



Biology

Digestion: Vulture culture

People enjoy a wide range of foods – even some that are going mouldy. But no-one could stomach a vulture's diet of rotten, stinking meat! How can they live on fly-blown carcasses riddled with toxic bacteria and not get sick?

In this lesson you will investigate the following:

- What is digestion?
- What are some of the differences between the digestive systems of different organisms and why are there these differences?
- How is the digestive system like a theme park?

So let's begin our journey along the digestive tract.



This is a print version of an interactive online lesson. To sign up for the real thing or for curriculum details about the lesson go to www.cosmosforschools.com

Introduction: Digestion



Vultures love eating rotting meat, a meal that would make you and me so sick it would literally kill us. So how do these birds cope with the deadly bugs in their food?

Every animal needs to find a way to digest the sort of food that it eats. Sometimes it takes special systems and strategies to deal with the animal's particular diet. Vultures have a range of ways to fight the poisons that bacteria release into their food – they defecate on their own legs to disinfect them and their stomachs have 10 times more acid than human stomachs. That kills off many of the poison-producing bugs.

But even this is not enough to kill some of the bacteria found in rotting food.

To deal with these the birds have two types of “good bacteria” in their innards. One sort reproduces very quickly so that the harmful bugs the vultures eat don't have time to take hold in their bodies. The other is especially good at breaking down rotting meat and so helps the vultures get the maximum amount of nutrition out of the food.

Other animals wouldn't last a week on a vulture's diet. They have quite different gut systems, with different bacteria in them. And humans, with a widely varied diet of plants and often meat – hopefully none of it rotten – have their own particular digestive system too.

Read or listen to the full *Cosmos Magazine* article [here](#).



How much do you know about your digestive system? Answer these true-or-false questions and then compare your answers with your classmates. Your teacher has the answers.

 **Question 1**

Your mouth makes about half a litre of saliva each day.

- True
- False

 **Question 2**

Your intestines are about five times longer than your height.

- True
- False

 **Question 3**

Food doesn't need gravity to reach your stomach.

- True
- False

 **Question 4**

Your stomach does most of the digestion.

- True
- False

 **Question 5**

During your lifetime your digestive system will handle about 90 tonnes of food and drink.

- True
- False

 **Question 6**

Your intestines contain around 100 trillion bacteria of 500 different species.

- True
- False

Gather: Digestion

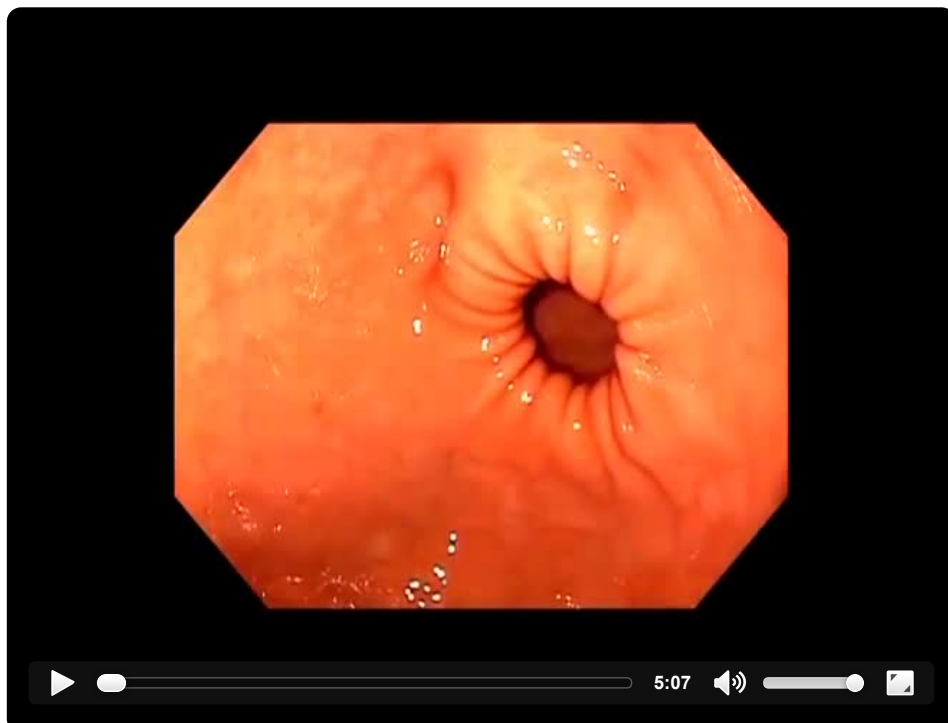
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LESSONS



Just smelling a homemade apple pie or thinking about how delicious an ice cream sundae will taste, you begin to produce saliva. And so the digestive process begins, preparing you for that first scrumptious bite.

Nutrients in the food you eat give your cells the energy and substances they need. But first the food has to be digested – broken down into microscopic pieces that your body can absorb and use.

The different parts of the digestive system are adapted for particular roles in digesting and absorbing food. The following video tracks the digestive process of an infant.



Question 1

Sequence: After food is swallowed it moves down the oesophagus and through the gut in the order of:

- small intestine → stomach → large intestine
- stomach → small intestine → large intestine
- stomach → large intestine → small intestine
- large intestine → small intestine → stomach

Question 2

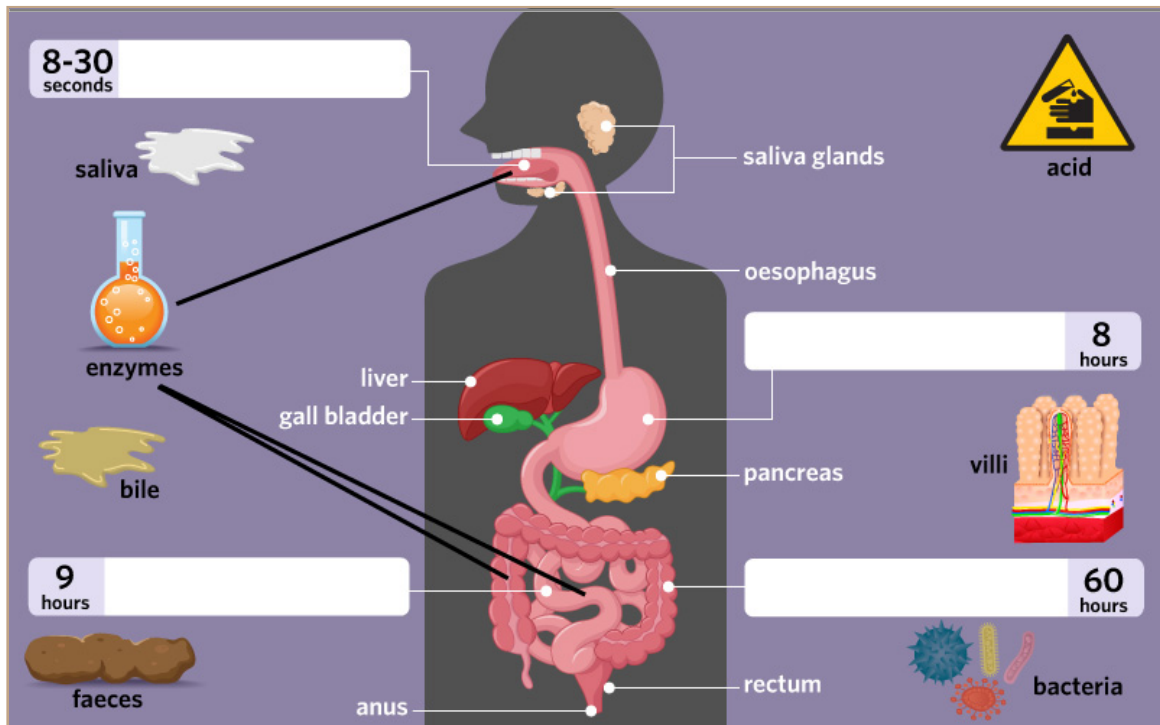
Recall: Digestion starts in the:

- mouth
- oesophagus
- stomach
- small intestine

Question 3

Label: Digestion takes a lot longer in adults than the 12 hours it takes in infants. Using information from the video:

- label the unnamed organs in the *digestive tract* – the series of cavities and tubes that food passes through, and
- draw lines from the items around the edges of the diagram to the parts of the digestive tract where they can be found. The video mentions that enzymes are chemicals that help to break down food in the large intestine but they are also found in the mouth and small intestine, as shown.



Question 4

Analyze: In adults food spends approximately 8 hours in the:

- large intestine
- small intestine
- stomach
- oesophagus

Question 5

Calculate: Approximately how much longer does food spend in the large intestine compared to the small intestine?

- 3 times longer
- 6 times longer
- 9 times longer
- 12 times longer

Question 6

Select: The first row of words below has the names of parts of the digestive tract, while the second gives words relating to the functions of these parts. They are in random order.


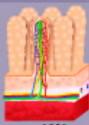


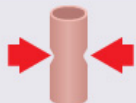
teeth | stomach | anus | large intestine | small intestine
 churns | expelled | grind | reabsorb water | absorption

Each sentence in the table below is missing two terms, one from each row. Write these in the second and third columns.

	Part	Function
The _____ is where most digestion and _____ take place.		
The _____ is where waste from the rectum is _____.		
The _____ and tongue _____ and mash up food.		
The main role of the _____ is to _____ from undigested food.		
The _____ is a bag of muscle that _____ food into liquid.		

Question 7

Match: Draw lines to match each of the following features of the digestive system to its main function or functions.

 acid		lubricates food
 villi		move food along the digestive tract
 saliva		breaks down food chemically
 bacteria		increase surface area for better absorption
 muscle contractions		break down food that our own systems can't digest

Question 8

Describe: Do your parents tell you to chew your food thoroughly before swallowing? Describe two benefits of following their advice.

Did you know?

The average person breaks wind 15 times a day.

The medical term for gas in the intestines is *flatus*, and when it comes out, that's *flatulence*. Some of the gas comes from bacteria in the large intestine as they break down food, and some from air that you have swallowed.

People differ in how much flatus they produce, and it can depend on their diet and the types of bacteria in their bowels (another name for the intestines).

Some habits that can lead to increased flatus include talking while eating, drinking from a water bottle or fountain, sipping hot drinks, smoking and chewing gum.

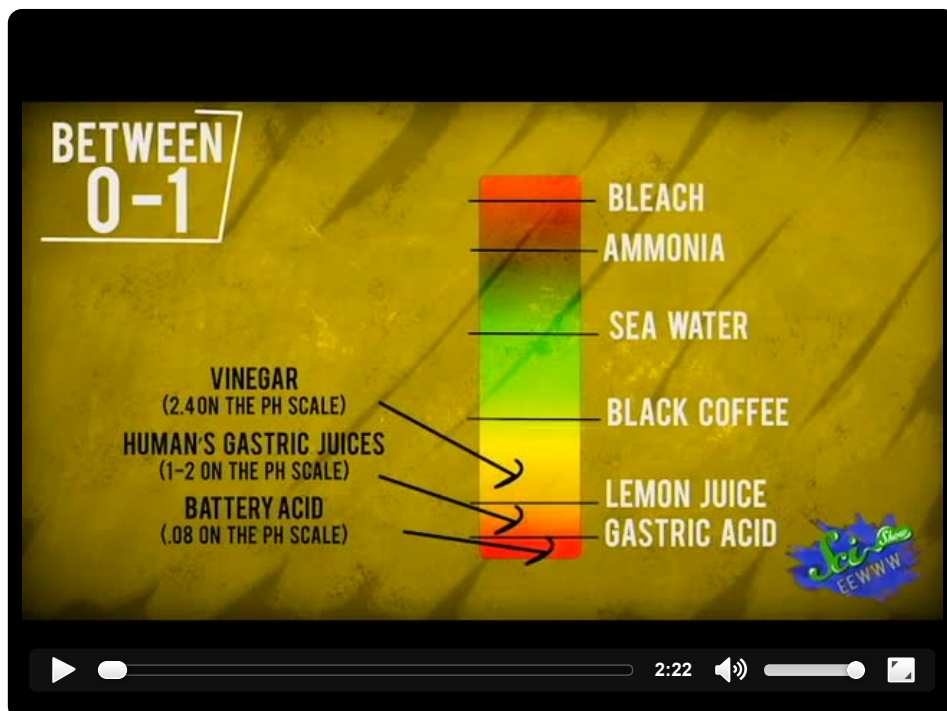


Process: Digestion



Vultures

The name "vulture" is used for many different species of birds. What they all have in common is that they scavenge meat from rotting carcasses. Because they eat meat they are **carnivores**.



Question 1

Describe: How is the stomach acid of vultures different from that of humans? What advantage does this give vultures?

Question 2

Outline: How do vultures help limit the spread of life-threatening diseases such as rabies and anthrax to other animals and even to humans?

Hint: what happens when it rains on a rotting carcass?

Koalas

In contrast to vultures, koalas are strict **herbivores**, meaning they only eat plants. But koalas don't eat just any plants – they feed entirely on leaves from certain types of eucalyptus tree. Not only are the eucalyptus leaves very low in nutrients, they also contain poisonous cyanide chemicals.



Question 3

Explain: How many hours do koalas eat each day? How does that compare with your eating habits? Why is there such a difference?

Question 4

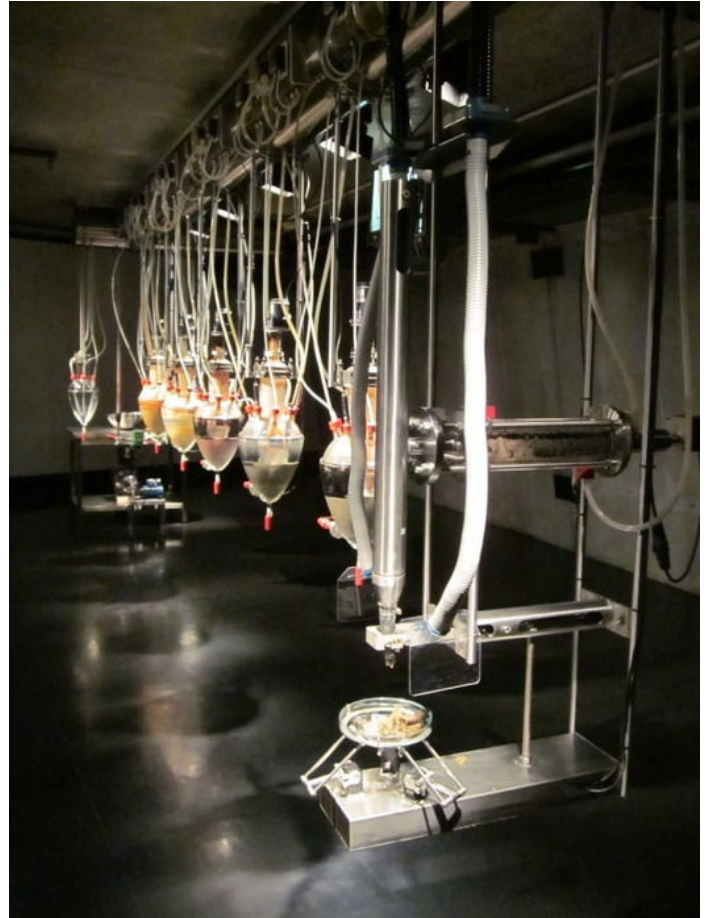
Paraphrase: How does eating pap benefit koala cubs?

Did you know?

Artist Wim Delvoye created an artificial digestive system as a work of art. It is displayed at the Museum of Old and New Art (MONA) in Tasmania, Australia.

The machine is fed twice a day and once a day, regular as clockwork, it expels the final waste product. In between the food is mashed and goes through a series of glass bowls with enzymes and bacteria, just like a real gut. So what comes out is pretty much the same as what humans produce.

It's interesting, but is it art?



Comparing digestive systems

So far we have examined a carnivore and a herbivore. Most humans eat a combination of meat and plant foods, making them **omnivores**.

How do the digestive systems of the three compare?

Gut bacteria

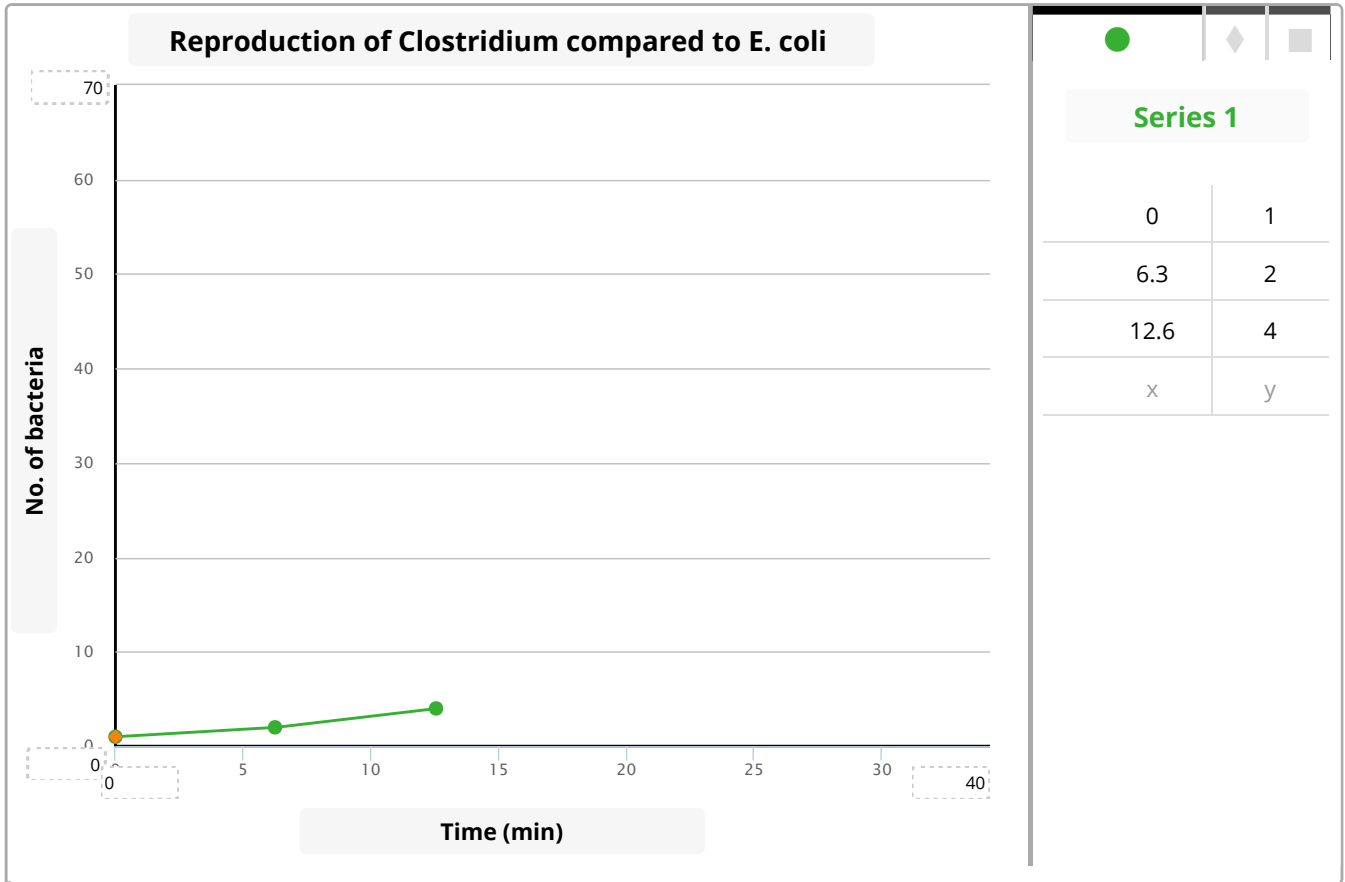
One important difference between vultures, koalas and humans is in the bacteria that live in their large intestines:

- **vultures** – have two species of bacteria. One species, *Fusobacteria*, very efficiently breaks down flesh. The other, *Clostridia*, is very fast-breeding. In good conditions *Clostridia* reproduce every 6.3 minutes, compared to 20 minutes for *E. coli*, a common bacteria in humans.
- **koalas** – have 45 bacteria species. Some break down the eucalyptus leaves they eat and some break down the poisons that the leaves contain.
- **humans** – have over 5,000 species of bacteria. Recently there have been discoveries about how important these bacteria are for our immune systems and even our brains.

Question 5

Plot: If you started with one *Clostridium* bacterium and one *E. coli* bacterium and they both reproduced at their optimal rates, how many of each would there be after 40 minutes? Work out the answer by plotting the reproduction of each in separate plots on the graph.

Note: the number of bacteria doubles with each reproduction.

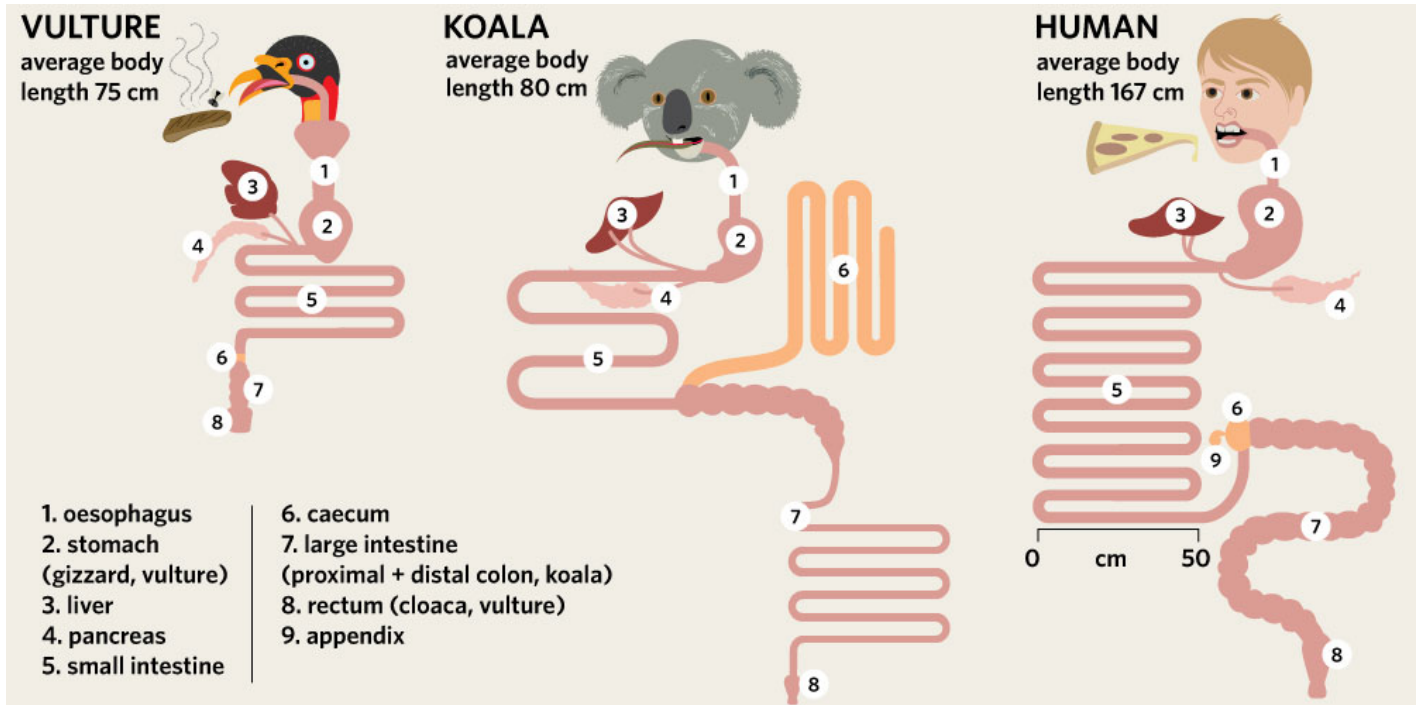


Question 6

Deduce: Explain how you think the rapid reproductive rate of *Clostridia* benefits vultures.

Length of digestive tract

In the diagram below you can see that the lengths of the digestive tracts are quite different too.



Of course, small animals have shorter tracts than big animals, so in order to make comparisons scientists often measure the length of the digestive tract relative to the animal's body length. For example:

- with average body length 75 cm and length of digestive tract 220 cm, vultures' digestive tracts are 2.9 times the length of their bodies.
- with average body length 80 cm and length of digestive tract 570 cm, koalas' digestive tracts are 7.1 times the length of their bodies.
- with average body length 167 cm and length of digestive tract 850 cm, humans' digestive tracts are 5.1 times the length of their bodies.

Question 7

Infer: Compare the ratios of digestive tract to body length in vultures and koalas. How can the differences be explained by their different diets?

Caecum

The caecum is a pouch-like area where the small and large intestines connect. Its chief role in most animals is to provide a home for bacteria that help break down plant-based foods.

Question 8

Infer: Suggest why you think the caecum is very different in size in vultures and koalas.

Question 9

Reflect: Some people argue that by comparing the human digestive tract with typical carnivore and herbivore digestive tracts we can see that humans are naturally carnivores. Others say it shows exactly the opposite. Bringing together all that you have learnt in this lesson, do you think we can draw either conclusion? What more evidence do you think you might require?

Share your opinion about this issue with your classmates using the discussion board below.

Hint: If the discussion board is not open, ask your teacher to open it.

Apply: Digestion

How is the digestive system like a theme park?



Aim

Imagine you're the leader of a design company who has been asked to plan GastroLand, a theme park based on the digestive system.

Be creative! You might want to include rides, obstacle courses, gladiator challenges, shows, simulations, or invent a whole new theme park attraction. Each of the attractions in your theme park should allow visitors to experience some aspect of the digestive system and what it does.

Question 1

Plan: Use the table to plan three of the attractions in your theme park.

Name of attraction			
Description			
Part of the digestive system it represents			
Connection between the part and the attraction			

Question 2

Draw: Draw pictures and/or design plans for each of your attractions, as well as a map of your theme park showing the layout. You can use a sketchpad or use paper and upload a photo.

Career: Digestion



Brought to you by Edith Cowan University



Question 1

Reflect: When you look inside our digestive systems it's easy to feel disgusted by what you find. What reasons does Swapna give for pursuing a career in gastroenterology – the branch of medicine that deals with the digestive system? Do you think the same reasons could persuade *you* to follow the same path? If not, which organs of the human body would you prefer to study or treat?



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