
Scientist for Phyletic Gradualism Theory

You are trying to persuade the audience that the fossil record is incomplete, and that over geological time many of the products of evolution have been lost. However, you are fully convinced that the fossil succession proves evolution.

Briefing Sheet

Why are the transitional features/intermediate forms missing?

Only a small handful of disputable intermediates are found because on evolutionary time-scales, rock layers are constantly in motion. Many fossils have been lost in the depths of the earth. Organisms which die tend to decay at once. The few bones which do survive can easily be washed away and lost. The record of the rocks is therefore like a series of poor snapshots taken over a very long time.

What's the evidence for your theory?

Despite the lack of intermediates, the evidence suggests a gradual increase in complexity over time. Different kinds of fossils are not distributed randomly. Some fossils appear to be distinctive of certain sedimentary rock layers called strata systems. You interpret this as indicating successive periods of time during which the organisms lived. For instance, you believe dinosaur-bearing rock beds reflect a time when dinosaurs were the dominant life form on earth.

Are there any problems for your theory?

► Scientists find a highly uneven or jerky fossil record – species appear suddenly, show little signs of change, and then disappear suddenly. ► Many fossils are found in many different strata systems. Only a minority are found in rocks from just one period. ► Fossils have been turning up in unexpected strata systems for years. These fossils are called 'holdover taxa', 'refugia species', or 'Lazarus taxa'. ► Numerous fossils are said to be reworked (or eroded) from older strata, often with no independent supporting evidence. ► The Cambrian explosion is the sudden appearance of many basic types of organism with next to no signs of ancestry. This is a truly massive gap in the fossil record. ► Although scientists continue to find new fossil beds, the fossils they find there belong to major groups of organisms we already know about. Therefore, a lack of intermediates is not just an artifact of poor data sampling.

To prepare for the debate:

In your books, write the title 'Fossil Record TV Debate' and draw a table similar to the one below. Fill out the table with questions and responses.

Questions you could face	How you might respond



Scientist for Punctuated Equilibrium Theory

You are trying to persuade the audience that evolution occurs in sudden bursts, in between long periods of little change. You believe that the fossil record does not show intermediate forms because of the rapid way in which new species originate.

Briefing Sheet

Why are the transitional features/intermediate forms missing?

Like a 'Phyletic Gradualist', you are convinced that the fossil record supports the theory of universal common descent. However, since speciation occurs very **quickly**, at the edges of small geographically separated populations, the chances of an intermediate form being fossilized are very low.

What's the evidence for your theory?

Scientists find a highly uneven or jerky fossil record – species appear very suddenly, show little signs of change, and abruptly disappear. This is especially true during the Cambrian explosion, where many new body plans and structural features appear with no indication of ancestral forms. You believe the lack of evolutionary change in the fossil succession is real data, and represents the way in which evolution occurs rapidly. You argue that huge genetic changes (e.g. large scale mutations - resulting in a bird springing from a reptile's egg) should never be confused with your argument.

Are there any problems for your theory?

► According to your theory, the process of evolutionary change is largely invisible. Therefore, you may be open to the criticism, that if no fossil evidence can be found to support the framework of universal common ancestry, then the framework should soon be re-evaluated. ► There is no known mechanism to account for the observed origin of new body plans so suddenly. Rapid, large scale mutations (called macromutations) are not considered a good explanation for the origin of entirely new structures.

To prepare for the debate:

In your books, write the title 'Fossil Record TV Debate' and draw a table similar to the one below. Fill out the table with questions and responses.

Questions you could face	How you might respond



Scientist for Phyletic Discontinuity Theory

You are trying to persuade the audience that the fossil record is a good source of evidence about life in the past. The basic forms of life each had a separate beginning and did not evolve from a common ancestor. That is why there are no intermediate forms.

Briefing Sheet

Why are the transitional features/intermediate forms missing?

The intermediates are missing because they never existed. Life does not have a universal common ancestor. Your theory suggests that biological forms are discontinuous and that evolutionary (ancestor-descendant) relationships cannot account for the origin of the basic types of organism. Rather, they were created.

What's the evidence for your theory?

The fossil record is highly uneven or jerky. Basic types of organisms appear very suddenly, showing little signs of change, and then disappear just as quickly – often going extinct. Gaps in the fossil succession are real data – telling us that historical evolution between basic body plans never occurred. The Cambrian explosion, where many new organisms appear abruptly, is just one of these gaps. Although there are some small fossils from before the Cambrian, there are no clear intermediate forms among them. What fossils do show, in general, is a record of mass extinction through environmental upheaval.

Are there any problems for your theory?

► Smaller, less complex organisms tend to be found lower down in the 'geologic column'. Some scientists explain this by separate creation events, others by deaths at different times during catastrophic events. Some scientists suggest that the standard 'geologic column' is itself flawed – with only a few locations on earth (about 0.4% of its area) having a reasonably complete column ► Basic body plans and the limits to diversification remain ill defined in your theory. ► Some people claim that your theory is unscientific because it requires a Creator.

To prepare for the debate:

In your books, write the title 'Fossil Record TV Debate' and draw a table similar to the one below. Fill out the table with questions and responses.

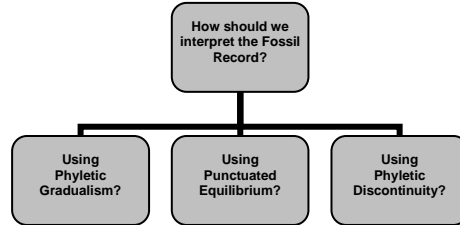
Questions you could face	How you might respond



Audience Member

Your role is to discover as much as you possibly can about the three theories. Only this way can you come to an informed decision about which theory is best. You can ask the three scientific experts only one question each – so try to make it an open question that requires more than just a 'yes' or 'no' answer.

The question is raised:



Phyletic Gradualism - The fossil record does not show intermediate forms because it is highly imperfect.

Punctuated Equilibrium - The fossil record does not show intermediate forms because evolution occurs rapidly.

Phyletic Discontinuity - The fossil record does not show intermediate forms because they never existed.

What you already know:

1. You have heard of the 'geologic column' and know that fossils are usually found in sedimentary rock layers, laid down by water under mild conditions of temperature and pressure.
2. You know that there are 'gaps' in the fossil record for evolution, but you are puzzled as to why they are there. You have come across a website on the Internet claiming that the gaps disprove the theory of evolution.
3. You have heard from science magazines that there are a handful of fossils which contain transitional features, such as the bird *Archaeopteryx* and the swimming creature *Ambulocetus*.
4. You know that some animals alive today seem to have transitional features – such as the Hoatzin bird (*Opisthocomus hoazin*) which has claws on its wings, and the duck-billed platypus (*Ornithorhynchus anatinus*).

To prepare for the debate:

In your books, write the title 'Fossil Record TV Debate' and draw a table similar to the one below. Fill out the table with your questions and include who they are directed towards.

Question you will ask	Who you will ask it to

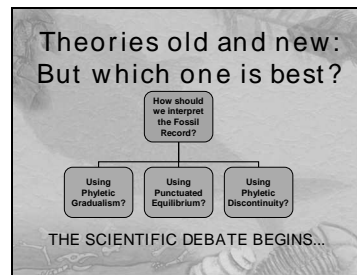
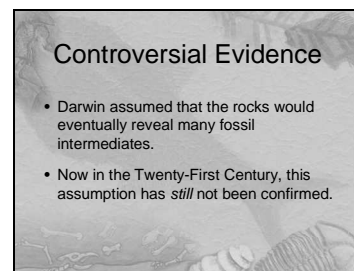
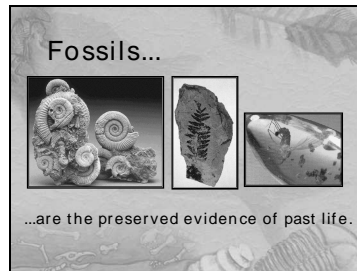
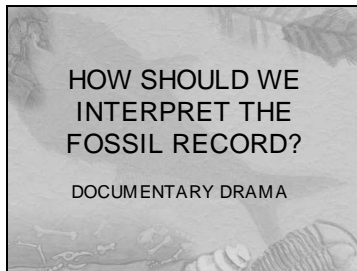
TV Presenter

Your role is to introduce the debate to the studio audience and to the (digital video camera) home audiences, and manage the controversy in a fair and professional way.

Production Briefing:

You have been asked to host a televised debate. This will involve you as presenter, a small panel of scientists, and a keen studio audience. Based on the evidence the scientists present, members of the audience will generate questions and then decide which theory provides the best interpretation of the fossil record.

Briefing Sheet



The production will be shot in the following sequence:

1. Begin the TV debate with a 30 second introduction to the fossil record for home audiences. For this, you may wish to use the Powerpoint presentation provided. Whilst introducing, look directly into the digital camcorder rather than at the studio audience.
2. Introduce the scientific panel, stating who they are and which university they come from. Open the discussion by asking one of the scientists: 'So Professor....., how do you explain the fact that the fossil record does not show intermediate forms?'
3. One by one, give the other scientists time to comment. In turn, ask them to explain their own theories. Allow responses from the others.
4. When the teacher indicates, end the discussion with the phrase:

'Well, I'm afraid I'm going to have to stop you there as we've run out of time'.

5. Invite the studio audience to ask their questions. The panel answers.
 6. At the end of the question session, all group members must vote for which theory they think is best.
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