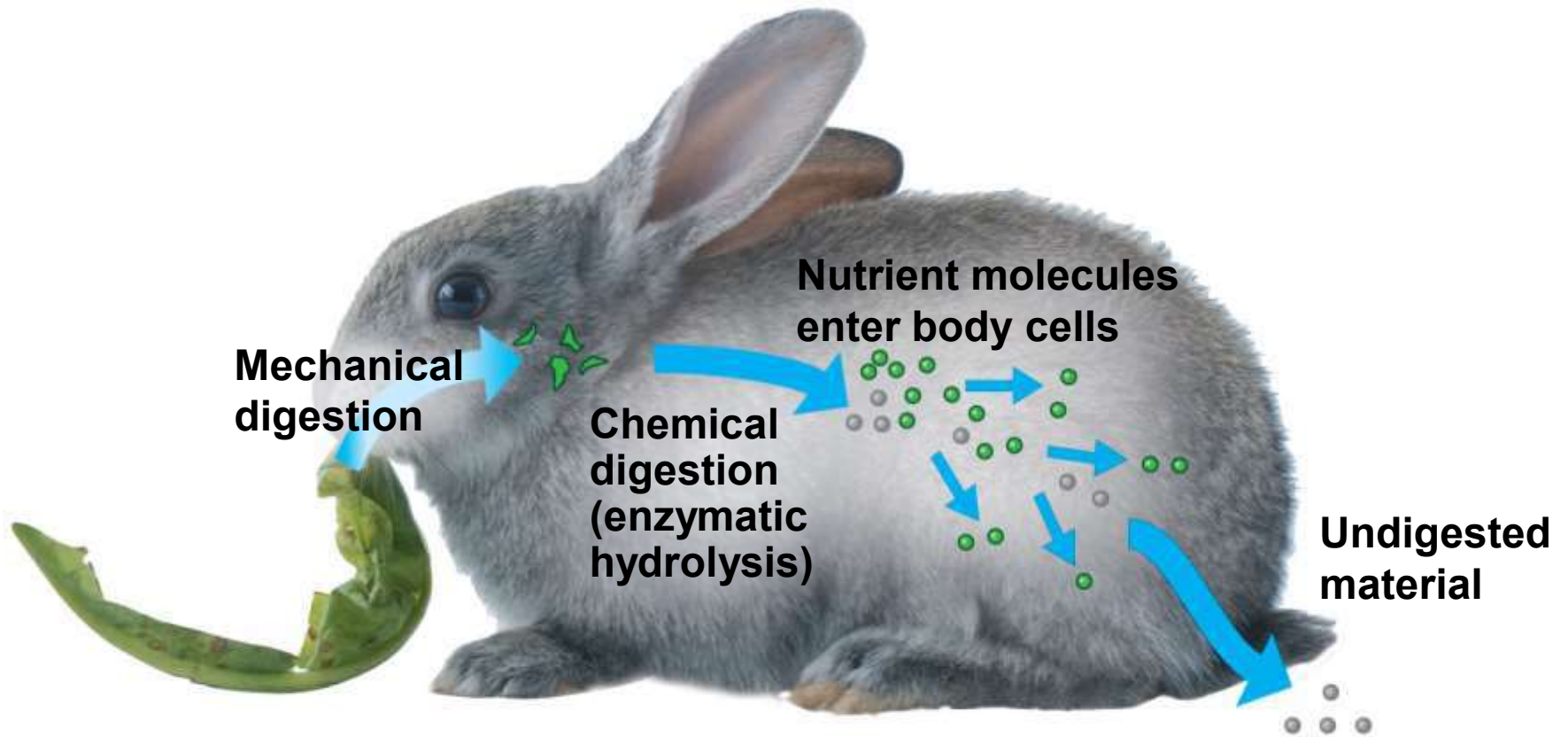
**Concept 41.2: The main stages of food processing are <sup>①</sup>ingestion, <sup>②</sup>digestion, <sup>③</sup>absorption, and <sup>④</sup>elimination**

تناول الطعام

- **Ingestion** is the act of eating

تختلف بين أنواع  
الحيوانات

Figure 41.5



- 1 Ingestion**    **2 Digestion**    **3 Absorption**    **4 Elimination**

*put it in his mouth*

*↳ Mechanical digestion  
↳ chemical digestion  
[enzymatic hydrolysis]*

Figure 41.6

# Suspension Feeders and Filter Feeders

# 4 ways of Ingestion

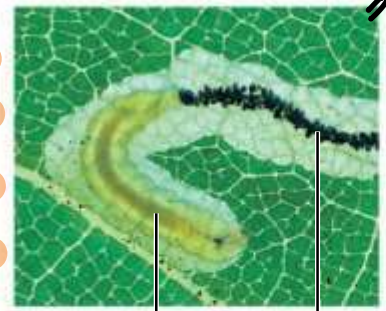
1

whale



2

Substrate Feeders



3

Fluid Feeders



4

Bulk Feeders

Python snake



يرقة الفراشة Caterpillar Feces larva of butterfly

تعيش في ورقة نبات

oak البلوط

وذلك لأنها تأكل الغذاء

- تحتوي على البلاستيدات الخضراء

photosynthesis.



## عوالق Suspension Feeders

- Many aquatic animals are **suspension feeders**, which sift small food particles from the water

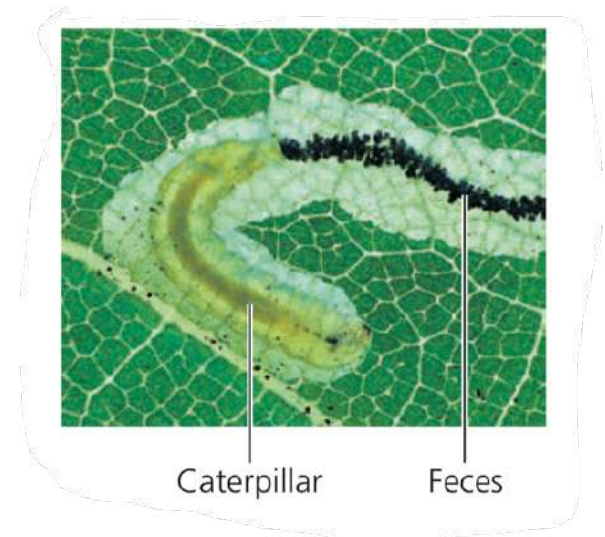
The humpback whale, shown above, is one example. Attached to the whale's upper jaw are comblike plates called baleen, which remove small invertebrates and fish from enormous volumes of water and sometimes mud. Filter feeding in water is a type of suspension

و حط غذائي

## 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.



## Fluid Feeders [ei: mosquito]

- **Fluid feeders** suck nutrient-rich fluid from a living host

**\*\*** This tsetse fly has pierced the skin of its human host with hollow, needle-like mouthparts and is consuming a blood meal.



## كبير في الحجم 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.

- **Digestion** is the process of breaking food down into molecules small enough to absorb
- **a** Mechanical digestion, including chewing, increases the surface area of food
- **b** 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



- **Absorption** is uptake of nutrients by body cells

التخلص  
من  
الفضلات

**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 sugars

# Digestive Compartments

بشكل أنواع / حسب  
تطور  
الكائنات

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

# *Intracellular Digestion*

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

# *Extracellular Digestion*

②

الحيوانات الأكل كغيرها من الأمثلة

multicellular, but doesn't have digestive system / it has gastrovascular cavity

- **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

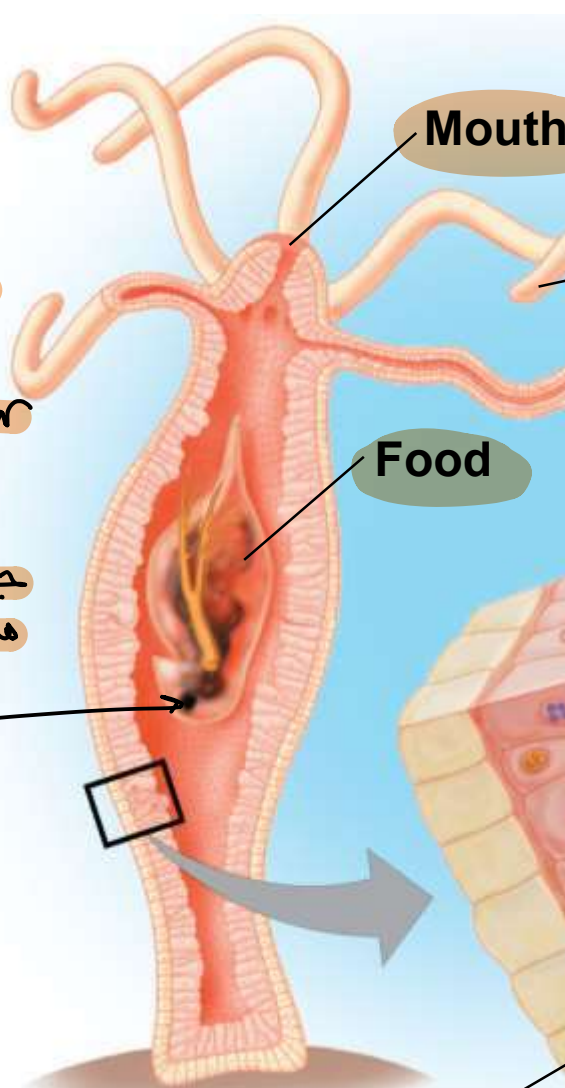
Figure 41.7

الهيدرا

[تقيش في المياه العذبة freshwater]

تحتوي على تجويف جوي gastrovascular cavity

جسمها يتكون فقط هنا طبقين من الخلايا



only one opening : that's why it isn't a digestive tube

Doesn't have anus --- incomplete digestive system mouth تاكل منه وتخرج منه الفضلات

Tentacles : تفسك بهم أي عوالق أو حيوانات أصغر منها تقيش معها في المياه العذبة

أيضاً تفرز مادة لاصقة تسهل حركته ، ثم تدخله عبر mouth إلى gastro.. cavity لتتم عملية هضمه بخلية extracellular digestion

- 1 Digestive enzymes released from gland cells
- 2 Food particles broken down into smaller particles
- 3 Food particles engulfed and digested in food vacuole

Epidermis Gastrodermis تجزئ انزيماتها إلى gastrovascular



٣ مَلَبَقَات  
أَرْقَى هُنَّ  
الْهَائِرَات

More complex animals have a digestive tube with two openings, a mouth and an anus

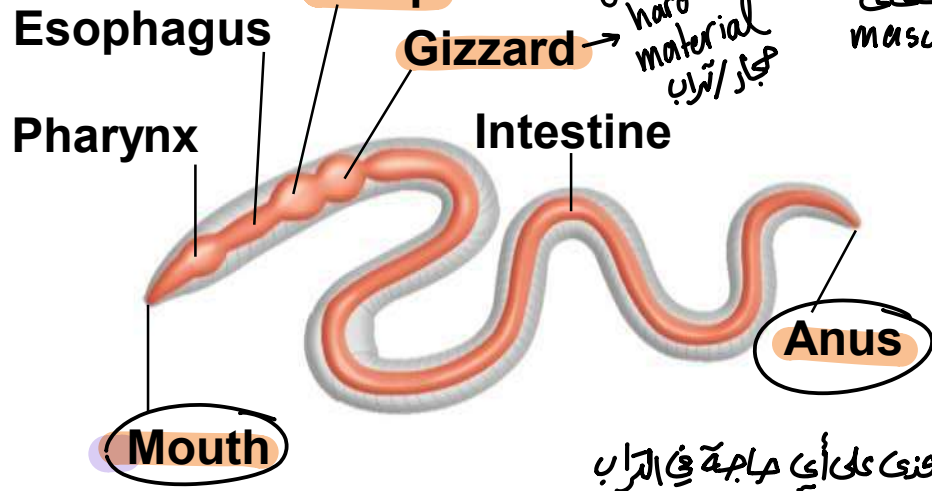
- This digestive tube is called a **complete digestive tract** or an **alimentary canal**
- It can have specialized regions that carry out digestion and absorption in a stepwise fashion

← المعدة الأولى: تخزن فيها الأكل لأنه مش دائماً متوفر  
**Crop**

المعدة الثانية وتسمى muscular stomach  
 تهضم كل hard material حجار / تراب

مُطَبَّة

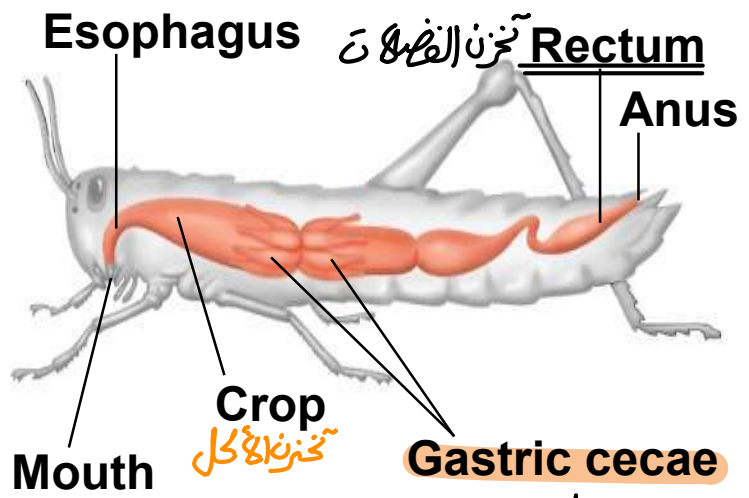
تطور الجهاز الهضمي حسب البيئة التي يعيش فيها الحيوان



complete digestive system [2 openings]

(a) Earthworm دودة الأرض → تتغذى على أي مادة في التراب حجار / تراب / نبات / ...

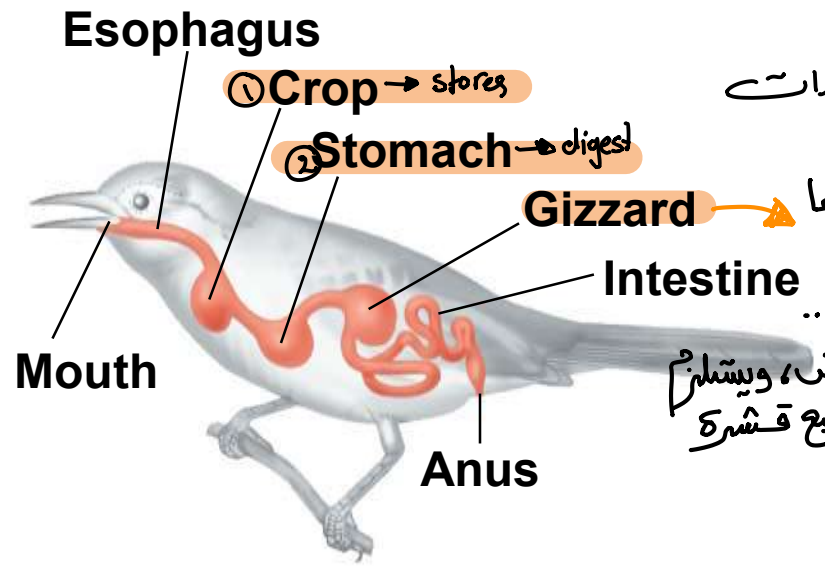
Foregut Midgut Hindgut



تخزن الفضلات

تخزن الأكل

(b) Grasshopper بجندب



مخاض

تمضم فيها الحجارو الكالسيوم .. لأنها تبيض، ويستلزم ذلك تصنيع قشرة البيض

(c) Bird

branches in digestive system to increase surface area for absorption