

• Fundamental Principles of Evolution



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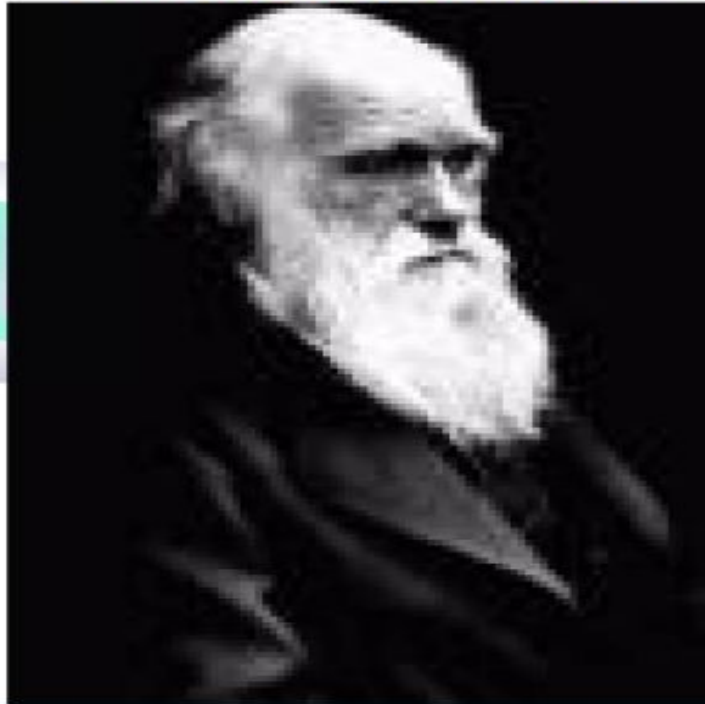
Evolution: What is it?

- **What does the word “evolution” mean to you?**
- **What kinds of organisms can “evolve”?**
- **How do organisms evolve?**
- **How do we know that organisms have evolved?**

Evolution

- **1.5 million species of life on earth.**
- **Were all of these species created separately or can species change and give rise to new species?**
- **Before 1859, no one ever thought about the “changing” of a species.**

Charles Darwin



- At age 22, sailed aboard the “HMS Beagle” to the Galapagos island.
- Believed that God created each species to match its habitat and a species never changed.

Charles Darwin cont

- During his journey, he made observations and recorded them in a journal.
- Darwin began to doubt that species remained “constant.”



Darwin's Finches

- Galapagos Islands 600 miles from the coast of Ecuador. Darwin collected several species of finches.
- All the species were similar except for their method of catching food.
- All of the species of finches closely resembled one species of South American finch.

Darwin's Finches cont.

- Wood pecker finch captures insects with its grasping bill.
- Crushing bill of the large ground finch enables it to feed on seeds.
- The cactus finch uses its probing bill to feed on cactuses.



Charles Darwin cont.

- In 1859, Darwin published “The Origin of Species”
- His book stirred up controversy.
- Why?
 - Goes against God
 - Suggested apes were close relatives to humans.



- God has created the world and universe.
- Who had created God – Khushwant Singh ?
- Man did not create God. He was there when Dynosaurs were there too?

The universe is everything. It includes all of space, and all the matter and energy that space contains. It even includes time itself and, of course, it includes you. Earth and the Moon are part of the universe, as are the other planets and their many dozens of moons.

Today hydrogen is estimated to account for 90% of all atoms in the universe, and it is essential to the material world. That includes ourselves: close to two-thirds of the atoms in our bodies are hydrogen.

It turns out that our Sun is an average sized star. There are bigger stars, and there are smaller stars. We have found stars that are 100 times bigger in diameter than our sun. Truly, those stars are enormous.

While the UY Scuti is the largest star.

What is multiverse? Evolution of universe

- The multiverse is the hypothetical set of all universes. Together, these universes are presumed to comprise everything that exists: the entirety of space, time, matter, energy, information, and the physical laws and constants that describe them.
- Our universe began with an explosion of space itself - the Big Bang. Starting from extremely high density and temperature, space expanded, the universe cooled, and the simplest elements formed. Gravity gradually drew matter together to form the first stars and the first galaxies.
- Universe is expanding – Entropy is increasing.
- Dark energy (Repulsive) is more than dark matter.

Where did life come from?

- Mineral-laden water emerging from a hydrothermal vent on the Niua underwater volcano in the Lau Basin, **southwest Pacific Ocean**. The microorganisms that live near such plumes have led some scientists to suggest them as the birthplaces of Earth's first life forms



The Origin of Species

Major Points

- **Species do change over time.**
- **These gradual changes may cause one species to change into new species.**
- **African apes are close genetic relatives of modern humans.**
- **Organisms have traits that help them survive.**

What causes evolution?

- Evolution is the genetic change in a species over time.
- Darwin provided a reason for why species undergo changes.
- He called it “natural selection.”

Lamarck's Evolutionary Theory

- 1st scientist to recognize that living things change over time.
- Organisms adapt to their environment.



Lamarck's Proposal:

- That by selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime. These traits could then be passed on to their offspring. Over time, this process led to change in a species.

Lamarck Believed

- Organisms needed to be able to accomplish a skill by persistence it would achieve.
- Organisms could alter the size of their structures.
- Acquired trait were passed to offspring.

Darwin vs. Lamarck

- Darwin

- 
- **Organisms best suited to their environmental conditions are most likely to survive and reproduce.**

- Lamarck

- **Organisms pass on acquired traits to their offspring.**

Natural Selection

- **A process by which organisms best suited to their environmental conditions are most likely to survive and reproduce.**



Natural Selection cont.

- 1) Every species contains variety.
- 2) Living things face a constant struggle for existence. (food, shelter)
- 3) Some individuals are better adapted to their environments. Those who are best suited to live will pass traits to their offspring that will help ensure survival.
- 4) Genetic change in the species
- 5) The entire population of that species is now better suited for survival.

Natural Selection In Action:

- Peppered moth (Kettelwell)
- Natural selects which members of a species will struggle for existence.



IMPORTANCE OF EEE COURSE EOR US ALL

- Evolutionary principles are now routinely incorporated into medicine and agriculture. Examples include the design of treatments that slow the evolution of resistance by weeds, pests, and pathogens, **ROTATION OF FORESTS, GRAZING BY ANIMALS AND BY NOT USING STUBBLE AS NUTRIENT.**
- Our research in biotechnology- species enrichment.
- The design of breeding programs that maximize crop yield or quality – **Green Revolution (introduction into developing countries of new, high-yielding varieties, beginning in the mid-20th century).**
- Evolutionary principles are also increasingly incorporated into conservation biology, breeding tiger species, cheetahs, natural resource management and environmental science.

- Evolution provides an essential framework for SEVERAL DAY TO DAY EVENTS OR DEVELOPMENTS because only in its light can we understand fundamental questions about our world and ourselves.
- Why do we get sick? What determines antibiotic and pesticide effectiveness? How much and in what ways can crops be improved?
- How can we tackle multi-resistant bacteria. Quorum sensing and quorum quenching.
- How can we prevent our crops from pesticide resistant pests, insects etc.
- Can natural populations adapt to environmental change?
- With this recognition, decision makers are increasingly called on to incorporate evolutionary thinking into environmental science, conservation biology, human health, agriculture, and natural resource . This concerns all of us?

- Examples include the protection of small and isolated populations from **inbreeding depression** (mating between relatives).
- **Inbreeding depression** refers to the decrease or loss of fitness and strength which is mainly caused due to **inbreeding**. In simpler form, the mating between the relatives in a small population is common and this may lower the population's ability to persist and reproduce which is referred to as inbreeding depression.
- The identification of key traits involved in adaptation to climate change, the design of harvesting regimes that minimize unwanted life-history evolution i.e., growth and the setting of conservation priorities based on populations. , species, or communities that harbor the greatest evolutionary diversity and potential.

Will evolution stop altogether for humans? Has it stopped already?

- Also known as descent with modification. Over time these evolutionary processes lead to formation of new species (speciation), changes within lineages (anagenesis), and loss of species (extinction).

"Evolution" is also another name for evolutionary biology, the subfield of biology concerned with studying evolutionary processes that produced the diversity of life on Earth.

Genetic studies suggest that the answer that humans are still evolving and evolution has not stopped presently,.