INTRODUCTION TO NUTRITION IN MAMMALS 23 APRIL 2014

Lesson Description

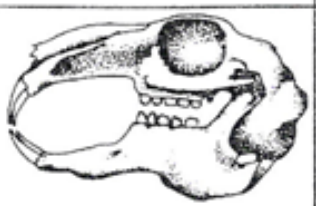
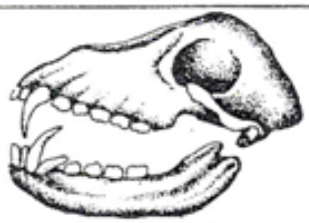
In this lesson, we will:

- Describe nutrition in various animals Herbivores, Carnivores and Omnivores
- Explain dentition in various animals

Challenge Question

A – SKULLS OF MAMMALS

SKULLS OF DIFFERENT TYPES OF MAMMALS:

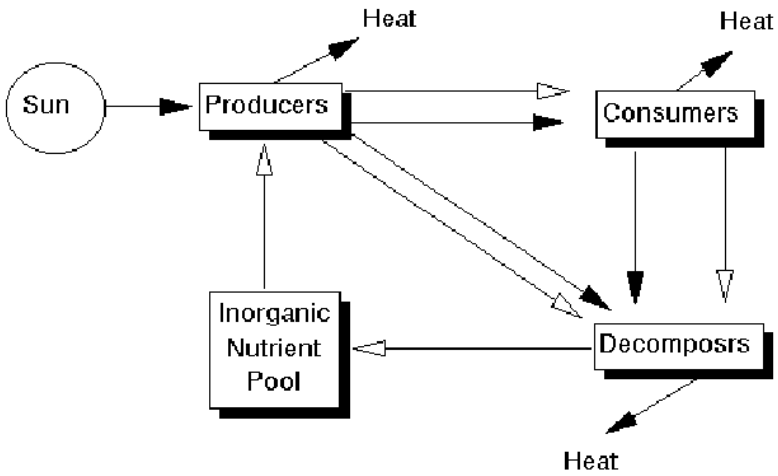
A.  Dental formula: 0.0.3.3 / 3.1.3.3	B.  Dental formula: 3.1.4.2 / 3.1.4.3
C.  Dental formula: 2.0.3.3 / 1.0.2.3	D.  Dental formula: 2.1.2.3 / 2.1.2.3

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

Summary

- Nutrition is defined as the sum of the following processes – ingestion, digestion, absorption, assimilation and egestion.
- All organisms are part of a food chain.
- Each food chain is made up of the following:

Producers → Primary consumers →Secondary consumers → Decomposers



(http://www.marietta.edu/~biol/102/ecycle.gif)

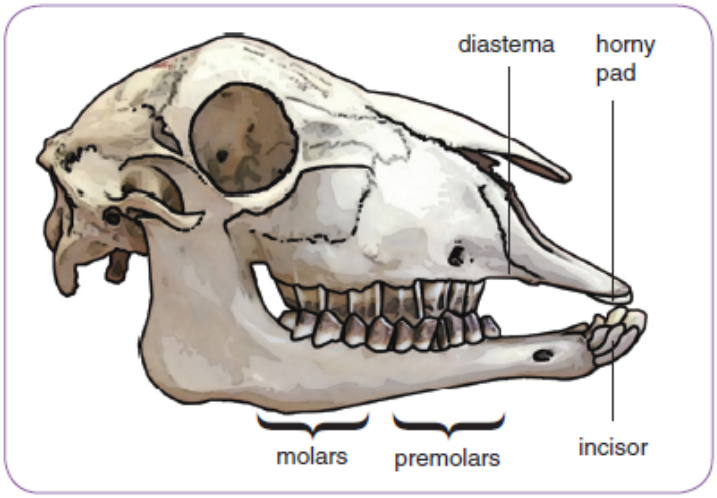
- As energy flows from one organism to another, some energy is lost because:
  - ♣ Some energy remains in the food that is not eaten
  - ♣ Energy is lost as heat
  - ♣ Energy is excreted in the waste
- Approximately 10% of the trophic level energy is passed on to the next level therefore the number of organisms that each level can support decreases.
- Food is produced by plants (autotrophs) through the process of photosynthesis as we have learned in the last two weeks
  - There are more producers than consumers i.e more producers than herbivores and more herbivores than carnivores

- Definitions that you need to know:
  - Herbivores: (primary consumers) eat only plants (producers)
  - Carnivores (secondary consumers) eat other consumers
  - Omnivores eat producers and consumers

- The types of teeth that each consumer has depend on its eating habits. Herbivores will have different teeth to carnivores and omnivores.
  - Incisors are found at the front of the mouth and are chisel shaped and are used for biting off food.
  - Canines are found just behind the incisors and are pointed and used for catching, tearing, holding and killing
  - Premolars and molars are flat with uneven surfaces and are used for crushing and grinding.

Dentition of herbivores

- **Herbivores** are mammals that consume plant material. Their dentition and digestive tract have adapted to consuming large amounts of plant material.
  - Herbivores clip leafy material off the plants and then grind it down into a mash that can be more easily digested.
  - Their mouths are smaller and their tongues are muscular.
  - The upper jaw has a tough horny pad instead of incisors.



(Solutions for all Life Sciences, Macmillan, p146)

The dental formula for sheep is as follows:

$$\frac{0.0.3.3}{4.0.3.3}$$

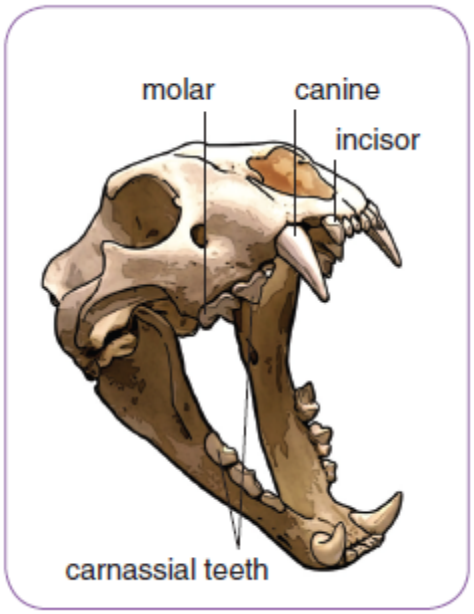
(Remember that a dental formula only shows the teeth for half a jaw)

- This formula shows that the sheep has 8 incisors on the lower jaw which meet the horny pad of the upper jaw. The incisors are well developed and there is a large gap or diastema between the incisors and the premolars. There are 6 premolars and 6 molars. The premolars and molars have broad grinding surfaces with complex ridges.

- 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.

Dentition or carnivores

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



(Solutions for all Life Sciences, Macmillan, p147)

Carnivores have the following dental formula:

$$\frac{3.1.4.3}{3.1.4.3}$$

- 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 canines are long and sharp and are used for the killing of prey and tearing of the flesh.
    - ♣ The incisors are short and prong-like for holding and shredding.
    - ♣ The molars (carnassial teeth) are sharp and uneven and they are used for chewing the tough meat. They have knife-like serrated edges and they cut and slice the meat off the bone.

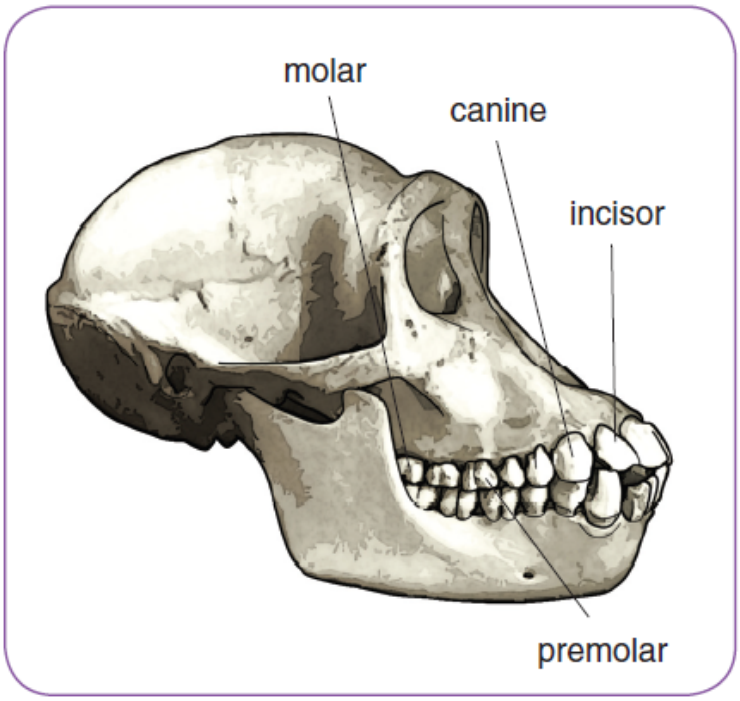
Dentition of omnivores

- **Omnivores** have digestive systems and dentition that are adapted to eating both plant and animal tissues.
- New world monkeys have slightly different dental formulae to old world monkeys and humans. A new world monkey such as the Emperor Tamarin has the following dental formula:

$$\frac{2.1.3.2}{2.1.3.2}$$

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

$$\frac{2.1.2.3}{2.1.2.3}$$



(Solutions for all Life Sciences, 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.
    - ♣ The incisors are shovel-shaped for biting.
    - ♣ The canines are pointed for tearing off large pieces.
    - ♣ The flat molars have bumpy crowns for grinding food.

Test Yourself

Question 1

How many canine teeth does an adult human have?

A. 2

B. 4

C. 6

D. 8

Question 2

Compared to that of herbivores, carnivores' intestines are generally

A. longer

B. more convoluted

C. less convoluted

D. about the same

Question 3

Animals that eat both plant and animal material are called

A. herbivores

B. incisors

C. carnivores

D. omnivore

Question 4

The vast majority of energy taken into an ecosystem is

A. utilized by secondary consumers

B. lost as heat

C. used by the primary consumers

D. concentrated in the decomposers

Question 5

A lion that feeds on zebras is in trophic level

A. 1

B. 2

C. 3

D. all of the above

Question 6

Carnassial teeth are found in

A. carnivores

B. omnivores

C. herbivores

D. all of the above

Question 7

The dental formula for a carnivore is

A. $\frac{0.0.3.3}{4.0.3.3}$

B. $\frac{3.1.4.3}{3.1.4.3}$

C. $\frac{2.1.2.3}{2.1.2.3}$

D. $\frac{2.1.3.2}{2.1.3.2}$

Question 8

As energy flows from one organism to another, some energy is lost because

A. some energy is left in the uneaten food

B. energy is given off as heat

C. energy is excreted in the waste

D. all of the above

Improve your Skills

Question 1

Type of animal	kJ/ kg/day
Lion	470
Gorilla	420
Sheep	380

The table above shows the approximate energy needs of three different animals per kilogram of the animal's mass per day. Energy is measured in kilojoules.

1.1 Draw a bar graph showing the information in the table. (10)

1.2 Which animal uses the most energy per kilogram per day? (1)

1.3 Why do you think that this animal uses the most energy? (1)

1.4 How much energy does a 50 kg sheep use per day? Show your workings. (3)

1.5 Discuss two ways each in which a herbivore, a carnivore and an omnivore are adapted to their diets. (6)

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Question 2

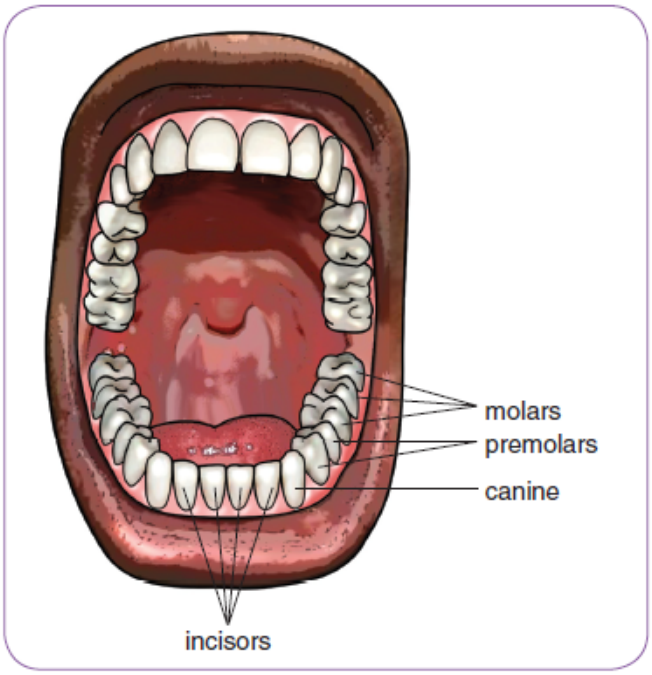
Copy and complete the following table which compares herbivore nutrition with carnivore nutrition.

	Herbivore	**Carnivore**
Example of mammal		
Size and shape of canines		
Size and shape of molars		
Two other adaptations		

(12)

Question 3

Look at the human teeth below and compare them to what you know about lions' teeth.



3.1 List three ways in which human teeth and lion teeth differ. (6)

3.2 Explain how the teeth are perfectly suited to the lifestyle of

a) humans (3)

b) lions (3)