Western culture resisted evolutionary views of life

- On November 24, 1959, Charles Darwin published *On the Origin of Species by Means of Natural Selection*.
  *(Can you name another **extraordinary** event that occurred on this date?)*

- Darwin made ***two points*** in *The Origin of Species*:
  - Today's organisms ***descended from ancestral species*** – *(we came from organisms of the past)*
  - ***Natural selection*** provided a mechanism for evolutionary change in populations

- The *Origin of Species* challenged a worldview that had been accepted for centuries.

- The key classical Greek philosophers, Plato and Aristotle, opposed any concept of evolution.
  - Plato believed in two worlds:
    - Real world – ideal and perfect
    - Illusory world – imperfection that we perceive through our senses
  - Aristotle believed that
    - all living forms could be arranged on a ladder (*scala naturae*) of increasing complexity
    - every rung taken with ***perfect, permanent*** species.

- The Old Testament account of creation supported the idea that species were individually designed and did not evolve.

- In the 1700's, the dominant philosophy, **natural theology**, was dedicated toward studying the adaptations of organisms as evidence that the Creator had designed each species for a purpose.

- At this time, Carolus Linnaeus, a Swedish botanist, developed **taxonomy**, a system for naming species and grouping species into a hierarchy of increasingly complex categories based on their morphology.

- Darwin's views were influenced by **fossils**, the relics or impressions of organisms from the past, mineralized in **sedimentary rocks**.
  - Sedimentary rocks form when mud and sand settle to the bottom of seas, lakes, and marshes.
  - New layers of sediment cover older ones, creating layers of rock called strata.
  - Deeper strata of rocks contain older species
  - Fossils within layers show that a succession of organisms have populated Earth throughout time.

- **Paleontology**, the study of fossils, was largely developed by Georges Cuvier, a French anatomist.
  - Curvier recognized and supported the following:
    - Cuvier recognized that extinction had been a common occurrence in the history of life.
    - Instead of evolution, Cuvier supported **catastrophism –** extinctions, then migrations gave the appearance of change over time

Theories of geological gradualism helped clear the path for evolutionary biologists

- James Hutton (1726-1797), a Scottish geologist, proposed that the diversity of land forms (e.g., canyons) could be explained by mechanisms *currently* operating.
  - Proposed a theory of **gradualism** - that profound change results from slow, continuous processes.
- Charles Lyell (1797-1875) proposed a theory of **uniformitarianism** - that geological processes had not changed throughout Earth's history.
- Hutton's and Lyell's observations and theories had a strong influence on Darwin.
  - First, if geological changes result from slow, continuous processes, rather than sudden events, then the Earth must be far older than the 6000 years assigned by theologians from biblical inference.
  - Second, slow and subtle processes persisting for long periods of time can add up to substantial change.

Lamarck placed fossils in an evolutionary context

- In 1809, Jean Baptiste Lamarck published a theory of evolution based on his observations of fossil invertebrates in the Natural History Museum of Paris.
  - Lamarck saw what appeared to be several lines of descent in the collected fossils and current species.
  - Each was a chronological series of older to younger fossils leading to a modern species.
- Central to Lamarck's mechanism of evolution were the concepts of ***use and disuse of parts*** and of ***inheritance of acquired characteristics.***
  - ***Use and disuse of parts*** - body parts used extensively to cope with the environment became larger and stronger, while those not used deteriorated.
  - ***Inheritance of acquired characteristics*** - modifications acquired during the life of an organism could be passed to offspring.
- Lamarck's theory was an attempt to explain both the fossil record and the current diversity of life through its recognition of the great age of Earth and adaptation of organisms to the environment.
- However, there is no evidence that acquired characteristics can be inherited.
  - Acquired traits (e.g., bigger biceps) do not change the genes transmitted by gametes to offspring.