Title: Fossil Evidence for the Theory of Evolution

Narrator: Welcome to this discussion of fossil evidence for the theory of evolution. In this presentation, we are going to look at how fossils can serve as evidence for the theory of evolution.

Slide 2

Title: How Can Fossils Serve as Evidence for the Theory of Evolution?

Slide Content:
Text: None

Image: Fossilized trilobites

Narrator: Fossils have long fascinated man, particularly in the last few hundred years. While it was no secret that they were marks of the living past, their story wasn’t fully appreciated until viewed through the lens of evolutionary theory. As more and more fossils are found, and their age determined with great accuracy, a grand tale of evolutionary change is laid out before us.

Slide 3

Title: Four Predictions from Coy (Plus One)

Slide Content:
Text:
- The earliest life should be simple.
- The “newest” fossils should be most like modern species.
- Modern species should have traits that resemble their ancestors.
- Transitional forms should be present.
- Unless the rock strata have been disturbed, ancestral forms should be found in deeper strata than their descendants.

Images: An iguana and a tortoise

Narrator: Scientists have noticed patterns in the fossil record that are consistent with the concept of “descent with modification” in which new species arise by alteration of pre-existing species. As responsible scientists, our aim is to look for patterns or aspects of the fossil record that are inconsistent with the following predictions that follow from Darwin’s idea:

The earliest life should be simple (This prediction is best applied to the earliest of life’s history).
The “newest” fossils should be most like modern species. Modern species should have traits that resemble their ancestors. The closer the relationship, the greater the predicted similarity.
Transitional forms should be present. Unless the rock strata have been disturbed, ancestral forms should be found in deeper strata than their descendants.
Slide 4

Title: Darwin’s Concept

Slide Content:

Text: None

Images: Darwin’s first tree drawing

Narrator: Remember Darwin suggested that existing species were descended from pre-existing species. Each new form was a modification of proceeding forms. This is a family tree for life with a single original parent. Fossils and the accompanying dating, permit us to reconstruct much of this tree.

Slide 5

Title: Darwin’s Idea Revealed in Barnacles

Slide Content:

Text: None

Image: Graph which uses barnacles to show how different species have evolved from long ago to the present day

Narrator: Let’s consider the logic of Coyne’s predictions given a Darwinian view of the formation of species. This is an illustration of a barnacle phylogram, or evolutionary “family tree.” Superimposed on the family tree are rock strata. Any branch tip of the phylogram that extends above the most recent rock layer represents a modern, extant barnacle species. Branch tips that do not breach the surface of the uppermost stratum are extinction events. The “T’s” of each branch (for example point C) are speciation events where an ancestral species diversified into two species. The line at the very bottom of the phylogram represents the ancestor of all of the barnacles. Now for the predictions:

The earliest life should be simple. This prediction is meant to apply to the entire tree of life rather than this specific example of barnacles. The earliest life was single-celled. More complicated forms were built on modification of that simpler foundation. Modern barnacles are not necessarily more complex than the ancestral barnacle.

The “newest” fossils should be most like modern species. Species D should be more similar to modern species than species E. Although extinct, much of the evolutionary pathway (and the changes of characters that go with it) to species D was shared by modern species, but not species E.

Modern species should have traits that resemble their ancestors. The closer the relationship, the greater the predicted similarity. Species A should share characteristics with the ancestor of all barnacles, but fewer characters than Species E shared with this ultimate ancestor.

Transitional forms should be present.
Species B likely has characters that are transitional between the form of Species C and Species A.

Unless rock strata have been disturbed, ancestral forms should be found in deeper strata than their descendants. Species A, a recently evolved form, should not be found in rock strata that are deeper than the first fossils of Species E.

Slide 6

Title: If Darwin’s Idea was Wrong

Slide Content: Graph which uses barnacles to show how life would appear if species formed simultaneously and independently of all others

Narrator: These predictions do not make sense (or less sense) if Darwin was wrong and each species was formed simultaneously and independently of all others. Let’s examine each prediction under this new scenario:

The earliest life should be simple (this prediction is best applied to the earliest of life’s history). If the model of diversity’s origin represented in this figure were true, life in the very oldest rock strata should be no more or less complex than modern forms of life.

The “newest” fossils should be most like modern species. If the model of diversity’s origin represented in this figure were true, the term “modern” would have no meaning as proponents of this separate origin concept scenario suggest that species have been relatively unchanged over time. Under this scenario, the fossil record, no matter the stratum, should be a homogenous mixture of what we call modern and ancestral species. If great change within a species after its formation (evolution) were accepted then, perhaps, a real phenomenon, anagenesis, could be applied here. In anagenesis, an entire species undergoes change into a different form or species rather than speciation being the result of a splitting event. However, anagenesis from a myriad of separate ultimate ancestors is not consistent with A) the fossil record and B) a parsimonious explanation of similarity between different organism (homology will be discussed in the next module).

Modern species should have traits that resemble their ancestors. The closer the relationship, the greater the predicted similarity. Under this scenario, there are no ancestors but an inexplicable pattern of similarity between species would emerge. Darwin’s idea provides a logical and scientific mechanism that results in these similarities.

Transitional forms should be present. Similar to the previous point, an inexplicable array of intermediate forms would be observed.

Unless the rock strata have been disturbed, ancestral forms should be found in deeper strata than their descendants. Under this alternative scenario, species would be seen to disappear; extinction events would still be expected. However, species that Darwin attributed to descent with modification would appear out of nowhere in the fossil record. Their similarity to proceeding forms would need to be viewed as coincidental without explanation.
The point is that the fossil record supports Darwin’s parsimonious natural explanation of the diversity of life as we know it and not the unsubstantiated alternative presented here.

**Slide 7**

**Title:** Evidence in the Fossil Record

**Slide Content:**

**Text:** None

**Image:** photo of a dinosaur and early version of man

**Narrator:** The fossil record provides solid evidence for descent with modification. As a result, many attempts have been made to discredit the fossil evidence. The physics of radioactive decay has been questioned so that estimates of the Earth’s age would be greatly reduced. The validity of transitional forms has been repeatedly challenged (for example, whales, birds, etc.). Claims that “missing links” in the fossil record invalidate proposed evolutionary histories are common. When the missing links are found, alternative “gaps” in the evolutionary sequence are suggested. Still others propose that, despite all fossil evidence to the contrary, all species have coexisted with one another and that any suggestion of ancestor-descendant relationship is an artifact of an imperfect fossil record. Along these lines, these critics of evolutionary theory have constructed exhibits depicting humans and dinosaurs living side by side. Fossils separate the two by approximately 63 million years! Please, review the evidence in the rocks. Does it support evolution?

**Slide 8**

End of Presentation