

RAPTORS IN ACTION

PROGRAM OVERVIEW

TOPIC: Small theropods known as “raptors.”

THEME: Explore the adaptations that made raptors unique and successful, like claws, intelligence, vision, speed, and hollow bones.

PROGRAM DESCRIPTION: Razor-sharp teeth and sickle-like claws are just a few of the characteristics that have made raptors famous. Working in groups, students will build a working model of a raptor leg and then bring it to life while competing in a relay race that simulates the hunting techniques of these carnivorous animals.

AUDIENCE: Grades 3–6

CURRICULUM CONNECTIONS:

- Grade 3 Science: Building with a Variety of Materials
- Grade 3–6 Math: Patterns and Relations
- Grade 4 Science: Building Devices and Vehicles that Move
- Grade 6 Science: Evidence and Investigation

PROGRAM OBJECTIVES:

1. Students will understand the adaptations that contributed to the success of small theropods.
2. Students will explore the function of the muscles used in vertebrate movement and the mechanics of how a raptor leg works.
3. Students will understand the function of the raptorial claw.
4. Students will discover connections between small theropod dinosaurs and birds.

RAPTORS IN ACTION

SUGGESTED PRE-VISIT ACTIVITIES

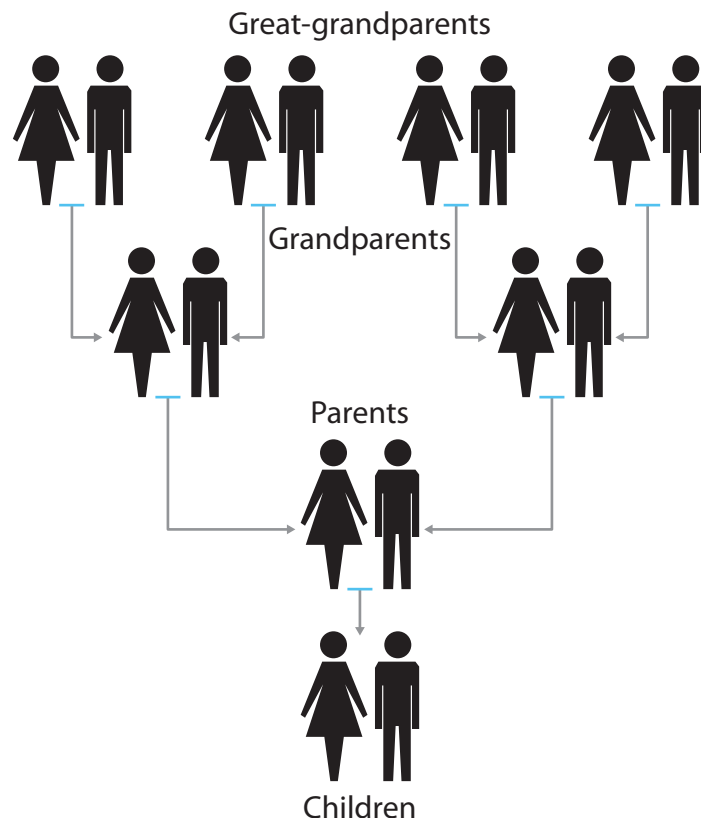
UNDERSTANDING CLADISTICS

Animals and plants are often referred to as part of a family or group. For example, the dog is part of the canine family (along with wolves, coyotes, foxes, etc.). Scientists group living things together based on relationships to gain insight into where they came from. This helps us identify common ancestors of different organisms.

This method of grouping is called “cladistics.” Cladistics is a system that uses branches like a family tree to show how organisms are related to one another. When organisms look similar to each other, or have similar behaviours, we assume that they have these similarities because they came from the same ancestor. When organisms are grouped together on one branch of the “tree,” this means they are more closely related to each other than to any other organism.

A helpful way to understand how organisms are related is to think of them as part of a family group.

e.g. This is a simple family tree showing familiar relationships.



RAPTORS IN ACTION

SUGGESTED PRE-VISIT ACTIVITIES

I. ORGANIZE THE ANIMALS

OBJECTIVE: To understand how animals can be grouped differently, depending on classification method.

Cladograms can be made for any animal or plant group. There are many ways to group animals. They can be organized based on geography, number of limbs, animal type, etc. Try to create as many groups as you can with the animals below, then fill out the cladograms on the next page. One example has been completed for you.



Frog



Butterfly



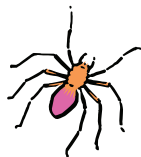
Dolphin



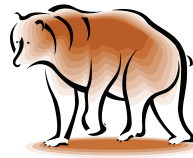
Horse



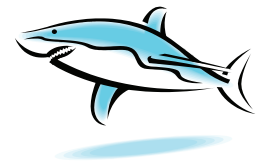
Lizard



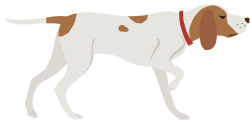
Spider



Bear



Shark



Dog



Monkey



Sea Turtle



Tiger



Pig



Platypus



Owl



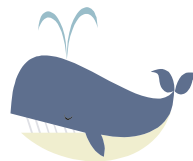
Starfish



Cow



Ant



Whale

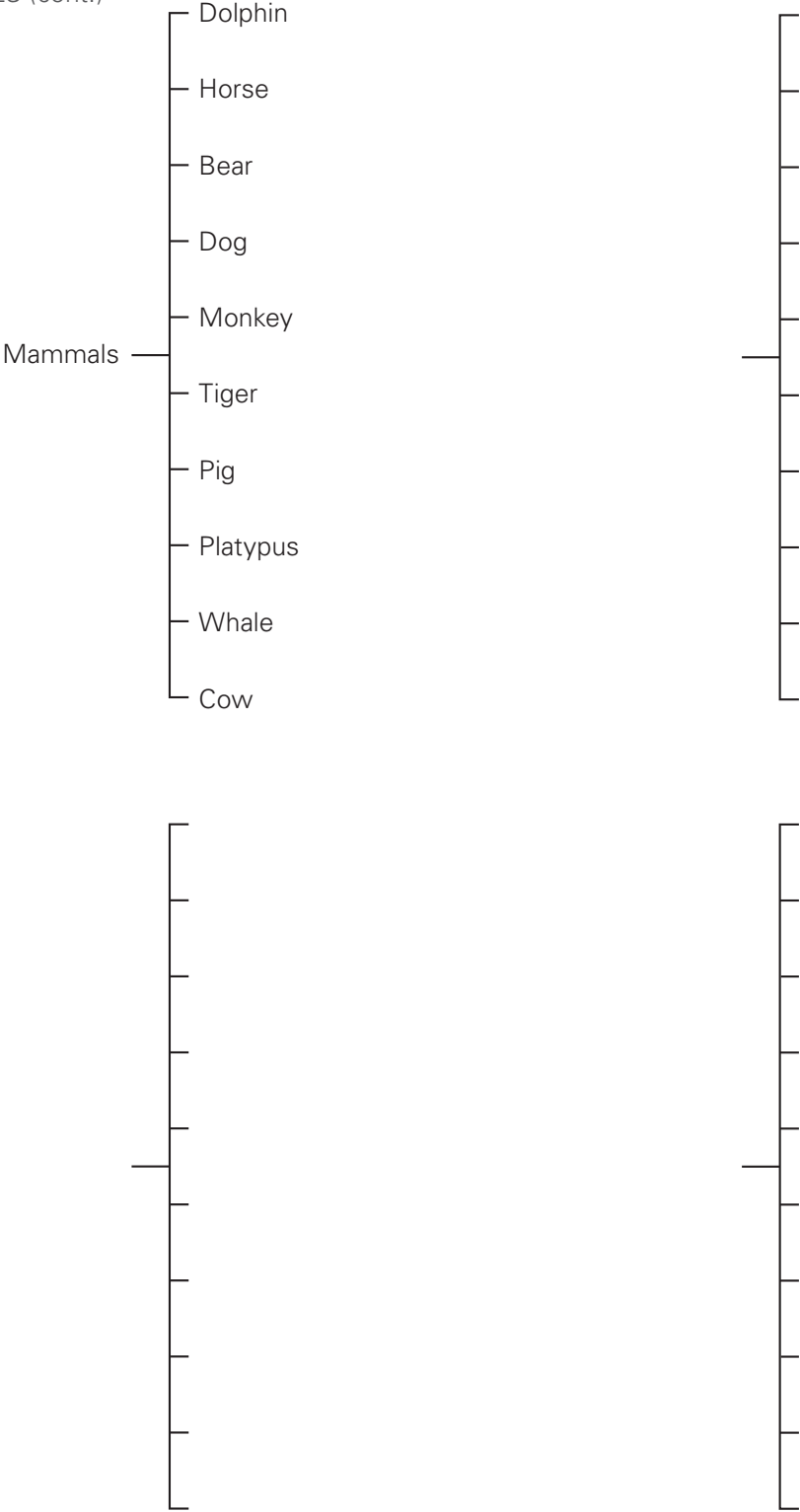


Goldfish

RAPTORS IN ACTION

SUGGESTED PRE-VISIT ACTIVITIES

I. ORGANIZE THE ANIMALS (cont.)



RAPTORS IN ACTION

SUGGESTED PRE-VISIT ACTIVITIES

I. ORGANIZE THE ANIMALS (cont.)

A vertical line with a horizontal bar at the top and bottom, forming a bracket. There are 11 short horizontal tick marks along the vertical line, with one tick mark positioned slightly to the left of the rest.

A vertical line with a horizontal bar at the top and bottom, forming a bracket. There are 11 short horizontal tick marks along the vertical line, with one tick mark positioned slightly to the left of the rest.

A vertical line with a horizontal bar at the top and bottom, forming a bracket. There are 11 short horizontal tick marks along the vertical line, with one tick mark positioned slightly to the left of the rest.

A vertical line with a horizontal bar at the top and bottom, forming a bracket. There are 11 short horizontal tick marks along the vertical line, with one tick mark positioned slightly to the left of the rest.

RAPTORS IN ACTION

SUGGESTED PRE-VISIT ACTIVITIES

II. DINOSAUR GROUPS

At the bottom of this page is a list of dinosaur groups. Divide the class into small teams and designate one dinosaur group to each team. Have the teams research their group and answer the following questions:

1. What types of dinosaurs are in your dinosaur group? List as many as you can find.
2. Look for descriptions and images of the dinosaurs in your group to help you identify characteristics that they share. Describe their appearance and behaviour to better understand why scientists group them together. Asking questions will help you find shared traits. Do they all have horns? Do they eat meat? Do they walk on four legs?

After completing questions one and two, join two teams together and complete the activities below. Check the teacher's answer sheet for some suggested group pairings.

3. Compare your two groups. Can you find any similar features between the two groups? Can you see any differences between them? List the similarities and differences.
4. Based on what you have discovered in question three, determine whether or not your dinosaur groups would be positioned closely together on a cladogram or on separate branches?

DINOSAUR GROUPS:

Hadrosaurs	Sauropods
Stegosaurus	Therizinosaurs
Spinosaurus	Tyrannosaurs
Ceratopsians	Ornithomimids
Ankylosaurus	Pachycephalosaurs

TEACHER'S NOTE: Finding images or detailed descriptions for each dinosaur group might not be possible, as some of these finds are not yet well known. Have the students try and find at least two images for their dinosaur group to get a general idea of the animals' physical traits.

RAPTORS IN ACTION

POST-VISIT ACTIVITIES

I. RAPTOR SCIENTIFIC NAMES DECODED

The dinosaurs commonly known as 'raptors' belong to the dromaeosaur family. Following are two lists of scientific names of dinosaurs. Each species has a two-part name; a genus name and a species name, in that order. This is a standard naming system known as taxonomy. The first list contains names of dromaeosaurs from around the world. Notice that not all dromaeosaurs have the word 'raptor' in their name. 'Raptor' is a common term used as a synonym for dromaeosaur. However, the term 'raptor' describes behaviour, not a type of dinosaur. This is best demonstrated by the second list, which contains names of dinosaurs that have the word 'raptor' but are not dromaeosaurs.

DROMAEOSAURS

<i>Achillobator giganticus</i>	<i>Adasaurus mongoliensis</i>
<i>Atrociraptor marshalli</i>	<i>Buitreraptor gonzalezorum</i>
<i>Deinonychus antirrhopus</i>	<i>Dromaeosaurus albertensis</i>
<i>Microraptor zhaoianus</i>	<i>Sauornitholestes langstoni</i>
<i>Utahraptor ostrommaysorum</i>	<i>Velociraptor mongoliensis</i>

NON DROMAEOSAURS

<i>Oviraptor philoceratops</i>
<i>Eoraptor lunensis</i>
<i>Conchoraptor gracilis</i>
<i>Sinraptor dongi</i>
<i>Gigantoraptor erlianensis</i>

ACTIVITY PART 1: GENUS NAMES

To better understand these dinosaur names, use the list of descriptors on the next page as a decoder.

Remember, the genus name is the capitalized word and is the first word in the two-part name. A descriptor is a word that describes or tells us something about the animal. Most of these descriptors are Latin or Greek root words.

RAPTORS IN ACTION

POST-VISIT ACTIVITIES

PART 2: SPECIES NAMES

Try and figure out what these species names mean on your own. Most of the descriptors for the species names are not included in the list, so you may want to do an internet search. Keep in mind that species are often named for places or people. *Remember, the species name is the second word in the two-part name.*

PART 3: CREATE YOUR OWN DINOSAUR NAME

Look at the list of descriptors and choose one noun and two adjectives. Combine these descriptors to invent your very own dromaeosaur name. Draw what your dromaeosaur would have looked like based on what its name means. You can also create a dramatic landscape that reveals an environment in which this animal might have thrived.

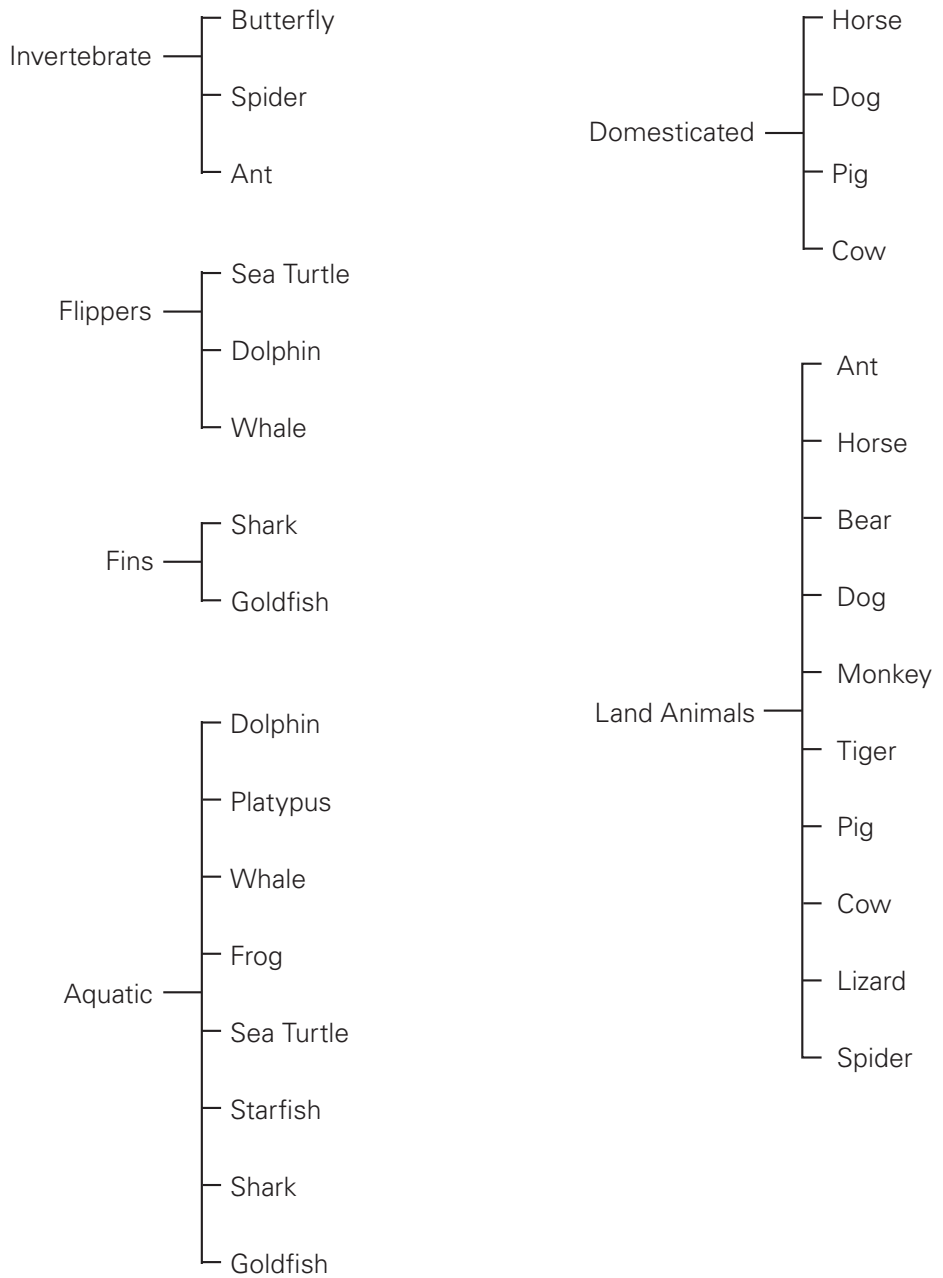
DESCRIPTORS

<i>Achilles</i>	Greek	a Greek warrior in the Trojan War
<i>Ada</i>	Mongolian	an evil spirit from Mongolian mythology
<i>Atrocitas</i>	Latin	cruel
<i>Bator</i>	Mongolian	warrior
<i>Concha</i>	Latin	seashell
<i>Deinos</i>	Greek	terrible
<i>Dromos</i>	Greek	running
<i>Eo</i>	Greek	early
<i>Gigantos</i>	Greek	giant
<i>Gracilis</i>	Latin	thin
<i>La Buitrera</i>	Spanish	a location in Rio Negro Province of Argentina
<i>Lestes</i>	Greek	robber
<i>Lunaris</i>	Latin	of the moon
<i>Mikro</i>	Greek	small
<i>Onych</i>	Greek	claw
<i>Ornithos</i>	Greek	bird
<i>Ovum</i>	Latin	egg
<i>Philia</i>	Greek	love for
<i>Raptor</i>	Latin	robber or plunderer
<i>Saurus</i>	Greek	lizard
<i>Sino</i>	Latin	Chinese
<i>Veloci</i>	Latin	swift

RAPTORS IN ACTION

PRE-VISIT ACTIVITY ANSWER KEY

I. ORGANIZE THE ANIMALS



TEACHER'S NOTE: These are only a few examples of the possibilities. Essentially all answers are correct as long as the students can justify how they are dividing up their groups.

RAPTORS IN ACTION

PRE-VISIT ACTIVITY ANSWER KEY

II. DINOSAUR GROUPS

1. What types of dinosaurs are in your dinosaur group? List as many as you can find.

Hadrosaurs: *Telmatosaurus, Brachylophosaurus, Edmontosaurus, Gryposaurus, Kritosaurus, Lophorhothon, Maiasaura, Naashoibitosaurus, Prosaurolophus, Saurolophus, Wulagasaurus*

Stegosaurs: *Stegosaurus, Kentrosaurus, Paranthodon, Monkonosaurus, Hesperosaurus, Dacentrurus, Maragaia, Wuerhosaurus, Chialingosaurus, Tuojiangosaurus*

Spinosaurs: *Spinosaurus, Baryonyx, Suchomimus, Suchosaurus, Cristatusaurus, Angaturama*

Ceratopsians: *Achelousaurus, Albertaceratops, Avaceratops, Brachyceratops, Centrosaurus, Einiosaurus, Monocloniu, Pachyrhinosaurus, Styacosaurus, Agujaceratops, Anchiceratops, Arrhinoceratops, Chasmosaurus, Eotriceratops, Nedoceratops, Pentaceratops, Torosaurus, Triceratops, Turanoceratops*

Ankylosaurs: *Ankylosaurus, Euoplocephalus, Nodocephalosaurus, Pinacosaurus, Saichania, Shanxia, Talarurus, Tarchia, Tianzhenosaurus, Tsagantegia*

Sauropods: *Apatosaurus, Supersaurus, Suuwassea, Barosaurus, Diplodocus*

Therizinosaurs: *Thrizinosaurus, Suzhousaurus, Segnosaurus, Nothronychus, Neimongosaurus, Nanshiungosaurus, Erlikosaurus, Erliansaurus, Enigmosaurus*

Tyrannosaurs: *Tyrannosaurus, Daspletosaurus, Albertosaurus, Gorgosaurus, Alioramus, Tarbosaurus*

Ornithomimids: *Anserimimus, Archaeornithomimus, Dromiceiomimus, Gallimimus, Ornithomimus, Sinornithomimus, Struthiomimus*

Pachycephalosaurs: *Alaskacephale, Colepiocephale, Goyocephale, Hanssuesia, Homalocephale, Prenocephale, Stegoceras, Tylocephale*

RAPTORS IN ACTION

PRE-VISIT ACTIVITY ANSWER KEY

2. Look for descriptions and images of the dinosaurs in your group to help you identify characteristics that they share. Describe their appearance and behaviour to better understand why scientists group them together. Asking questions will help you find shared traits. Do they all have horns? Do they eat meat? Do they walk on four legs?

HADROSAURS

Similarities:

- quadrapedal (four-legged) and bipedal (two-legged)
- duck-bill mouth structure
- toothless bill but many teeth in jaw
- herbivore
- large

Differences

- some had flat heads and others had crests

CERATOPSIANS

Similarities:

- quadrapedal (four-legged) with longer hind legs
- horns on face
- frill
- beak
- herbivore

Differences:

- horn and frill structures differ for each

STEGOSAURS

Similarities:

- quadrapedal (four-legged)
- double row of plates along back
- spikes on tail
- herbivore

Differences:

- Some plates were paired, while others were alternating rows

ANKYLOSAURS

Similarities:

- quadrapedal (four-legged)
- body armour
- herbivore
- bony tail club

Differences:

- none

SPINOSAURS

Similarities

- bipedal (two-legged)
- carnivore
- medium-sized
- piscivorous (fish-eating)
- serrated teeth
- long skull
- three-fingered
- sail-like ridge of skin on back of the spine
- curved claw on thumb

Differences:

- none

SAUROPODS

Similarities:

- quadrapedal (four-legged)
- herbivore
- long, whip-like tail
- long neck
- large claw on the inside digit (finger) of the hand
- slender teeth

Differences:

- none

RAPTORS IN ACTION

PRE-VISIT ACTIVITY ANSWER KEY

THERIZINOSAURS

Similarities:

- bipedal (two-legged)
- herbivore
- extremely large claws
- three-fingered hands
- possibly feathered

Differences:

none

TYRANNOSAURS

Similarities:

- bipedal (two-legged)
- large
- carnivore
- serrated teeth
- large head
- very small forearms
- possibly scavenger
- two-fingered

Differences:

none

ORNITHOMIMIDS

Similarities:

- believed to be omnivores
- hollow bones
- medium-sized
- small head
- “ostrich-like”
- long arms

Differences:

some had teeth, but most had toothless beaks

PACHYCEPHALOSAURS

Similarities:

- bipedal (two-legged)
- thick skull
- believed to be omnivores

Differences:

none

3. Compare your two groups. Can you find any similar features between the two groups? Can you see any differences between them? List the similarities and differences.

HADROSAURS VS. THERIZINOSAURS

Similarities:

herbivore

Differences:

- two-legged vs. both two-legged and four-legged
- sharp claws vs. rounded toes
- feathered vs. not feathered

ANKYLOSAURS VS. CERATOPSIANS

Similarities:

- quadrupedal (four-legged)
- herbivore
- size (generally)

Differences:

different weapons and protection
(club tail & armour vs. frill and horns)

RAPTORS IN ACTION

PRE-VISIT ACTIVITY ANSWER KEY

PACHYCEPHALOSAURS VS. SAUROPODS

Similarities:

none

Differences:

bipedal vs. quadrupedal

different diets (omnivore vs. herbivore)

size

ORNITHOMIMIDS VS. STEGOSAURS

Similarities:

none

Differences:

quadrupedal vs. bipedal

different diets (omnivore vs. herbivore)

size

TYRANNOSAURS VS. SPINOSAURS

Similarities:

bipedal

carnivore

serrated teeth

Differences:

two-fingered vs. three-fingered

size

4. Based on what you have discovered in question three, determine whether or not your dinosaur groups would be positioned closely together on a cladogram or on separate branches?

Explain that answering either way is correct. It depends on which level of division the students have used. Technically, ornithomimids and stegosaurus do have something in common; they are both reptiles, and even more so, are both dinosaurs. However, when looking at their physical makeup more closely, it is obvious that they have very little in common and would be sitting on much different branches of a cladogram "tree."

RAPTORS IN ACTION

POST-VISIT ACTIVITY ANSWER KEY

RAPTOR SCIENTIFIC NAMES DECODED—PART 1 & 2

DROMAEOSAURS

Achillobator giganticus Achilles warrior giant

Adasaurus mongoliensis Evil spirit from Mongolia

Atrociraptor marshalli Cruel robber, named for Wayne Marshall who discovered the holotype

Buitreraptor gonzalezorum La Buitrera (a location in Argentina) thief, brothers Fabian and Jorge Gonzalez discovered the holotype

Deinonychus antirrhopus Terrible claw, counter balance

Dromaeosaurus albertensis Running lizard, from Alberta

Microraptor zhaoianus Small robber, named for Zhao Xijin a vertebrate palaeontologist

Saurornitholestes langstoni Lizard bird robber, named for American palaeontologist and professor Wann Langston Jr.

Utahraptor ostrommaysorum Utah robber, named for American palaeontologists John Ostrom and Chris Mays, a former airline pilot and founder of the robotics effects company Dinamation

Velociraptor mongoliensis Swift robber from Mongolia.

NON DROMAEOSAURS

Oviraptor philoceratops Egg robber, lover of ceratopsians

Gigantoraptor erlianensis Gigantic robber from the Erlian Basin (a location in Central Asia – China/Mongolia) where the dinosaur was collected

Eoraptor lunensis Early robber of the moon

Sinraptor dongi Chinese robber, named for Chinese palaeontologist Dong Zhiming

Conchoraptor gracilis Sea-shell robber, thin

PART 3

Answers will vary depending on which descriptors are selected.