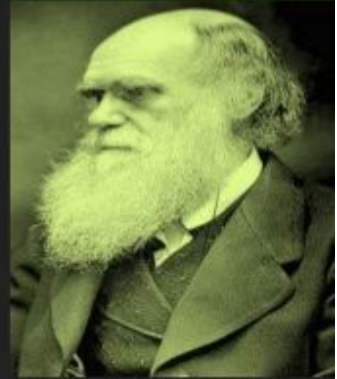


About Charles Darwin

- Full name : Charles Robert Darwin
- Birth place: England
- Birth date: 12th February, 1809
- He was the great English naturalist.
- His work mainly focused in understanding the life on the Earth.



Thomas Malthus

- Born: February 14, 1766, Surrey, United Kingdom.
- Died: December 29, 1834, Bath, United Kingdom.
- Wrote 'An essay in the First Principle of population' first published in 1798
- Debatable whether the principles of Malthus two hundred years ago (that were very revolutionary and controversial) have any relevance to the modern world.
- The world population in 1798 was at nine million people. We have now passed the seven billion mark.



The Core Principles of Malthus

- Food is necessary for human existence.
- Human population tends to grow faster than the power in the earth to produce subsistence.
- The effects of these two unequal powers must be kept equal.
- Since humans tend not to limit their population size voluntarily - “preventive checks” in Malthus’ terminology.

Theory of Population

- Malthus very concerned by the condition of the poor and particularly by rural poverty.
- Because of this he was skeptical of notions of the perfectibility of society.
- 1st Edition of the Essay is an a priori polemic—the 2nd Edition included much empirical observation.
- Inspired Darwin’s idea of “the struggle for survival” .

Malthus Theory

- In 1798 Thomas Malthus published his views on the effect of population on food supply. His theory has two basic principles:
- Population grows at a geometric rate i.e. 1, 2, 4, 16, 32, etc.
- Food production increases at an arithmetic rate i.e. 1, 2, 3, 4, etc.

Proposed Solutions of Malthus

- Malthus suggested that once this ceiling (catastrophe) had been reached, further growth in population would be prevented by negative and positive checks. He saw the checks as a natural method of population.

Negative Checks (Decreased Birth Rate)

- Negative Checks were used to limit the population growth. It included abstinence/ postponement of marriage which lowered the fertility rate.
- Malthus favored moral restraint (including late marriage and sexual abstinence) as a check on population growth. However, it is worth noting that Malthus proposed this only for the working and poor classes!

Positive Checks (Increased Death Rate)

- Positive Checks were ways to reduce population size by events such as famine, disease, war - increasing the mortality rate and reducing life expectancy.

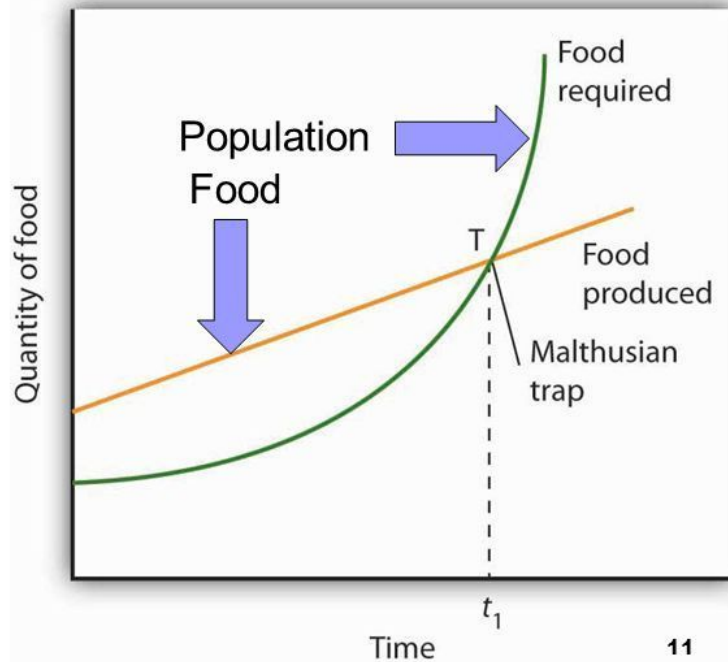


What is the Malthusian theory?

Population
increases
geometrically

Food increases
arithmetically

Population could
increase beyond
what the planet
could support



Malthus reasoned

- That if the human population continued to grow unchecked, sooner or later there would be insufficient living space and food for everyone

- Darwin realized that this applied even more to plants and animals than it did to humans because animals and plants had more offspring than humans did

DARWIN THEORY OF EVOLUTION

- ☐ Charles Robert Darwin was an English naturalist.
- ☐ Darwin theory was based of **scientific evidence**.
- ☐ **His theory tell that** all species have evolved from one or few common ancestors **through the process of** Natural selection.
- ☐ This theory became widely accepted by the scientific community and now forms the basis of modern evolutionary theory

DARWIN THEORY OF EVOLUTION BY NATURAL SELECTION

- ❑ According to Darwin- the inherited variation that increase an organism's chance of survival in a particular environment is called adaption.
- ❑ Natural selection is the differential survival and reproduction of individuals due to differences in phenotype. It is a key mechanism of evolution, the change in the heritable traits characteristic of a population over generations.
- ❑ There are two factor behind the natural selection
 1. Struggle for existence
 2. Survival of Fittest

DARWIN THEORY OF EVOLUTION BY NATURAL SELECTION

- First , Darwin stated that variation exist among individuals of a species.
- Second, he stated that **scarcity of resources** in a population would lead to **competition** between individual of same species because all use the **same limited resources** (**struggle for existence**).
- Such competition would lead to the **death of some individuals**, while other would survive. From this reasoning Darwin concluded that individuals having **advantageous variations** are more likely to survive and reproduce than those without the advantageous variation (**survival of the fittest**)

Natural selection

Natural selection is the **differential survival** and reproduction of individuals due to differences in **phenotype**. It is a key mechanism of **evolution**, the change in the **heritable traits** characteristic of a **population** over generations.

1. There is **variation in traits**.

For example, some beetles are green and some are brown.

2. There is **differential reproduction**.

Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, brown beetles tend to get eaten by birds and survive to reproduce less often than green beetles do.

3. There is **heredity**.

The surviving green beetles have green offspring beetles because this trait has a genetic basis.

The more advantageous trait, green coloration, which allows the beetle to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be green.

If there is a variation, differential reproduction, and heredity, it have evolution by natural selection as an outcome



Natural selection: Industrial Melanism



- Industrial melanism is an evolutionary effect in moth, where dark pigmentation (melanism) has evolved in an environment affected by industrial pollution.
- When tree barks were covered with pollutants and it became dark, at that time the dark color moth had a higher fitness as they got their phenotype matched with background. They are thus favoured by natural selection.
- Originally, peppered moths lived where light-colored lichens covered the trees.
- For camouflage from predator against that clean background, they had generally light coloration.
- During industrial revolution in England, pollution in the atmosphere reduced the lichen cover, while soot blackened the bark of trees, making the light-colored moth more vulnerable to predation.
- This provided selective advantage to the gene responsible for melanism and dark color moths increased in frequency.
- The melanic phenotype of *Biston Betularia* has been calculated to give a fitness advantage till 30%.
- By the end of 19th century, it almost completely replaced the original light-colored moth, forming a peak of 98% of population.

Natural selection

Darwin's process of natural selection has four components.

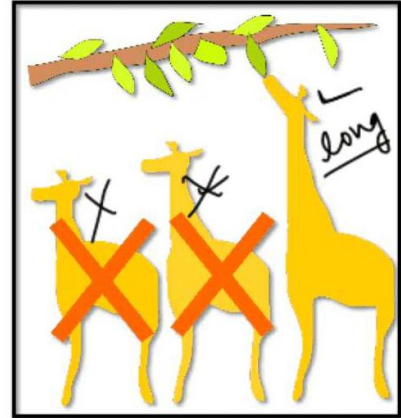
- 1) • **Variation-** Organisms (within populations) exhibit individual variation in appearance and behavior. ...
- 2) • **Inheritance-** Some traits are consistently passed on from parent to offspring. →
- High rate of population **growth**.
- 3) • **Differential** survival and reproduction.

Natural selection, process that results in the **adaptation** of an organism to its **environment** by means of selectively reproducing changes in its **genotype**, or genetic constitution.

Example #1

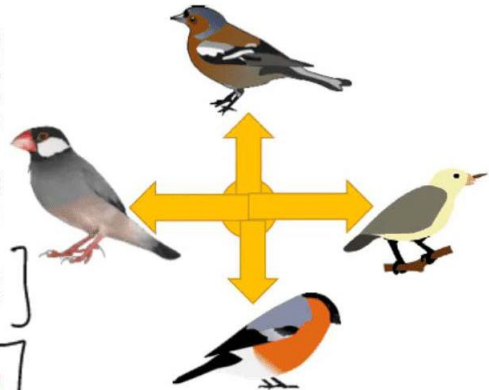
Darwin

- ✓ Giraffe neck- long neck due to survival of fittest which lead to natural selection of long neck giraffe. ✓

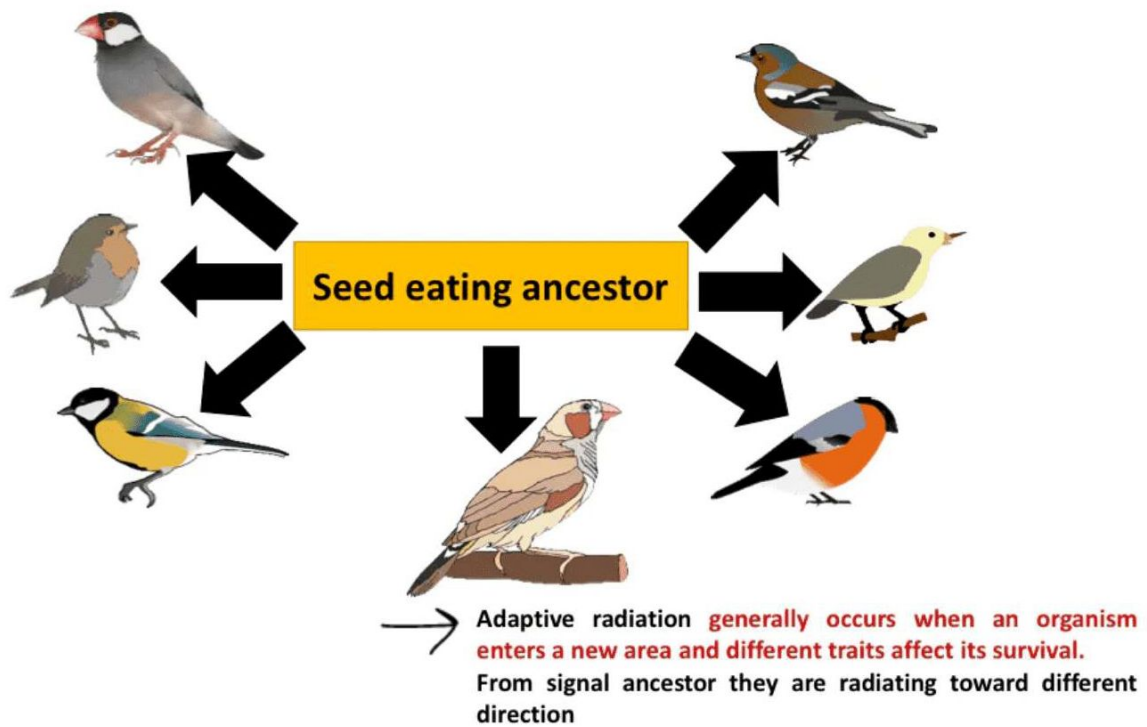


Example #2

- Darwin's Finches- An adaptation is a feature that is common in a population because it provides some improved function. Adaptations are well fitted to their function and are produced by natural selection .
- In evolutionary biology, adaptive radiation is a process in which organisms diversify rapidly from an ancestral species into a multitude of new forms, particularly when a change in the environment makes new resources available, creates new challenges, or opens new environmental niches.
- Starting with a recent single ancestor, this process results in the speciation and phenotypic adaptation of an array of species exhibiting different morphological and physiological traits.
- The prototypical example of adaptive radiation is finch speciation on the Galapagos ("Darwin's finches"), but examples are known from around the world.
- Beak size differ among the population of finches.
- Adaptive radiation is the relatively fast evolution of many species from a single common ancestor. Adaptive radiation generally occurs when an organism enters a new area and different traits affect its survival.



Radiation are emerging in different direction. From a common ancestor by course of adaptation



Finches with modified beak

