VERTEBRATE EVOLUTION SCAVENGER HUNT

EARTH SCIENCES museum

AGES 16 AND UP

NAME

DATE

Words in BLUE are defined on the back of the scavenger hunt.

The diversification of **VERTEBRATE** life has been well documented in the fossil record. The University of Waterloo Earth Sciences Museum has early examples of each major vertebrate group. Explore the museum, find these examples, and complete the following scavenger hunt.

1. The earliest reptile fossil found to date is *Hylonomis lyelii* from 312 million years ago (MYA). The earliest reptile in the Museum is 250 to 299 MYA. Its name is: **C** _ _ _ _ _ _ _ **N** _ _ .
2. Mammals are the only living **SYNAPSIDS**. The synapsid skull only has one temporal fenestra (opening). This mammal, which is often mistaken for a dinosaur, is the oldest synapsid represented in the museum: _ _ **M** _ _ _ _ **D** _ _ .
3. Birds are descended from Dinosaurs, and in particular, **THERAPSID** dinosaurs which had lizard-like hips. The largest example of a **SAURISCHIAN** hip at the Museum belongs to _ _ _ **E** _ _ _ **S** _ **U** _ _ _ . A smaller cousin of *Tyrannosaurus Rex.*
4. The other major group of dinosaurs is the **ORNITHISCHIAN**. The only example of the **ORNITHISCHIAN** hip in the Museum can be found on _ _ _ **A** _ _ _ _ **O** _ _ _ _ **U** _ , which is missing its back leg and tail.
5. The fishes that led to the earliest **AMPHIBIANS** were known as: **R** _ _ _ **I** _ **I** _ _ **I** _ _ .
6. Early fishes included sharks. There is only one shark fossil in the Earth Sciences Museum and it is a single tooth belonging to: **M** _ _ _ _ _ _ **O** _ .
7. The oldest **BATOIDEA** (Ray) in the museum was found in Western North America. It dates to 50 million years ago which is in the _ _ **C** _ _ _ era.
8. While birds are descended from **THERAPSID** dinosaurs, they are not direct descendants of *Tyrannosaurus Rex*. Several early birds have been discovered. **A** _ _ _ _ _ **O** _ **T** _ _ _ _ is an early 'protobird'.
9. Early jawed fishes included **PLACODERMS**. ***BOTHRIOLEPIS*** includes about 60 species found worldwide. These fish were also distinguished by their dermal _ **R** _ _ _ **R**.

Centre for Environmental and Information Technology (EIT)
200 University Avenue West, Waterloo, ON, Canada N2L3G1 | 519-888-4567, ext. 32469
earthmuseum@uwaterloo.ca waterloo.ca/earth-sciences-museum

UNIVERSITY OF WATERLOO

DEFINITIONS

VEREBRATE: An animal which has a brain enclosed in a skull and a segmented spinal column. Todays vertebrate groups include mammals, fish, birds, reptiles and amphibians.

THERAPSID: Any member of the major order of reptiles Therapsida of Permian and Triassic time (from 299 million to 200 million years ago). Therapsids were the stock that gave rise to mammals. (Encyclopedia Britannica)

SYNAPSID: A reptile with one temporal opening on each side of the skull. Synapsids evolved in the late Permian Period and were characterized by carrying their limbs under their body and developing front teeth that were different from their back teeth. (Dictionary.com)

SAURISCHIAN DINOSAURS: A saurischian, or "lizard-hipped" dinosaur, had a pelvis (hips) composed of three parts: the *ilium*, *ischium*, and *pubis*. What distinguishes saurischians (among other major characteristics; including a grasping hand, asymmetrical fingers, and a long, mobile neck) is the pubis that points downward and forward at an angle to the ischium. (UCMP)

ORNITHISCHIAN DINOSAURS: All ornithischians are united by a pubis pointing backward, running parallel with the ischium. The name "Ornithischia" means "bird-hipped," and birds also have pelvises in which the pubis points backwards. (UCMP)

AMPHIBIAN: Any cold- blooded vertebrate of the class Amphibia. Includes frogs and toads, newts and salamanders, and caecilians. Amphibian larvae are typically aquatic, breathing by gills, and the adults being typically semi terrestrial, breathing by lungs and through moist, glandular skin. (Dictionary.com)

BATOIDEA: Batoidea is a superorder of cartilaginous fish commonly known as *rays*. They and their close relatives, the sharks, comprise the subclass Elasmobranchii. Rays are the largest group of cartilaginous fishes, with well over 600 species in 26 families. Rays are distinguished by their flattened bodies, enlarged pectoral fins that are fused to the head, and gill slits that are placed on their ventral surfaces. (iNaturalist)

PLACODERM: The extinct armored fishes known as placoderms make up what is considered to be the earliest branch of the Gnathostome family tree – the earliest branch of the jawed fishes. Placoderms bore heavy bony armor on the head and neck, often with an unusual joint in the dorsal armor between the head and neck regions; this joint apparently allowed the head to move upwards as the jaw dropped downwards, creating a larger gape. However, most of the body was either naked or, less commonly, covered with small scales. Both of the placoderms shown above had long bodies with *heterocercal* (asymmetrical, shark-like) tails extending past the head armor. (UCMP)

BOTHRIOLEPIS: *Bothriolepis*, also spelled *Bothryolepis*, genus of extinct fishes of the order Antiarcha, class Placodermi, characteristic of the Middle and Late Devonian (from about 387 million to 360 million years ago). (Encyclopedia Britannica)

Centre for Environmental and Information Technology (EIT)
200 University Avenue West, Waterloo, ON, Canada N2L3G1 | 519-888-4567, ext. 32469
earthmuseum@uwaterloo.ca waterloo.ca/earth-sciences-museum

UNIVERSITY OF WATERLOO