# Topic Exploration Pack

# The Development of Species: Evolution and Class

**Task 1: Understanding Evolutionary Trees**

The diagram below shows a phylogenetic tree of species in the Hominidae family. Phylogenetic trees illustrate the evolutionary relationships that are thought to exist between species. This tree was constructed several decades ago based on fossil evidence and anatomical comparisons of the species.

Orangutans

*Genus: Pongo*

Humans

*Homo sapiens*

Chimpanzees

*Pan troglodytes*

Gorilla

*Gorilla gorilla*

Present

Genus: *Ramapithecus*

Time

1. Explain why the branch for *Ramapithecus* does not extend as far as the other species.
2. To which extant species (ie a species that is alive on Earth today) are humans most closely related, according to this tree?
3. On the diagram, circle the most recent common ancestor shared by gorillas and humans.
4. A student studied the tree and suggested that “humans and orangutans are unrelated”. Discuss whether this statement can be considered correct
5. The position of *Ramapithecus* on the phylogenetic tree was based on the appearance of fossils in comparison with living species. Since then, additional evidence has been found that indicates the following:

* Humans are more closely related to chimpanzees and gorillas than this diagram suggests.
* Chimpanzees have the closest evolutionary relationship to humans of any living species.
* Another species, *Pan paniscus*, commonly known as the bonobo, has been identified. Bonobos are in the same genus as chimpanzees.
* The *Ramapithecus* genus is now thought to be part of an extinct genus known as *Sivapithecus*. The closest living relative of *Sivapithecus* is the *Pongo* genus

.

1. Suggest the types of additional evidence that might have been used to reassess the evolutionary relationships of hominid species.
2. Using the information above, construct a new phylogenetic tree for the Hominidae family.

**Task 2: Considering examples of adaptations**

Consider the human adaptations in the table below.

Decide what type of adaptation each example represents (behavioural, physiological or anatomical).

A *selection pressure* is something that leads to natural selection and the evolution of an adaptation. For example, selection pressures could include changes in climate, food availability or competition for resources. Research and discuss the possible selection pressures that produced the evolution of the adaptations in the table. Discuss how the adaptations benefit the species.

Additional rows have been included in the table. Can you think of other adaptations of humans to their environment?

| Adaptation | Type of adaptation | Selection Pressure | Benefits of the adaptation |
| --- | --- | --- | --- |
| Bipedalism | Anatomical | One explanation is that climate change caused some forest habitats to be replaced with grassland. Natural selection would have favoured humans who were able to walk on two feet in these new habitats. | Hands free for communication and tool use. Greater endurance. Improved hunting ability. |
| Tool use |  |  |  |
| Opposable thumbs |  |  |  |
| Skin pigmentation (melanin production) |  |  |  |

| **Adaptation** | **Type of adaptation** | **Selection Pressure** | **Benefits of the adaptation** |
| --- | --- | --- | --- |
| Human dentition (evolving smaller teeth and different types of teeth) |  |  | Greater endurance. Improved hunting ability. |
| The ability to increase breathing rate |  |  |  |
| An extended childhood and longer dependency on parents. |  |  |  |
|  |  |  |  |
|  |  |  |  |

Task 3: Researching the Evolution of Language

The question “how did language evolve?” has been called the hardest question to investigate in science. Language cannot leave a fossil record, therefore it is difficult to find evidence for when, why and how language evolved. However, scientists can infer evidence and produce theories from a variety of sources.

Research and describe the types of evidence scientists have used to produce theories about when, how and why language evolved.

Choose one of the following theories of language evolution to research:

* The gossip/grooming hypothesis
* “Mother tongues”
* The gestural theory
* Language as a learning aid.

Write a brief description of the theory. What evidence, if any, do the scientists use to support their theory? How valid does the evidence seem? Has the theory received criticism?