

# MACRO AND MICRO EVOLUTION

BALAN GOVARTHAN LA-1 201(2)

## Macroevolution

- A change among species over a long time span with some species dying out and new species emerging. Major biological changes evident in the fossil record.

## Microevolution

- Evolution on the smallest scale. A generation to generation change in the frequencies of alleles within a population

# Evidence of Macroevolution

# 1. Fossil Record

The study of fossils provides the strongest evidence of evolution.

## What is a fossil?

*Any trace or remains of an organism that has been preserved by natural processes.*

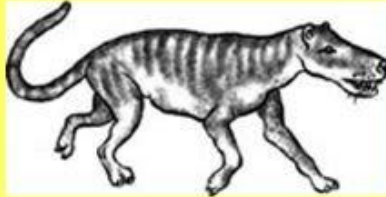
**By studying fossils, scientists can compare the remains of ancient organisms with organisms living today.**



**3. Pterodactyl (210-140 myo)**

# Whale Evolution Based on the Fossil Record

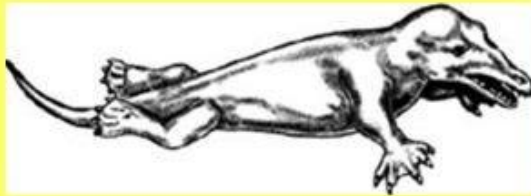
55 mya



***Mesonychids***

(extinct land mammals, with whale-like teeth)

48 mya



***Ambulocetus natans***

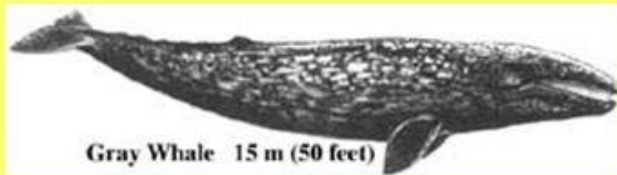
Walked on land. Swam with backbone and hindlimbs

46 mya



***Rodhocetus kasrani***

Spent little time on land

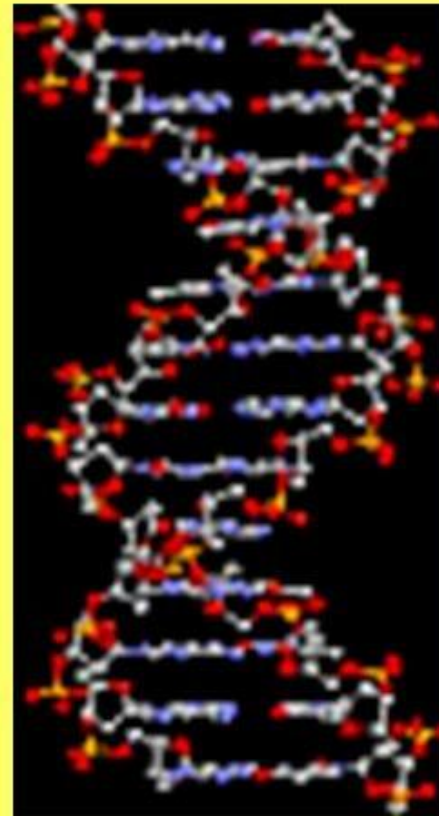


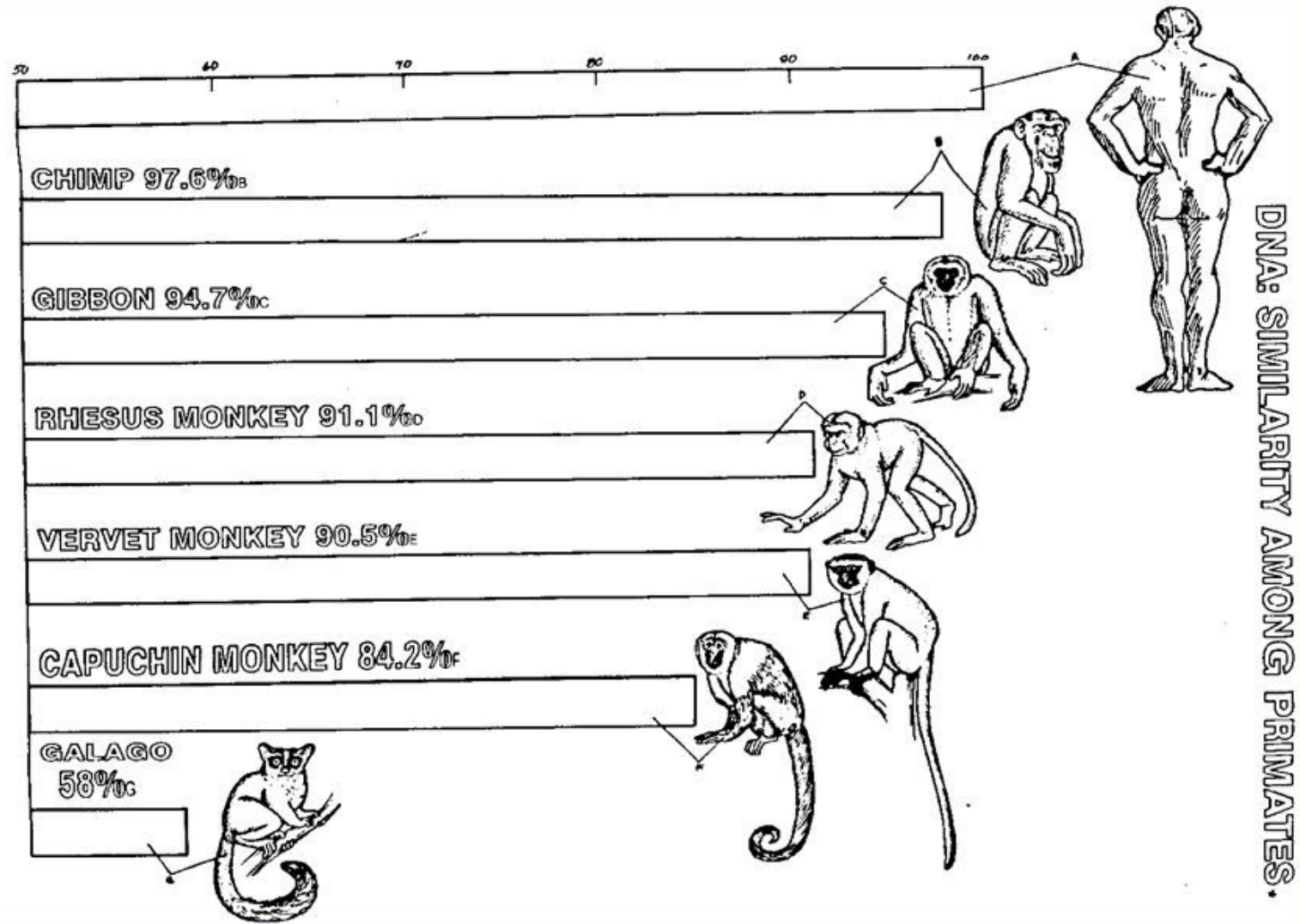
**Modern Whale**



## 2. Comparative Biochemistry and Genetics

- The closer the relationships between organisms based on anatomy, the more alike the structure of their DNA and protein molecules





# A chain of Amino Acids is a protein

Our hemoglobin shares only this many differences with these animals

Seems to agree with the DNA evidence we just saw

Species	Amino Acid Differences
	Compared with human hemoglobin
<b>Gorilla</b>	1
<b>Rhesus monkey</b>	8
<b>Mouse</b>	27
<b>Chicken</b>	45
<b>Frog</b>	67
<b>Lamprey</b>	125

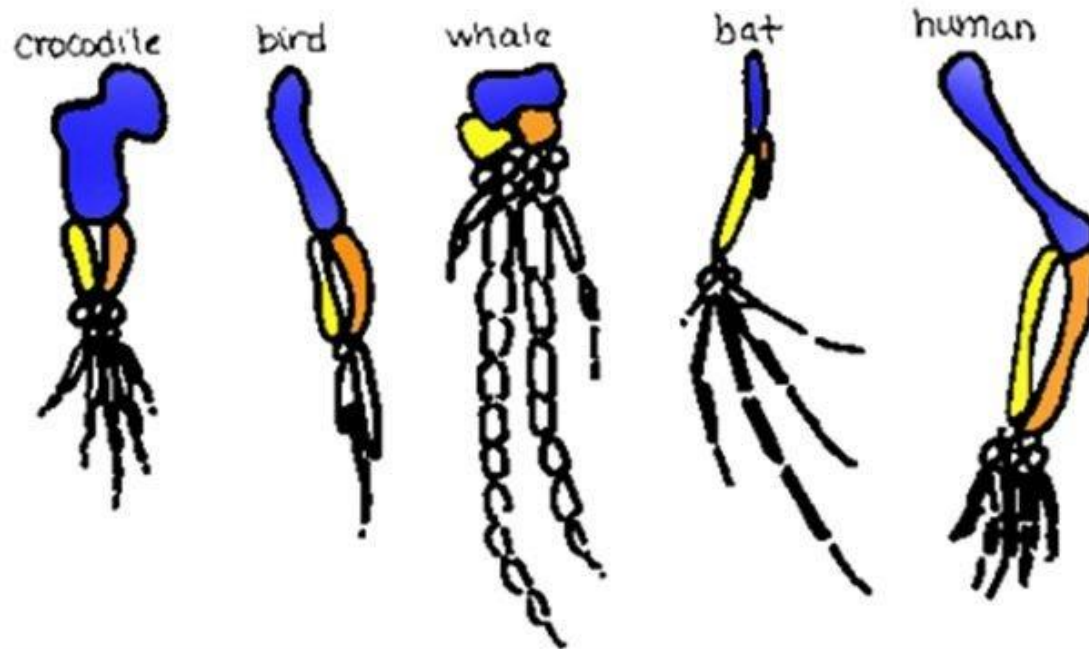


### 3. Comparative Anatomy

The presence of certain types of similarities in anatomy offers evidence for the evolutionary relationships between species.

**Homologous Structures** – parts of different organisms that have *similar structures but may have different forms and functions*.

## HOMOLOGOUS STRUCTURES



### KEY:

**Blue = humerus**   **Yellow = Radius**   **Orange = Ulna**

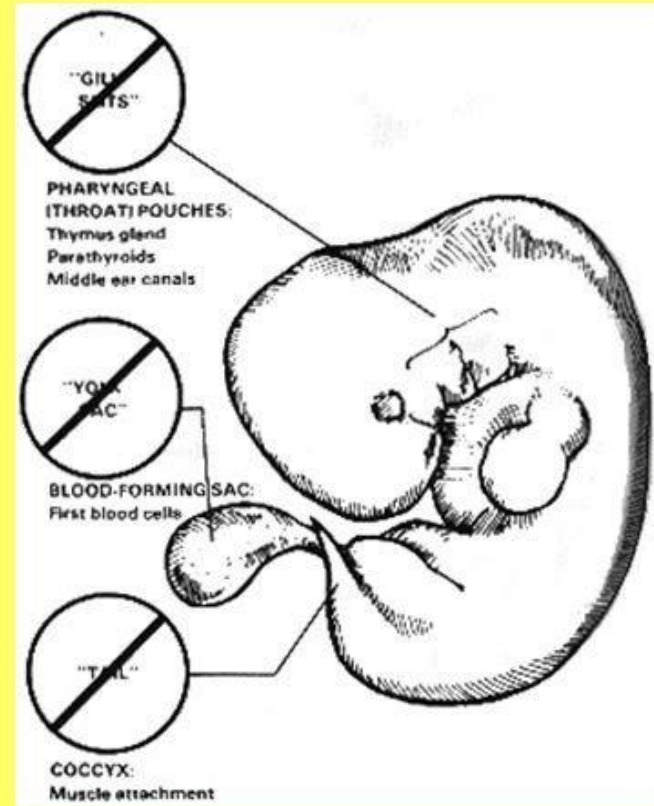
**Black = carpals, metacarpals, phalanges**

## 4. Vestigial Organs

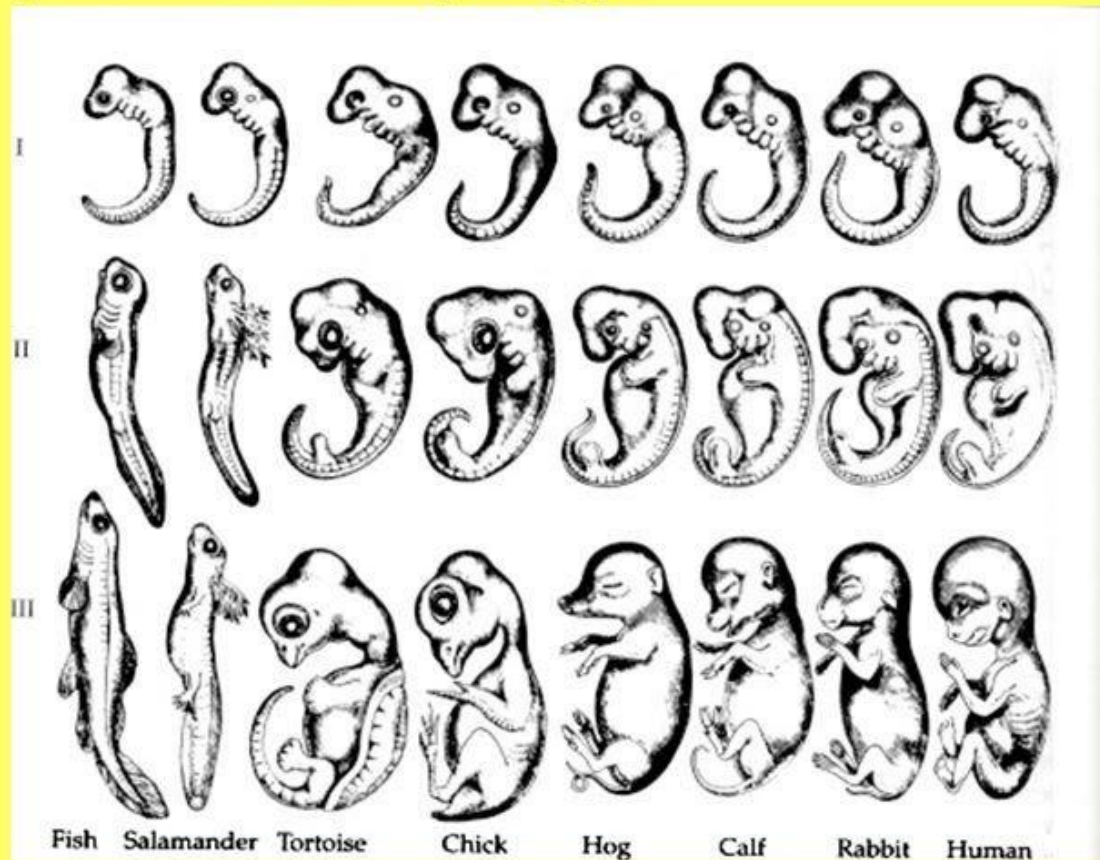
Small or incomplete structures with no apparent function

Ex. Coccyx, appendix, whale leg bones

Where these structures functional in an ancestral form?



## 5. Comparative Embryology



Similarities in the early stages of embryonic development suggest a common ancestor for these vertebrates.



# Models of **Gradualism** and **Punctuated Equilibrium** in Evolution

**Gradualism**- gradual changes over long periods of time leads to species formation

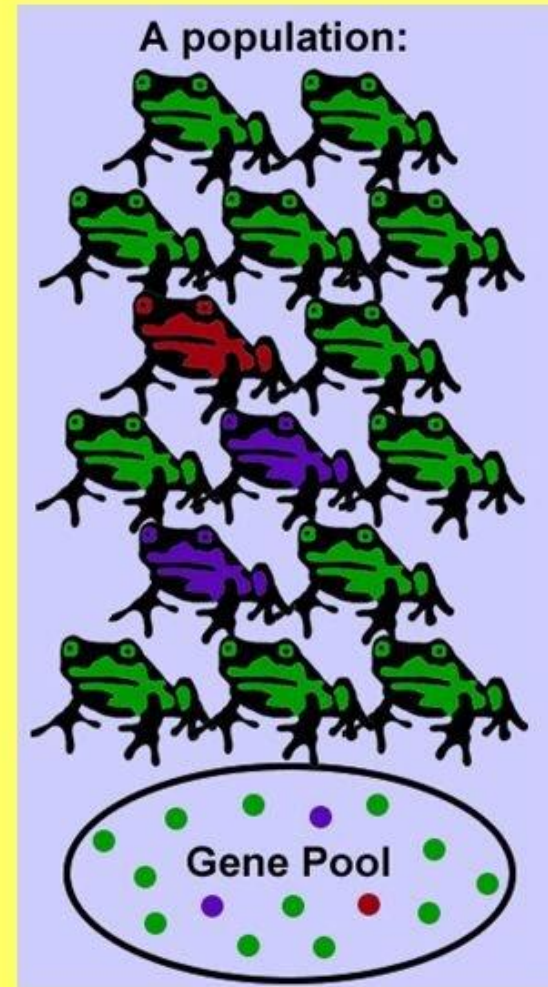
**Punctuated Equilibrium**- evolution occurs in spurts followed by periods of neutral change in species

*Evidence, like we have seen, supports that both may happen at once. Subtle changes **and** sudden “catastrophic events” to a species environment have shaped and continue to shape species on the planet*



# Mechanisms of Microevolution

- Microevolution occurs due to variations in the “gene pool”
- Gene pool – all the alleles (alternative forms of a gene) in all the individuals that make up a population. It is the “pool” from which the next generation draws its genes.



# Hardy Weinberg Equilibrium

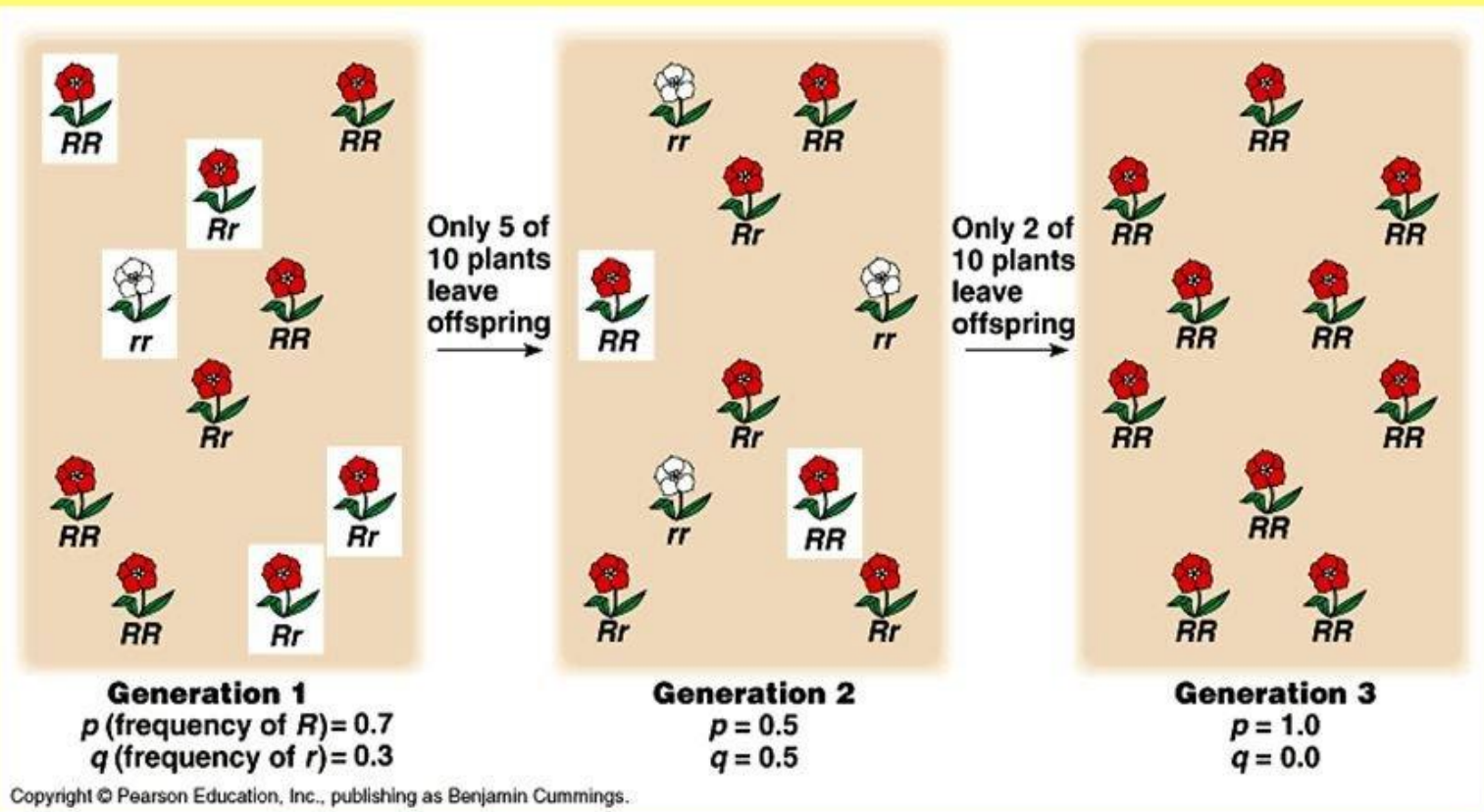
- Populations that do not undergo change to their gene pools are not evolving
- They are in a condition known as Hardy Weinberg equilibrium
- HOWEVER, populations rarely remain in H-W equilibrium for long, because many mechanisms can change a gene pool.....

# **Factors that Cause Changes to the Gene Pool**



# 1. Genetic Drift

Changes in the gene pool due to chance is called genetic drift. The smaller the population, the greater chance for random changes in frequencies.



# Founder Effect

When a few individuals colonize an island, lake or new habitat, the population of the new colony will likely have different genetic makeup than the original larger population



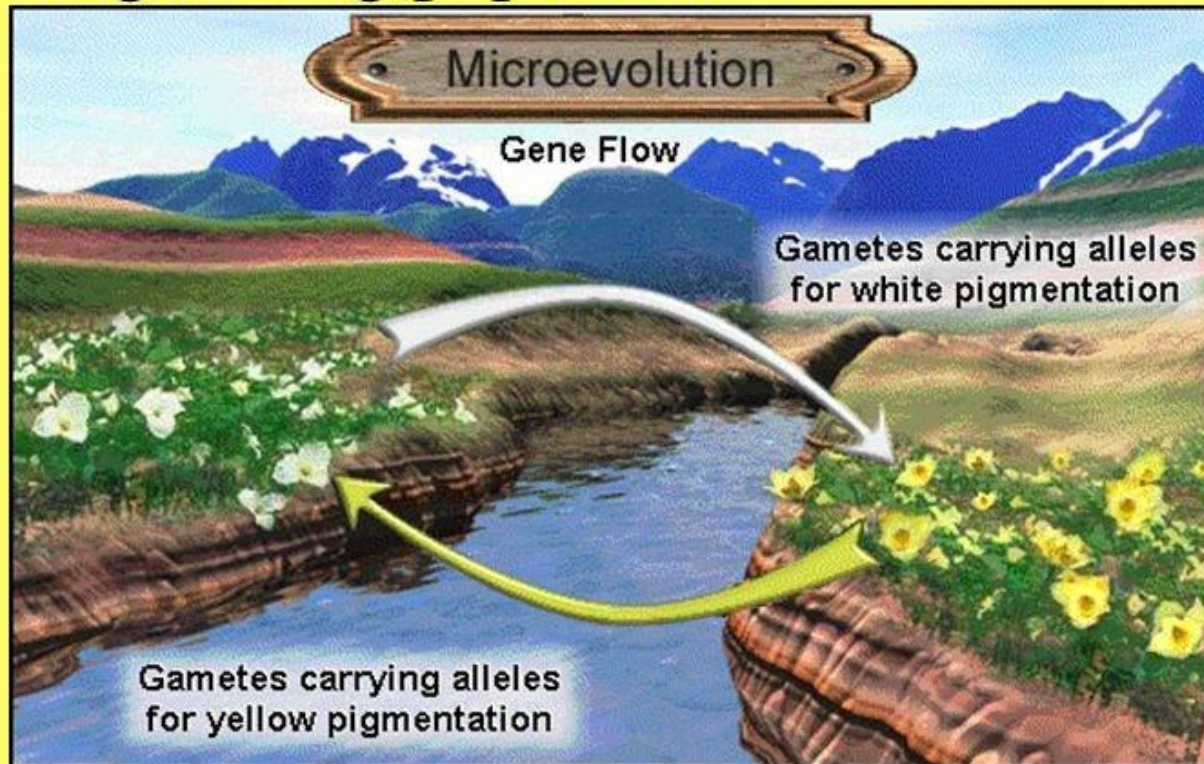
**Figure 38-12 AN AMISH CHILD WITH ELLIS-VAN CREVELD SYNDROME.**

The child has shortened limbs and six fingers on each hand. All the Amish with this syndrome are descendants of a single couple that helped found the Amish community in Lancaster County, Pennsylvania, in 1744. Because of inbreeding in the isolated community, the recessive trait is now common.



## 2. Gene Flow

Gene flow is caused by migration of individuals or their gametes between neighboring populations.



### 3. Mutation

Mutations are random changes in an organism's DNA. If the DNA is carried by a gamete, it enters the population's gene pool. The vast majority of mutations are very minor changes in the DNA not drastic changes such as the one pictured here!





## 4. Natural Selection

- This is the major force that leads to adaptation.
- It is a sorting among all the variations in the population for the “fittest”
- Fitness means the “contribution an individual makes to the gene pool of the next generation compared to the contributions of other individuals.”, in other words, production of more healthy fertile offspring than others.



**THANK YOU**