



Same planet. Different world.

# GRADE 5



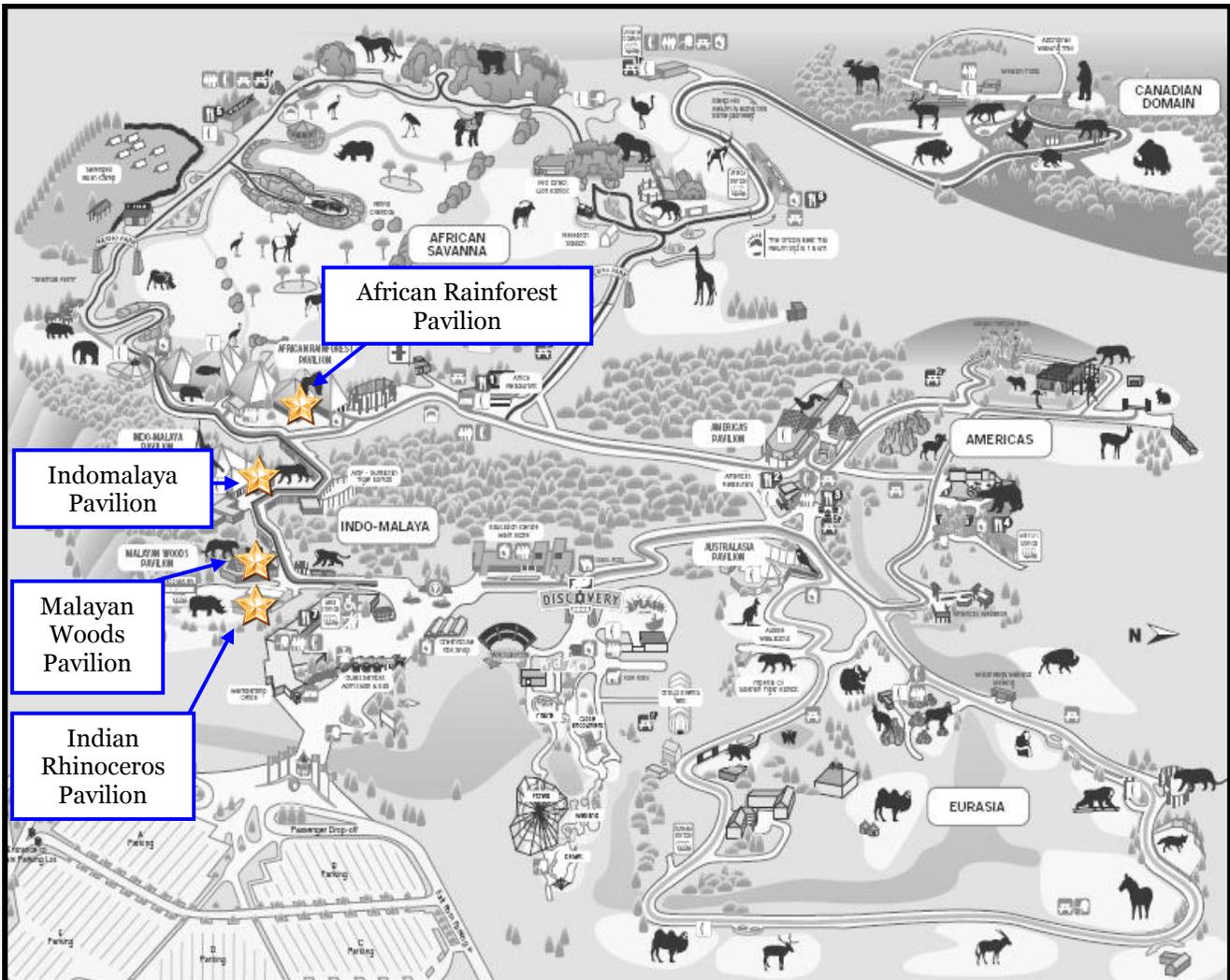
## ANIMAL DIGESTIVE SYSTEMS SELF-GUIDED TOUR

## Contents

- **Map** (p. 3)
- **Curriculum Objectives** (p. 4)
- **Introduction** (p.4) – The human digestive system; the digestive process in humans; animal digestion; teeth
- **Tour** (p. 6)
  - **Indian Rhinoceros Pavilion** (p. 6) – Indian rhinoceros, Malayan tapir
  - **Malayan Woods Pavilion** (p. 7) – Butterflies, red-tailed green ratsnake
  - **Indomalaya Pavilion** (p. 8) – Jumbo gourami, fish tank, gaur, reticulated python, orangutan, crocodile newt
  - **African Rainforest Pavilion** (p. 10) – Western lowland gorilla, West African dwarf crocodile, African bonytongue, sacred ibis
- **Conclusion** (p. 12) – Conclusion

## Site Map

★ = Stops on your tour



## Grade 5 Curriculum Objective:

Demonstrate an understanding of the structure and function of the digestive system and the organs within the system.

## INTRODUCTION

*The following discussion outlines suggested topics for review prior to visit.*

### The human digestive system

- Before we discuss how we process our food, we'll begin with an important question: why do we eat? Eating food allows us to get energy for our bodies to work, and nutrients to allow us to grow.
- When we eat, our body must break down our food into smaller molecules so that it may be used. This is the process of *digestion*.
- We have a special organ system used to break down food. What is it called? The *digestive system*.
- Two types of digestion occur when we eat. The first is called *mechanical digestion*. This is the process of breaking down food into smaller pieces, like when we chew.
- The second type of digestion is *chemical digestion*, which occurs when enzymes break down food to retrieve nutrients that can be broken down into smaller molecules and used by the body.

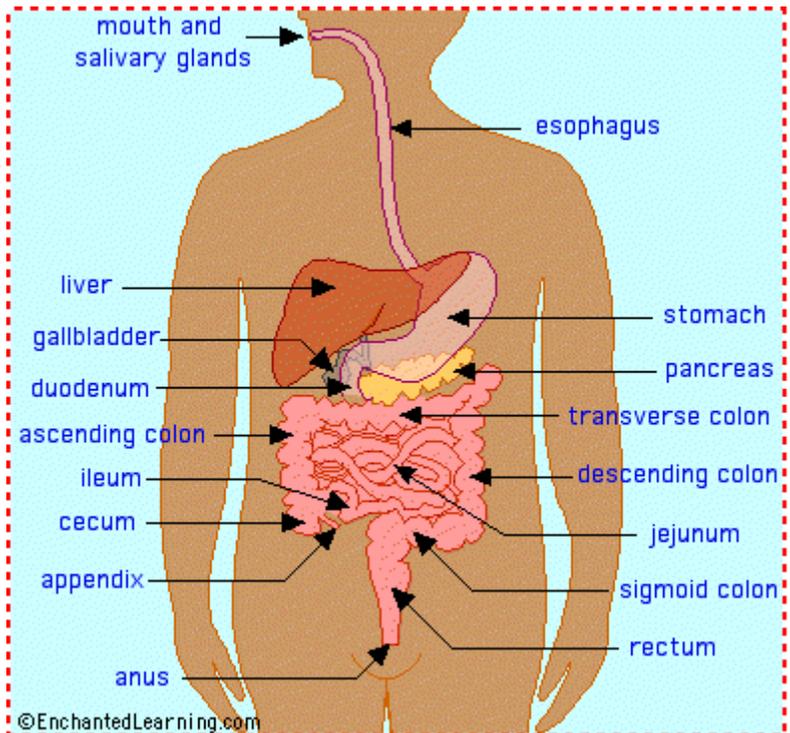
### The digestive process in humans

#### Mouth

- The first step begins while food is still inside our mouths. We take in food, and begin to break it down by chewing it.
- Our saliva helps to begin the break down of food by softening it so we can swallow easily. Food that has been softened by saliva is called a *bolus*.

#### Oesophagus

- When we swallow, food travels down the tube-like oesophagus. The oesophagus is a very strong muscle that makes wave-like movements, pushing food downward. The oesophagus is so strong that it would allow you to swallow even if you were standing on your head! (But of course, we wouldn't suggest trying this!)



### Stomach

- Once the food enters the stomach, it is churned and broken down by gastric juices. These juices are acidic and turn the food into a pasty substance called *chyme*. Food can stay in the stomach for several hours at a time.
- Humans are *monogastric* which means that we have only one stomach.

### Small Intestine

- In the small intestine, food is further broken down so that it may be absorbed into the bloodstream. The nutrients absorbed by the body provide energy and allow growth.

### Large Intestine

- Any left over food which has not yet been digested goes through the large intestine. Salts, minerals, water, and vitamins are absorbed through this organ.

### Rectum / Anus

- The final stop is the rectum and anus. Any waste that our bodies don't use is excreted through the anus.

## Animal Digestion

- Do animals digest their food the same way we do? Not always. The digestive systems of different animals change depending on what they eat.
- Some herbivores, like rhinos, elephants, and zebras, are monogastric like people. As we learned before, this means that they have only one stomach.
- Like us, these animals use their mouth, oesophagus, stomach, and intestines much the way we do, but they have an added feature – the *cecum*. After passing through the intestines, food is further digested by specialized micro-organisms and bacteria. These live inside the cecum and release nutrients by eating plant material.
- Other herbivores, called *ruminants*, have more than one stomach. Their digestive systems are useful as plants are difficult to digest. Cell walls of plants consist of cellulose which cannot be digested by humans. Ruminants, however, are able to digest cellulose with the help of special micro-organisms living in their stomachs.
- While herbivores have a relatively long digestive process to break down tough foods, carnivores break down food much faster.
- Birds have very different digestive processes from other animals. Their beak and tongue allows them to pick up and move food for swallowing. The oesophagus is large, allowing birds to swallow food whole since they do not chew.
- Many birds have a *crop*. The crop holds food so that the bird can eat very quickly, and fly away to digest somewhere safe. Like our saliva, the crop moistens food to prepare it for digestion.
- Instead of a stomach, birds have a gizzard used for mechanical digestion. Pebbles and sand in the gizzard help to grind up the food. Any materials that cannot be digested, such as bones and fur, are caught by the gizzard and formed into a pellet to be regurgitated.
- These are just some examples of the many different ways animals digest their food. As we tour through the Zoo, we will learn more about how animals process their food.

## Teeth

- We know that teeth are important in the process of mechanical digestion. Why does the shape of an animal's teeth matter?
- What might a carnivore's teeth look like? Animals that eat meat often have very sharp teeth. This is important as it helps them bite through skin and flesh.
- Herbivores often have pointed teeth at the front of their mouths to help them snip vegetation to eat. The back of their mouths holds flatter molars for grinding up plant matter.
- Knowing what carnivore and herbivore teeth look like, how do you think omnivore teeth would look? Since omnivores eat both plants and animals, they have both flat molars and sharp teeth for biting.
- What do our teeth look like? Our teeth are those of an omnivore.

## TOUR

### Indian Rhinoceros Pavilion

#### Indian rhinoceros

- The rhino is a *monogastric herbivore*. This means that it is a plant-eater with only one stomach. These animals eat grasses, leaves, and branches.
- Rhinos are called *browsers* meaning that they will lift their heads to eat shrubs and small trees. You may have heard of the term *grazer* which is similar. Grazers are animals like cattle which feed on grass.
- We have learned that the process of digestion begins with the mouth. How do you think this animal gets food into its mouth? Rhinos use their prehensile lips almost like we would use our hands to grasp and hold things.
- These animals have flat molars which are perfect for grinding down food.
- We know that the rhino is monogastric, and we learned earlier about the special added feature some herbivores have to aid digestion. What is this organ called? The *cecum* contains micro-organisms like bacteria and protozoa which break down cellulose. The colon also aids in this. This process is called *hindgut fermentation*.
- At the Zoo, the rhinos eat hay, barley, some fruit, and a prepared herbivore ration.



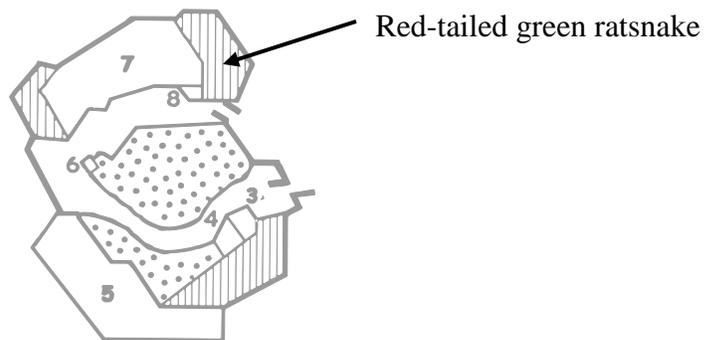
#### Malayan tapir

- Like the rhino, the tapir is also a monogastric herbivore.
- Tapirs use their snout to forage for food. It uses its senses of smell and touch to search

through vegetation. Hairs at the tip of the snout allow it to feel around.

- Once food is located, the snout can fold out of the way so that the tapir can grasp it with its teeth.
- Also like the rhino, tapirs have special bacteria in their cecum to break down cellulose.
- At the Zoo, the tapir eats alfalfa hay, herbivore cubes, apples, lettuce and carrots.

## Malayan Woods Pavilion



### **Butterflies** (throughout pavilion)

- Butterflies' mouths are different from our own. Butterflies have a long appendage, somewhat like a straw, called a *proboscis*. The proboscis allows the butterfly to drink juices.
- While most butterflies drink nectar from flowers, some actually drink tears! These butterflies sweep their proboscises over the eyes of grazing animals to cause their eyes to tear. The butterflies can then drink the fluid.
- At the Zoo, the butterflies' main diet consists of fruit like oranges.

### **Red-tailed green ratsnake**

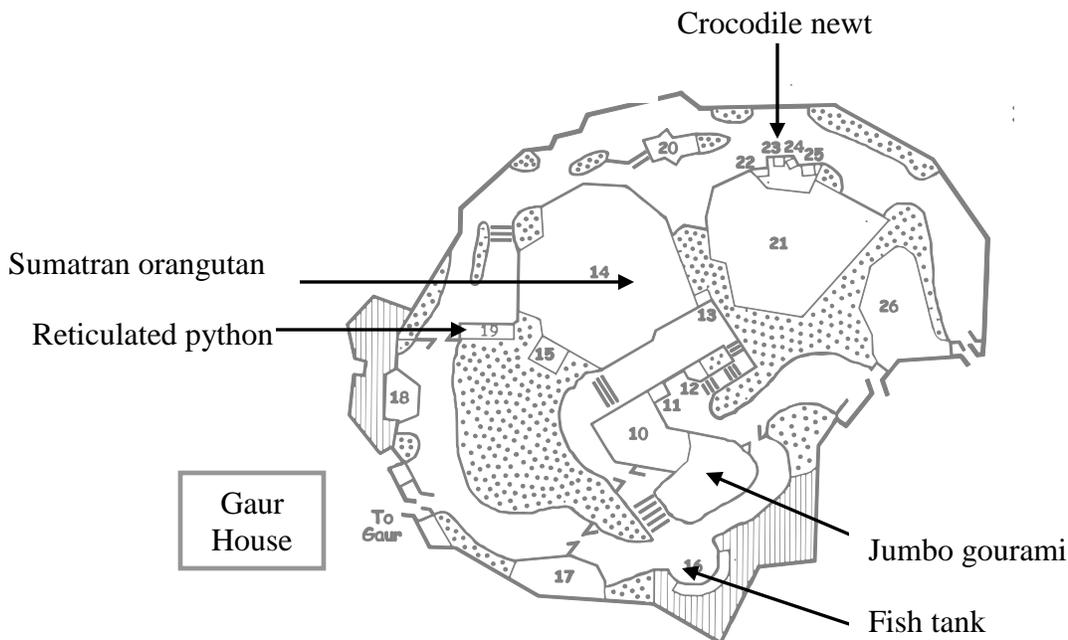
- This animal is a *monogastric carnivore*. What does this mean? It means that the snake is a meat-eater with one stomach.
- Snakes swallow their food whole.
- What do you think this animal eats? This snake eats small mammals like mice, and other small animals like birds or lizards.



- This species may constrict around the prey to kill it, and secure it while it grabs a hold of the animal using its mouth.
- The snake's jaws *disarticulate* while it eats its prey. This means that specialized joints open up to allow the jaw to become wider (note: contrary to popular belief, snakes do not "dislocate" their jaws; no unhinging occurs).

- Snakes do not chew their food, but rather swallow everything whole. They “walk” their jaw along the prey’s body, moving alternating sides forward until the last of the item enters the mouth.
- Do you think snakes have an oesophagus? Much like in people, the snake’s oesophagus pushes food into the body using wave-like motions. These movements are called *peristalsis*.
- The snake has strong stomach acids to dissolve bones. Sometimes, the fur remains and can be seen in the feces.
- As we learned before, carnivores have much shorter digestive systems than herbivores. Snakes cannot process plant matter at all; it passes through the body untouched.
- It takes days or even weeks for the snake to digest. Body temperature determines how fast the process occurs.
- Reptiles such as snakes, as well as birds and amphibians, do not have an anus. Once the waste is ready to be excreted, it passes through an opening called the *cloaca*. The cloaca is the point of exit for both the intestinal and urinary tract (note: both marsupials and monotremes, although mammals, have cloacas).

### Indomalaya Pavilion



### Jumbo gourami



- These fish are *omnivores*. What does this mean? Gouramis eat both plant and animal matter. Foods include aquatic weeds, fish, frogs, and worms.
- The mouth is near the top of the head as food is retrieved from the surface of the water. The location

of the mouth is also important as gouramis are air breathers.

- Seeds of eaten vegetation pass through the gourami's system. Gouramis are seed dispersers, meaning that as they defecate, the seeds are passed on to grow into new vegetation.

### Fish tank

- Fish have similar digestive systems to other animals. As we have seen, food enters the mouth, passes through the oesophagus to the stomach, and through the intestines.
- Also like other animals, fish that are herbivores have longer digestive systems than do meat-eating fish.
- Fish have very different teeth depending on their main food sources. For example, some fish have long and sharp teeth to grasp and keep control of prey, or even tear flesh apart. Other fish that eat small matter have bristle-like teeth for sweeping debris out of the water.

### Gaur

- The gaur is a ruminant. What does this mean? As we learned, ruminants are animals with more than one stomach. Gaurs have four chambers.
- The *rumen* is the first stomach. Bacteria assist in turning the plant matter into a pulpy substance.
- After the rumen, food moves through the *reticulum*. The reticulum forms food into a cud to be regurgitated. The gaurs then re-chew the food.
- Once the gaur has again swallowed the food, it passes to the *omasum*. This organ acts in much the same way that the saliva in our mouth does to further break down the food.
- Finally comes the *abomasum*, or the "true stomach". It is the last stomach and prepares the food so that the intestines may absorb the nutrients.
- At the Zoo, gaurs are fed herbivore cubes, timothy hay, and beet-pulp blocks.

### Reticulated python



- We learned about snake digestion earlier when we saw the red-tailed green ratsnake. What kind of digestive system do these carnivores have? Snakes are monogastric.
- Would you believe that this snake can open its mouth wide enough to eat a goat? It's true! Through disarticulation, snakes are able to open wide and stretch out the elastic connective tissue on their mandible (lower jaw).
- Similar to the red-tailed green ratsnake, the python "walks" its jaw along the prey to devour it. Specialized backward-facing teeth help to ensure that the prey is secure in the mouth.
- Just like we do, snakes need to be able to breathe while they eat, but with such a huge mouthful, how is breathing possible? While eating, a special tube is exposed in the snake's mouth which allows for air exchange.

### Sumatran orangutan

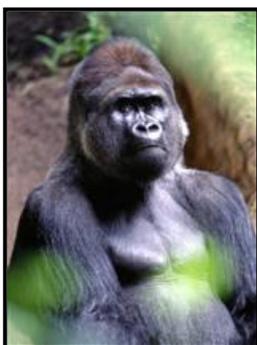
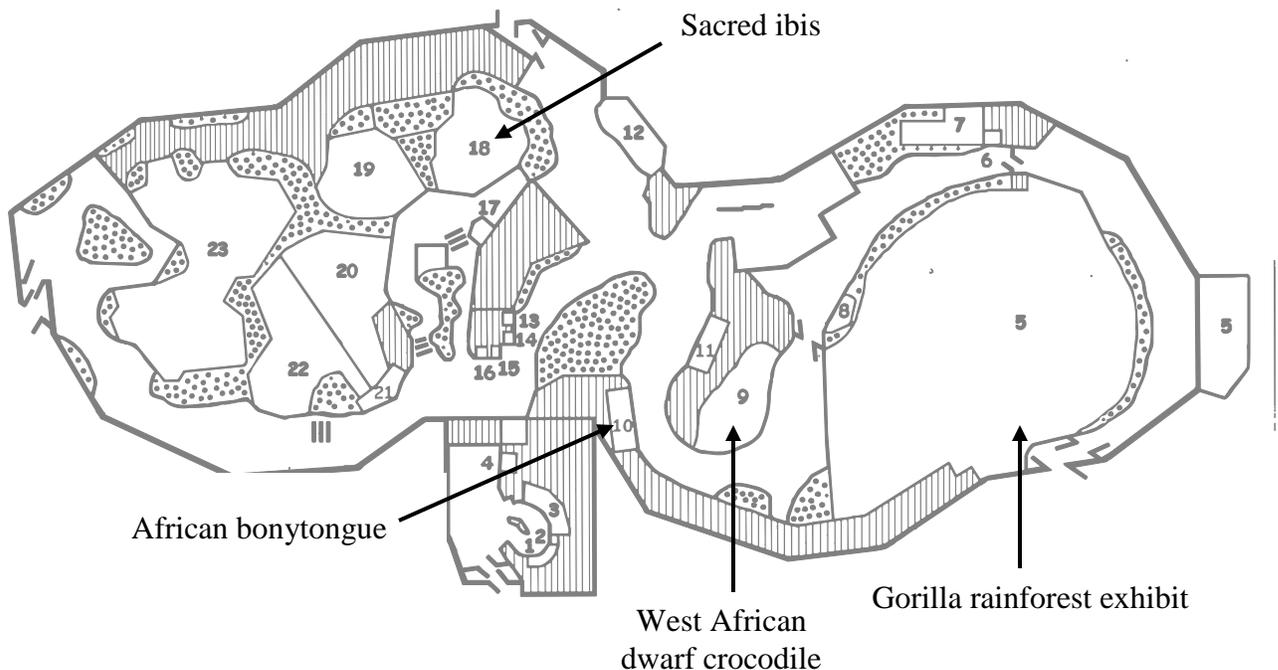
- Orangutans are omnivores meaning that they eat both plant and animal matter. They enjoy fruit, leaves, nuts, shoots, insects, and sometimes birds and small mammals.
- The digestive system of an orangutan is more similar to that of a carnivore than an herbivore. This means that these animals consume high quantities of food daily as their digestive systems are rather inefficient at processing plant matter.
- At the Zoo the orangutans eat a gelatine diet as well as fresh fruits and vegetables.



### Crocodile newt

- Like snakes, this animal is a monogastric carnivore.
- A newt's diet in the wild would consist mainly of insects, so these animals are a type of *insectivore*.
- At the Zoo, the newts are fed pinkie mice and beef heart gelatine.

## African Rainforest Pavilion



### Western lowland gorilla

- Gorillas are herbivores with only one stomach.
- We learned that herbivores have a longer digestive system than carnivores. Gorillas are one example. They have long intestines, and eat lots of food which stays in the body for a long time. This is called *residence time*, and the longer journey of the food through

the intestines allows for more nutrients to be extracted than otherwise would be.

- Gorillas spend much of their day eating, and consume various plant matters including fruit, shoots, flowers, leaves, and more.
- While gorillas have large canine teeth, they also have molars suited for breaking down plant material.

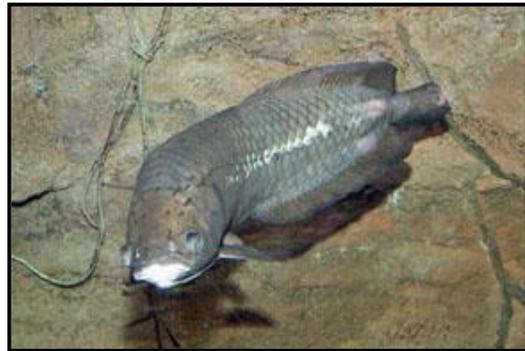
### West African dwarf crocodile

- Is this animal an omnivore, carnivore, or herbivore? Again similar to snakes, this animal is a monogastric carnivore.
- The crocodile will eat small animals like fish and amphibians, and also carrion (dead animals).
- Sharp teeth and extremely powerful jaws help the crocodile grab onto prey.
- *Gastroliths* or “gizzard stones” are small pebbles or stones that stay inside the digestive tract of crocodiles and some other animals, and grind food down, much like teeth would.



### African bonytongue

- This fish is known as a filter-feeder. Even though it looks big, bonytongues actually eat tiny little particles of food like zooplankton and algae.
- To retrieve food from the water, the bonytongue has a special organ that secretes mucus over a spiral shaped filter (over part of the gill arch). This mucus traps particles to be drawn into the mouth.
- These fish are monogastric omnivores.



### Sacred ibis

- These birds are monogastric carnivores, eating small animals like fish, frogs, and insects.
- Their curved beaks allow them to pick up prey from water and sift through mud.
- These are an example of a bird with a *crop*. This organ provides storage for food until the bird reaches a safe place and is able to digest.
- We learned that the gizzard of birds often contains gastroliths to aid in mechanical digestion. These are present in the ibis.

## CONCLUSION

### Sample Discussion Questions

- What are some examples of monogastric herbivores and ruminants that we saw today?
  - The Indian rhinoceros and Malayan tapir are examples of monogastric herbivores. They digest plant materials through hindgut fermentation.
  - The Gaur is a ruminant and possesses four stomachs to aid in its digestion.
- What is a difference between the digestive system of a monogastric herbivore and a monogastric carnivore? What are examples of each of these that we saw today?
  - Monogastric herbivores have long intestines and eat lots of food which can stay in the body for a long time. This allows for more nutrients to be extracted than otherwise would be. Examples include Indian rhinoceros, Malayan tapir, and Western lowland gorilla.
  - Monogastric carnivores have shorter intestines than herbivores and are unable to fully digest plant material. However, animal material is digested quite quickly. Examples include Red-tailed green ratsnake, Reticulated python, Crocodile newt, West African dwarf crocodile, and Sacred ibis.
- We know the gaur is a ruminant because it has four stomachs, what animals found on a farm do you think are also defined as ruminants?
  - Animals found on a farm that are defined as ruminants include cattle, sheep, and goats. (Note: Some students may suggest horses, however horses perform hindgut fermentation similar to the rhino and tapir, therefore they are not ruminants!)
- What is the main difference between the teeth of carnivores and herbivores?
  - Carnivore teeth are sharp and used for tearing flesh, whereas herbivores have pointed teeth at the front of their mouths to help them snip vegetation to eat and flat molars at the back of their mouth which are used for grinding up the plant material.
- Thinking about your own teeth, would you consider yourself a carnivore, herbivore or omnivore?
  - Humans possess both sharp teeth for tearing and flat teeth for grinding, we are considered omnivores.