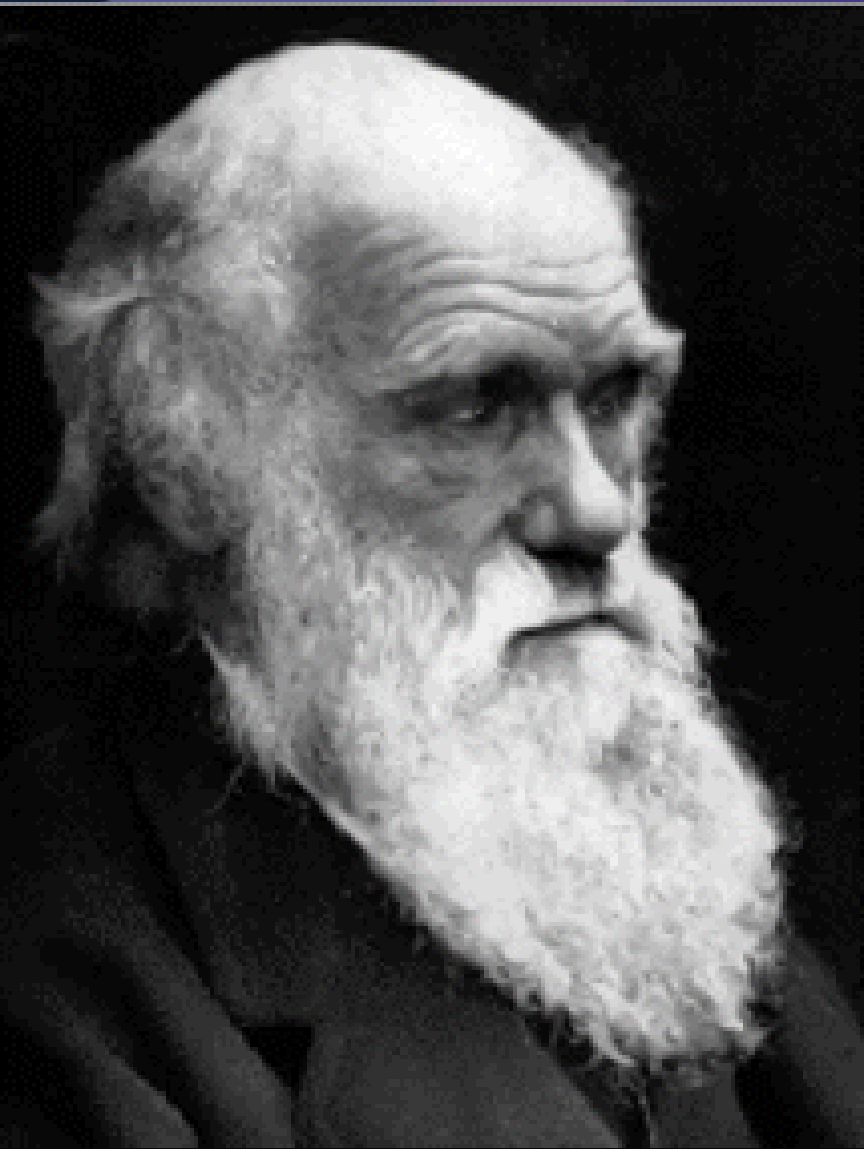




Introduction to Evolution

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Only a theory?

Basic premises for this discussion

- Evolution is not a belief system. It is a scientific concept. It has no role in defining religion or religious beliefs
- Evolution is a theory...but you don't get any better than that in science
- There is a lot of contention about evolution, but not among scientists or scientific organizations.

Some basic definitions

- **Fact:** an observation that has been repeatedly confirmed
- **Law:** a descriptive generalization about how the physical world behaves
- **Hypothesis:** a testable statement that can be used to build inferences and explanations

Some basic definitions

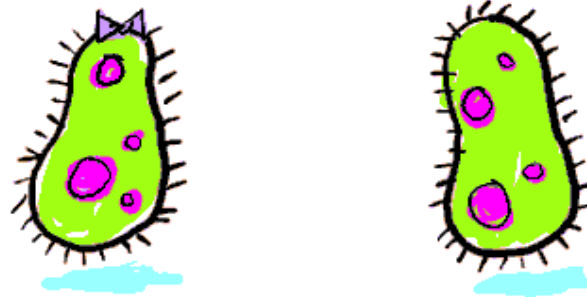
- Theory: a well-substantiated explanation that incorporates facts, laws, inferences and tested hypotheses.

In science, you don't get any better than a theory.

What is evolution?

Let's start by seeing what evolution is not.

The Evolution Of Man And Woman



What is evolution?

A basic definition of evolution...

“...evolution can be precisely defined as any change in the frequency of alleles within a gene pool from one generation to the next.”

- Helena Curtis and N. Sue Barnes, *Biology*, 5th ed. 1989 Worth Publishers, p.974

So what does the definition mean?

- Evolution is a change in the number of times specific genes that code for specific characteristics occur within an interbreeding population
- Individuals don't evolve, populations do
- There is no implied "improvement" in evolution

So what does the definition mean?

- Things don't change because organisms want or need them to (Lamarckism)
- There is no difference between macroevolution and microevolution. Macroevolution is merely a collection of microevolution events.

Definition problems



- Part of the problem is that a number of different definitions for evolution can be found both within and without the scientific community. These can easily confuse laypeople.

Definition problems

"evolution: The gradual process by which the present diversity of plant and animal life arose from the earliest and most primitive organisms, which is believed to have been continuing for the past 3000 million years."

-Oxford Concise Science Dictionary

"evolution: ...the development of a species, organism, or organ from its original or primitive state to its present or specialized state; phylogeny or ontogeny"

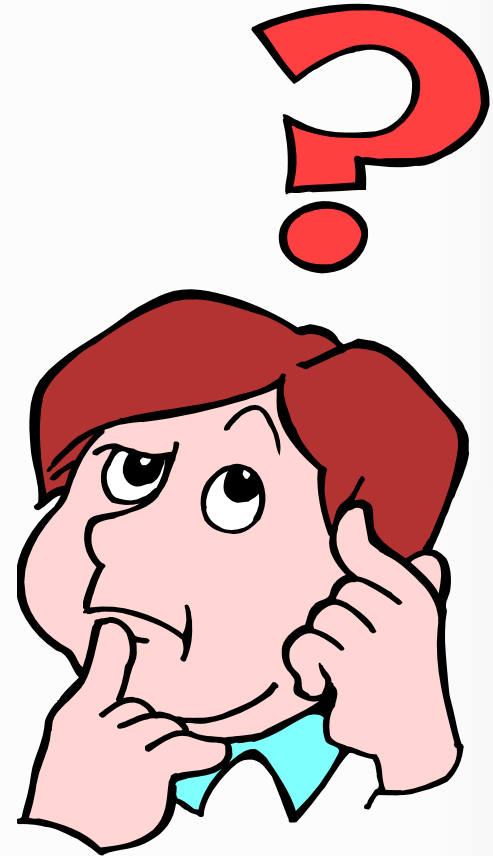
- Webster's

"evolution: ...the doctrine according to which higher forms of life have gradually arisen out of lower."

- Chambers

Definition problems

In addition to being simply wrong, these definitions can cause confusion since it is common for non-scientists to enter into a discussion about evolution with such definitions in mind.



A brief history of evolution

Charles Darwin was born on February 12, 1809 in Shrewsbury, England.

From 1831 to 1836 Darwin served as naturalist aboard the H.M.S. Beagle on a British science expedition around the world.

He observed much variation in related or similar species of plants and animals that were geographically isolated from each other.

These observations were the basis for his ideas.



DARWIN
CITREFFER



SMALL
INSECTIVOROUS
TREE FINCH
Camarhynchus parvulus

WOLF
WENMAN



MEDIUM
INSECTIVOROUS
TREE FINCH
Camarhynchus pauper

LARGE
INSECTIVOROUS
TREE FINCH
Camarhynchus palliatus



PINTA
AMINDON



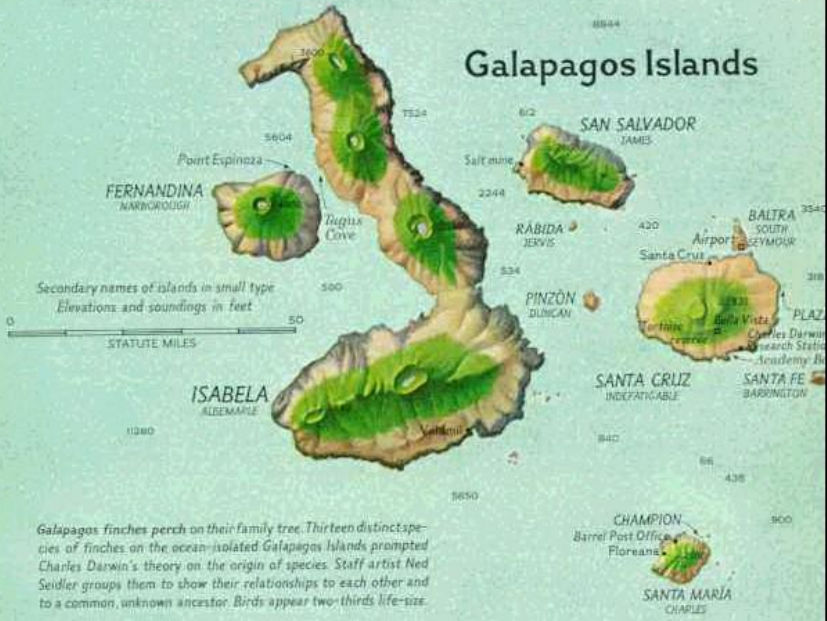
MARCHENA
BINNOLDE



GENOVES
TOWER



Galapagos Islands



Galapagos finches perch on their family tree. Thirteen distinct species of finches on the ocean-isolated Galapagos Islands prompted Charles Darwin's theory on the origin of species. Staff artist Ned Seidler groups them to show their relationships to each other and to a common, unknown ancestor. Birds appear two-thirds life-size.

MANGROVE FINCH
Camarhynchus heliobates



WOODPECKER FINCH
Camarhynchus pallidus



MEDIUM
GROUND FINCH
Geospiza fortis

LARGE
GROUND FINCH
Geospiza magnirostris



SMALL GROUND FINCH
Geospiza fuliginosa



LARGE CACTUS
GROUND FINCH
Geospiza conirostris



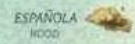
CACTUS
GROUND FINCH
Geospiza sagardorum



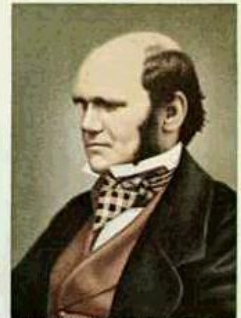
VEGETARIAN
TREE FINCH
Camarhynchus crassirostris



SHARP-BEAKED
GROUND FINCH
Geospiza difficilis



WARBLER FINCH
Certhidea olivacea



CHARLES DARWIN (1809-1882)

PAINTING BY STENO BRITZ AND BOB ZIEGLER
RESEARCH BY DR. LOU BISHOP AND
ILLUSTRATION AND DESIGN
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A brief history of evolution

Contrary to popular belief, Darwin was not the first person to describe the concept of evolution, but he was the one who gave it its driving force.

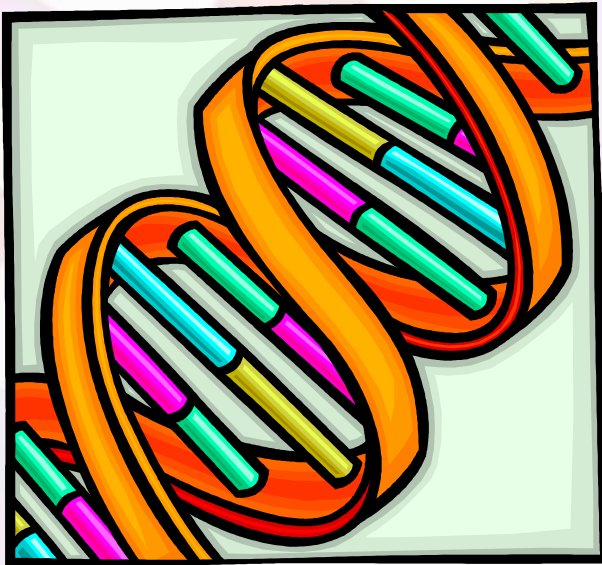


Darwin presumed that populations of individuals changed over time, and, in 1844, he developed the concept of the driving force for evolution. It wasn't until many years later that he published his idea.

“I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection.”

—Charles Darwin from "The Origin of Species", 1859

Natural Selection



Darwin knew nothing of genes, but what he did have were two observations and a little inference that provided the motive force for evolution.

Natural Selection

Observation 1: Organisms generally have more offspring than can survive to adulthood.

Observation 2: Offspring are not identical. There is variation in their appearance, size, and other characteristics.

Natural Selection

Inference: Those organisms that are better adapted to their environment have a greater likelihood of surviving to adulthood and passing these characteristics on to their offspring.

Survival of the “fittest.”

Darwin's dilemma

Darwin was hesitant to publish his theories because of the backlash that previous authors received.

If this book is true, “religion is a lie, human law a mass of folly and a base injustice; morality is moonshine.”

-Adam Sedgwick's response to Robert Chamber's 1844 book, *Vestiges of the Natural History of Creation*, in which Chamber's hinted that organic creation was the result of natural laws, not God's intervention.

Darwin's dilemma

It was a letter Darwin received on June 18, 1858, that precipitated the publishing of *The Origin of Species*.

Alfred Russell Wallace, exploring in Asia, had come to the same conclusion as Darwin.

Darwin's dilemma

Darwin, with a strong sense of honor, arranged for a simultaneous reading of his and Wallace's papers before the Linnean Society.

The readings were met with silence, so Darwin published the full text of his ideas.

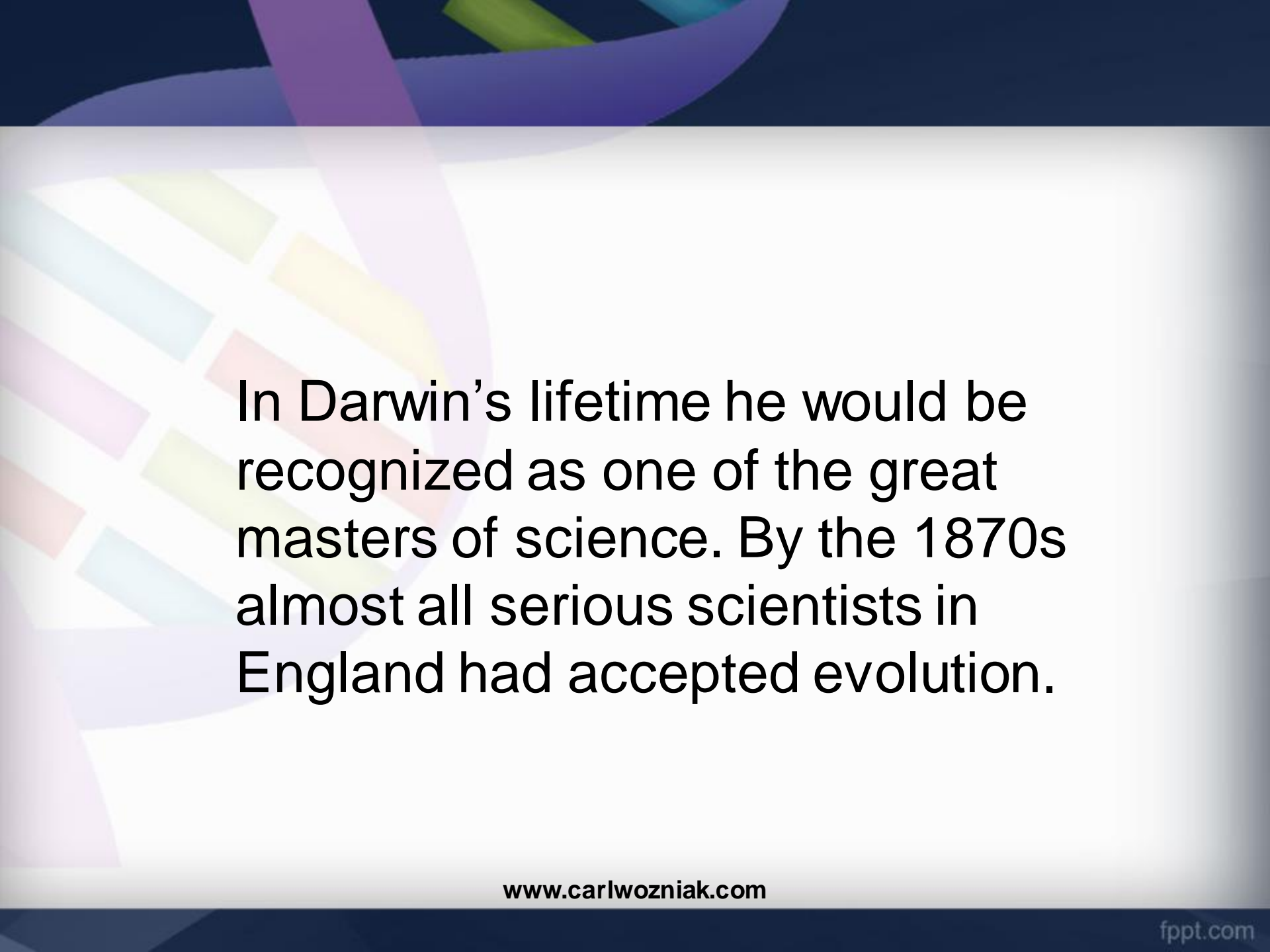
...then it hit the fan

“...tell me, is it on your grandfather’s or grandmother’s side that you are descended from an ape.”

-Bishop Samuel Wilberforce to Darwin defender, Thomas Huxley

“If...the question is put to me would I rather have a miserable ape for a grandfather or a man highly endowed by nature and possessed of great means and influence and yet who employs these faculties and that influence for the mere purpose of introducing ridicule into a grave scientific discussion I unhesitatingly affirm my preference for the ape.”

-Huxley’s response

The background features a large, semi-transparent handprint graphic in shades of purple and blue. Overlaid on this are several diagonal, semi-transparent bars in various colors including yellow, light blue, pink, and green. The overall aesthetic is modern and abstract.

In Darwin's lifetime he would be recognized as one of the great masters of science. By the 1870s almost all serious scientists in England had accepted evolution.

Observation and Inference

Let's do a little exercise...

Dinosaur tracks are common occurrences in the southern and eastern U.S.

Here is a section of tracks that were recently uncovered. Can you answer the following questions?



- What is the size and nature of the organisms?
- Were the tracks made at the same time?
- How many animals were involved?
- Can you reconstruct the events that occurred?

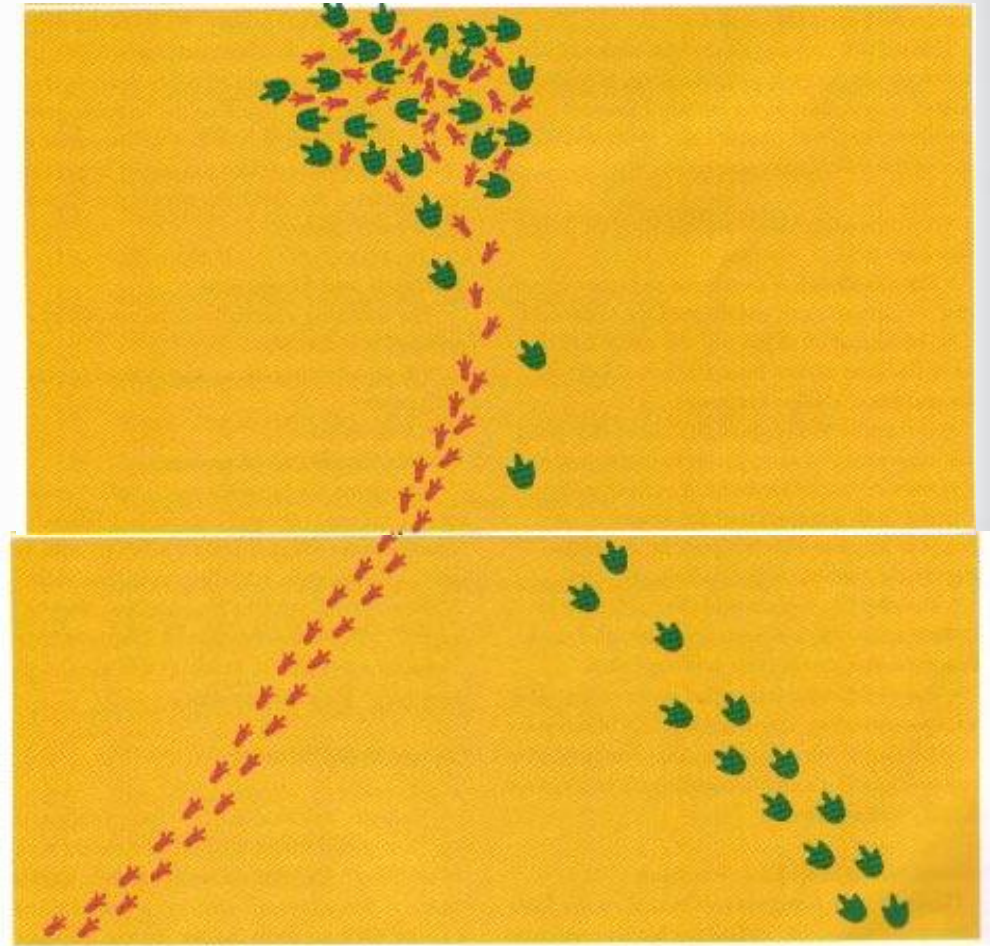


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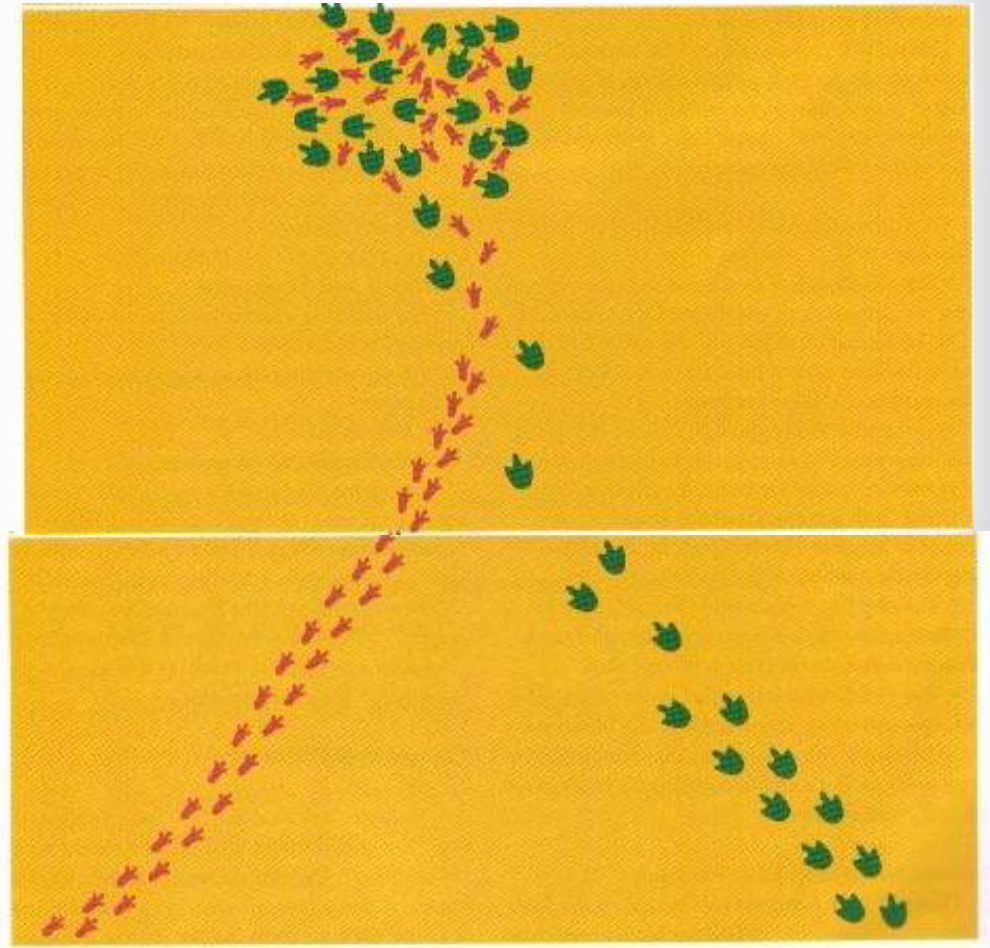
- In what direction did the animals move?
- Did they change speed or direction?
- Was the soil moist or dry?
- In what type of rock were the prints made?



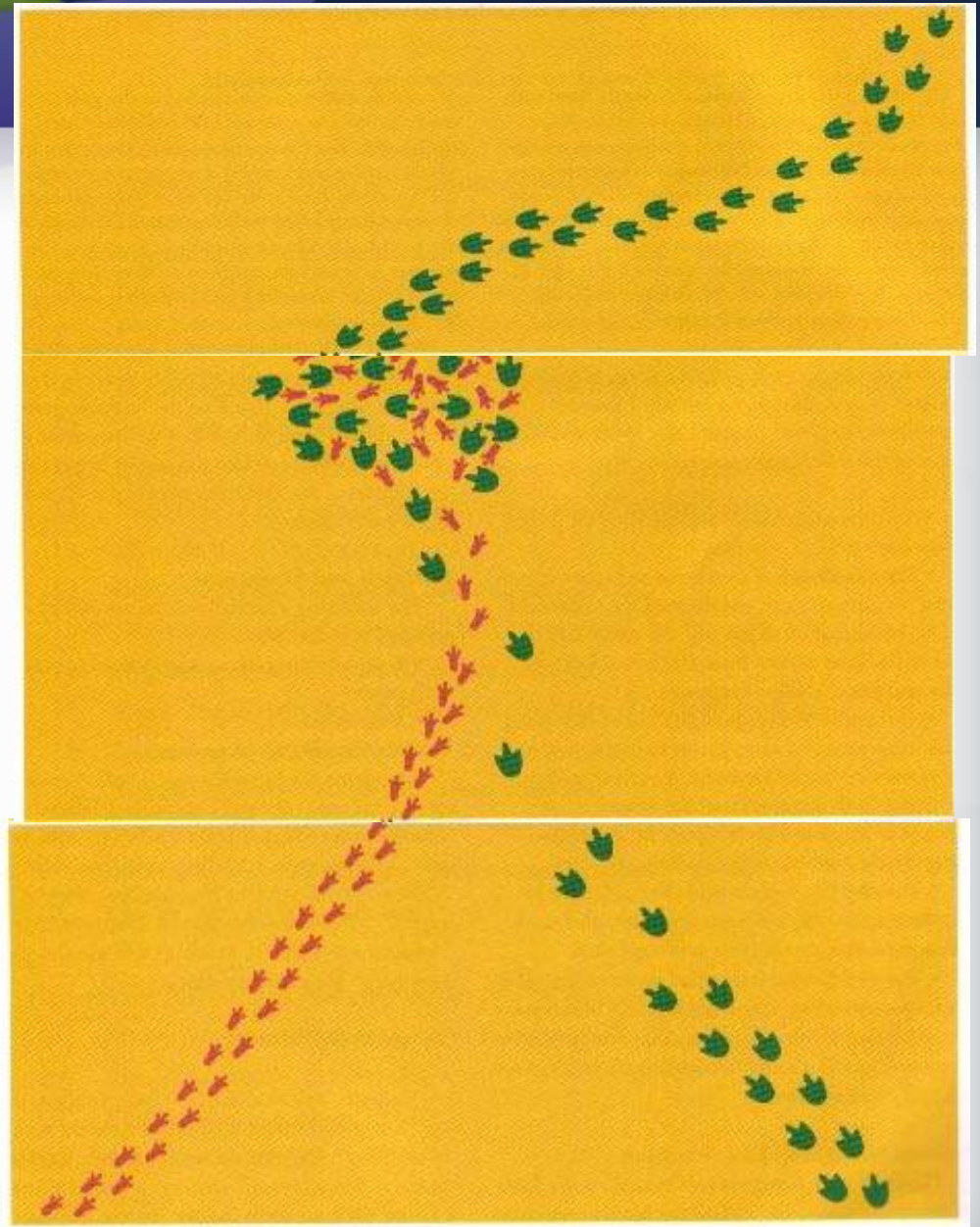
The following summer some more digging revealed more of the track. What additional information have you gained that allows you to refine your answers?



- Were the tracks made at the same time?
- How many animals were involved?
- Can you reconstruct the events that occurred?
- In what direction did the animals move?
- Did they change speed or direction?

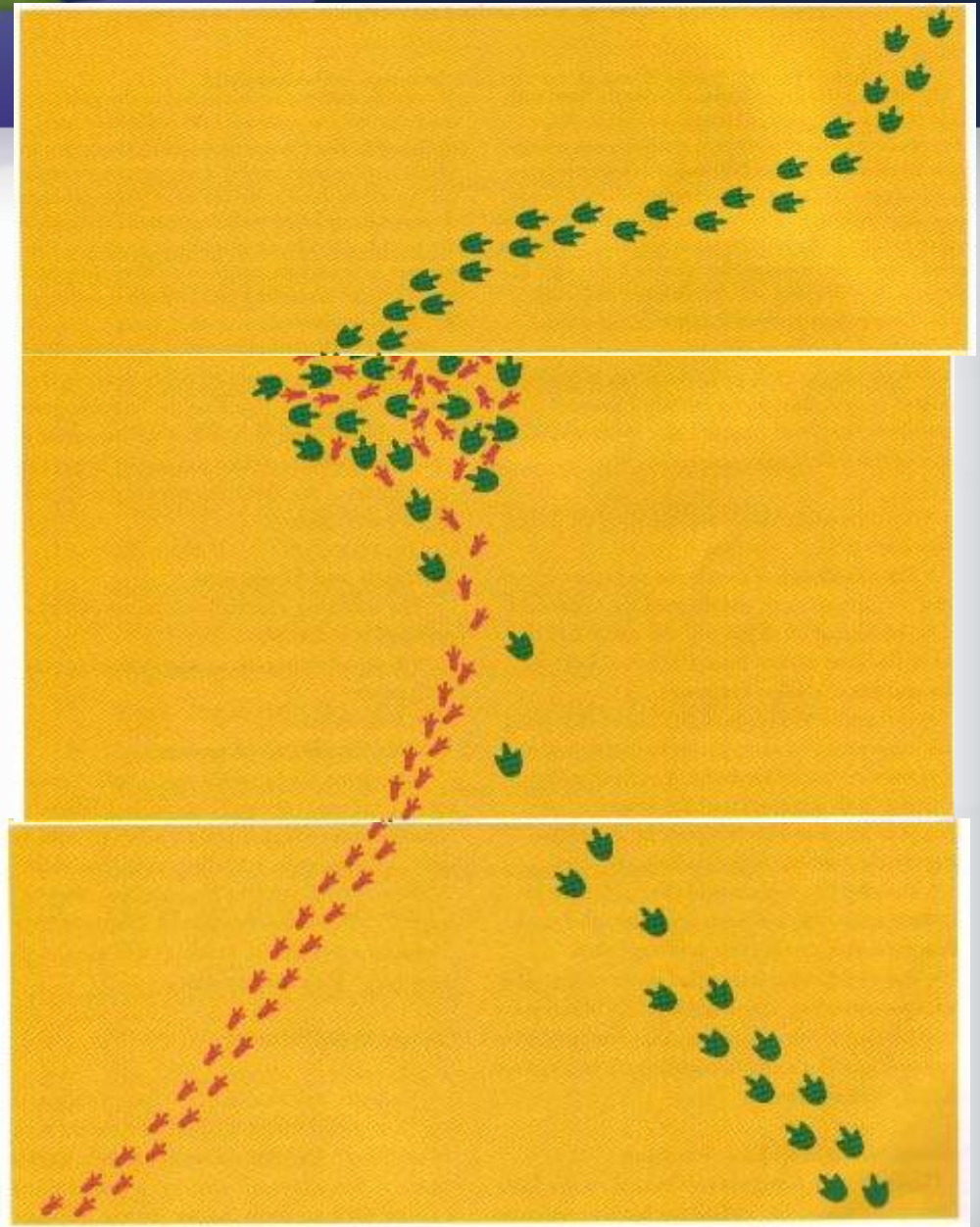


In the final summer of the excavation one last part of the footprint trail was uncovered. Does this section provide additional information to refine your hypothesis?

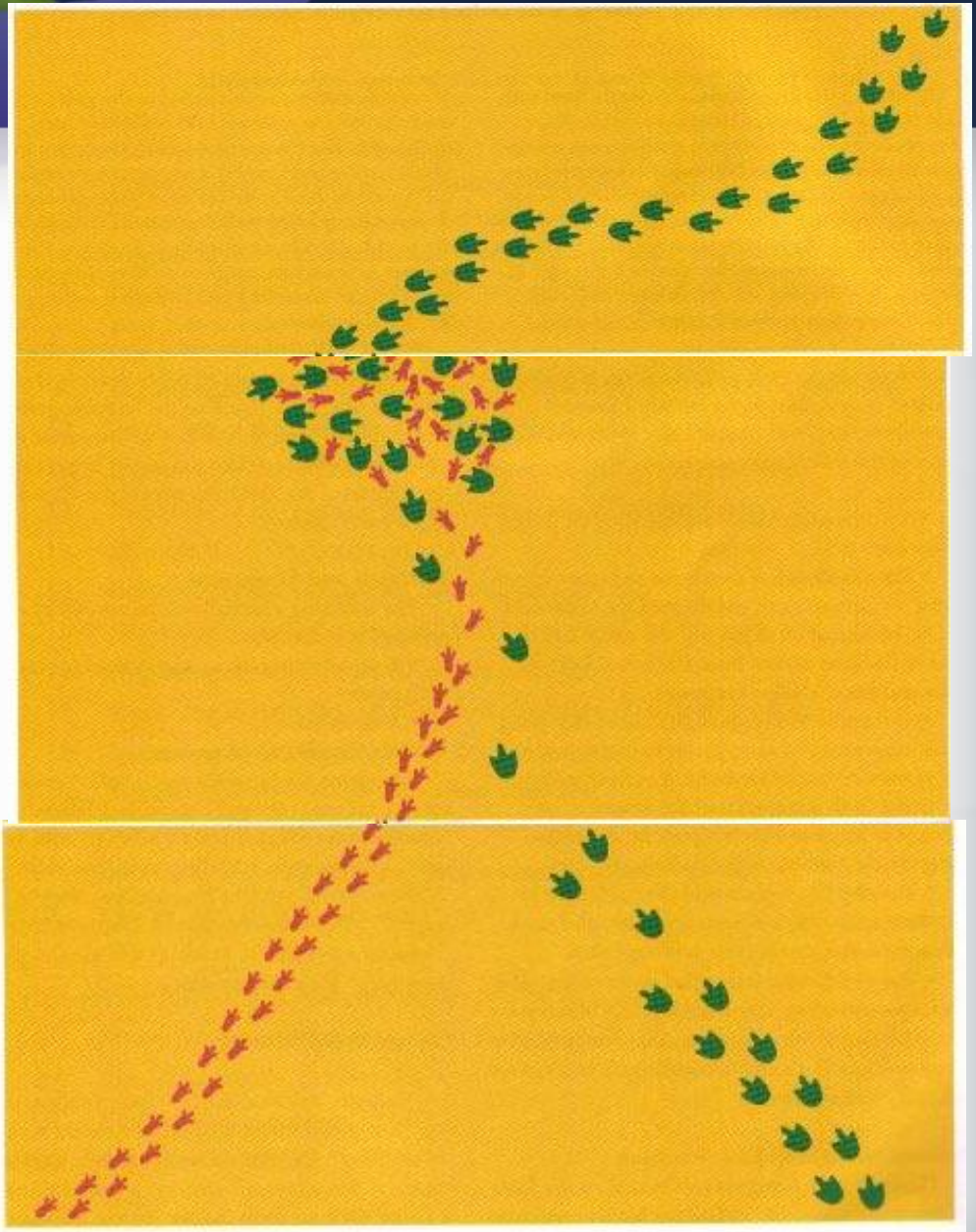


So what happened?

What part of your hypothesis is observation? What part is inference? What part is conjecture?



This is how science is done.



Ten questions about teaching evolution in the classroom

Teaching evolution in the K-12 classroom can pose pitfalls for a teacher. What follows are responses to 10 very common questions about evolution and its place in education.

1. Should I teach evolution?

- Absolutely. Evolution is as fundamental to the study of biological science as mass, force and gravity are to physical science.
- Both the Michigan Frameworks and Benchmarks and the National Science Education Standards have significant strands of evolutionary science.

2. Should I teach Creation Science or Intelligent Design?

- The question can be turned around. Does the scientific community include these in scientific explanations?
 - George Gilchrist of the University of Washington conducted a search in 6,000 journals in the life sciences for “intelligent and design.” His results:
 - “This search of several hundred thousand scientific reports published over several years failed to discover a single instance of biological research using intelligent design theory to explain life’s diversity.”
- If you are teaching science, it doesn’t belong; humanities is a different story

3. What's wrong with presenting both sides, evolution and creation?

- It might seem “fair,” but just what is the other side?
 - Which creation story is the appropriate one or ones to include in a “fair” accounting of how we came to Earth. Do we use the biblical, Hindu, Japanese Shinto, or Native American versions of creation? Do we teach based on the majority religion of an area? If so, are we doing justice to science?
- Consequently, it would be “unfair” to students to present non-science as science.

4. Why is evolution considered a scientific “fact?”

- A scientific fact may be defined as a theory that has been repeatedly confirmed and never refuted.
- Evolution fits this description, but that does not mean that new evidence couldn't refine or disprove the theory. Science is a progression, not a destination.

5. Don't a lot of scientists disagree with the concepts of evolution?

- One of the wonders of science is that it is self-correcting.
- Scientists may disagree on the precise mechanism, often violently, (i.e., punctuated equilibrium “evolution by creeps and jerks”), but the underlying premise is not in question.

6. Isn't it better to just de-emphasize evolution?

- No. To diminish or eliminate evolution from the life sciences curriculum makes as much sense as eliminating gravity from the physical science curriculum.
- Evolutionary theory is central to modern understanding of life as we see it.

7. Doesn't evolution go against the law of thermodynamics?

- 2nd law of thermodynamics: in a closed system, things will move from an ordered to unordered state (decay)
 - The Earth is not in a closed system. New energy from the sun is constantly flowing in.
 - Evolution doesn't have to be a "progression." (eg. intestinal parasites)

8. If evolution occurs in steps, what use is half a wing or eye?

- Evolution is not about “progress.” If a variation is neutral or marginally better it may be passed on.
- Certain characteristics are damaging in some forms (sickle cell, bird plumage)
- Bic pens, tracheotomies, and aliens

9. Does the evidence really exist?

- In short, overwhelmingly. Numerous examples of discovery of predicted intermediate forms, genetic similarity studies, and new molecular mapping have only confirmed the theory
- There are no cases where evolution has been found to be false

10. What about God?

- Science has nothing to say about God, not out of rejection, but merely because there is no way of studying or ascertaining theological truth.
- For some people, unfortunately, the only way of dealing with their conflict is to deny the evidence for evolution altogether.

10. What about God?

- Yet many scientists are very devout, and have no conflict with their understanding of evolution and their religion.



A copy of this presentation is available for download at:

www.carlwozniak.com

Thank you for your interest, attention, and input.

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Lakô hā salamát!

Maraming salamát!