

## EXAM RESULTS

With Out Gift

With Gift

Grade	Highest%	Freq	Grade	Highest %	Freq
E	60	22	E	60	11
D	70	35	D	70	20
C-	73.3	12	C-	73.3	8
C	77.7	18	C	77.7	18
C+	80	14	C+	80	20
B-	83.3	9	B-	83.3	10
B	86.7	6	B	86.7	14
B+	90	6	B+	90	13
A-	93.3	2	A-	93.3	2
A	100	0	A	100	8

## Outline of Darwin's Theory

Postulates.

There is variation within species.

There is some form inheritance such that offspring are likely to share common traits with their parents

All species have the biotic potential to produce more offspring than the environment can support.

A very old earth.

## Outline of Darwin's Theory

If individuals vary and the environment rather than the innate ability to reproduce limits population growth, then some individuals will by chance be more likely to survive and reproduce in a given environment.

## Outline of Darwin's Theory

If the favorable traits are passed can be inherited it follows that over time the proportion of individuals in the population that possess the favorable traits will increase.

If this process of "Natural Selection" is repeated for many generations small changes could accumulate resulting in species changing over time.

## Quick Summary

- Darwin really proposed at least five theories the most important being Natural Selection
- Darwin's Theory of Natural Selection develops logically from a relatively few postulates.
- Those being
  - There is variation within species
  - There is inheritance of variable traits
  - Every species has the ability to grow exponentially
  - The earth is very old.

## Game Plan

- Discuss some critically misunderstood terms related to Darwin's Theory
- The Radical Ideas embedded in Darwin's Theory of Evolution.

## Darwin's Theory and Catch Phrases

- **Natural Selection**
- **Survival of the fittest**
- **Nature red in tooth and fang**
- **Descent with modification**
- **Local Adaptation**

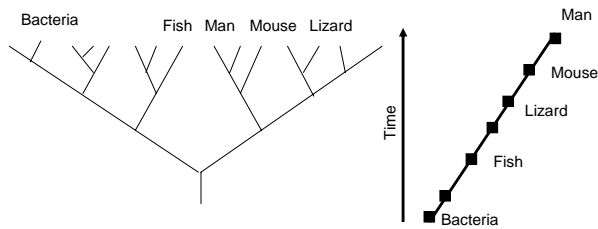
## The Origin of Species

Original Title – *On The Origin Of Species By Means Of Natural Selection, Or The Preservation Of Favoured Races In The Struggle For Life.*

The word "evolution" does not appear in text. The word "evolved" occurs only once as the last word in the text.

## Radical Ideas Embedded in Darwin's Theory

- Non-directional selection
  - Tree of life vs. Ladder of progress
  - Selection only favors adaptation to local conditions, Not progressive improvement!



## Vitalism Materialism and Natural Theology

- Vitalism – a doctrine that life is endowed with a “vital” force independent of physical and chemical processes.
- Materialism – a doctrine that all phenomena can be explained in their entirety based only on physical and chemical principles.
- Darwin's theory was materialistic and undermined the central tenants of natural theology.

## Radical Ideas Embedded in Darwin's Theory

- Thinking about Populations not Individuals
  - Populations evolve, individuals do not
  - Probability and chance play a major role.

## QUICK SUMMARY

- Darwin's theory were radical because –
- They challenged the idea of progress and direction in evolution.
  - They were materialistic
  - They required thinking about statistical changes in populations rather than understanding individuals.

### Darwin's Luck

- "Chance favors the prepared mind" -Pasteur
- Darwin assumed many things that in retrospect there was only marginal evidence or understanding of at the time.
- In the 140 years since Darwin's theory was published, the physical and chemical principles of those assumptions have become more fully understood.
- Darwin's crucial assumptions have all been supported by subsequent developments.

### Darwin's Luck

- Darwin assumed that there was variation within all species.
- Darwin based this assumption on a lifetime of experience of collecting and measuring organisms.
- He used inductive reasoning to generalize that because the species and specimens he studied varied, all species varied.

### Darwin's Luck

- Darwin did not know –
  - Why variation occurred.
  - Whether there were limits on the variation,
  - Whether the variation was caused by environment or genetics
- Subsequently, the discovery of DNA and the chemical and physical principles involved in mutation allow modern scientist to confirm –
  - Individuals vary, in part, because their DNA has different nucleotide sequences.
  - Mutation alters the nucleotide sequence and will provide a nearly limitless source of variation.
  - Variation is caused by both genetics (inherited nucleotide sequences) and environment.

### Darwin's Luck

- Darwin assumed that traits were inherited from parents, that individuals would tend to resemble their parents and that individuals did not acquire new traits during their lifetime.
- He based this assumption largely on the limited knowledge of inheritance that practical plant and animal breeders had developed over the centuries

### Darwin's Luck

- Darwin did not know –
  - The chemical or physical principles of inheritance.
  - Why offspring resembled their parents.
  - Why offspring are not identical to their parents.
  - Whether traits were inherited as discrete units or whether there was a blending of the two parents' traits
- Subsequently the discovery of chromosomes, meiosis, genes and DNA confirmed –
  - A well understood chemical and physical process will result in children inheriting discrete genes from each parent.
  - It is likely that offspring will share many traits with their parents.
  - In sexually reproducing species it is unlikely that the offspring will be identical to their parents
  - The units of inheritance are discrete, but the resulting offspring will have some traits that are characteristic of only one parent and other traits that will be intermediate between the two parents.
  - That traits acquired during life of an individual are unlikely to be transmitted to their offspring.

### Darwin's Luck

- Darwin assumed that every species had the potential for its populations to grow exponentially.
- Darwin based this on inductive reasoning, the species studied up to that time had demonstrated this ability. So he generalized that all species have that ability.
- Subsequent observations have yet to find a viable population that does not show this ability. Since it is impossible to study all species we still use inductive reasoning to make this generality, but it is supported by another 140 years of data.

### Darwin's Luck

- Darwin assumed that the earth was very old.
- He based this on the accepted geological theories of the time. Many of those theories were based on arguments about how and why geological strata were formed.

### Darwin's Luck

- The geological theories of Darwin's day were often based on analogies to how and how fast sediments are formed today. There was no independent way of dating when or how a sediment was formed.
- Subsequently
  - Knowledge of radioactivity and other physical and chemical principles have allowed the development of a number of techniques to assign dates to the formation of geological strata.
  - These independent dating techniques are consistent with a very old earth.