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Evolution For The CLA Project

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Evolution as a characteristic of life has been controversial. Jane Doe argues that the mechanism of evolution is creationism, the idea that a supernatural being created each type of organism separately at the beginning of the world, and that all modern organisms are essentially unchanged descendants of these ancestors (Audesirk and Audesirk, 1993). The only evidence she presented is the account of creation in the first chapter of the Bible, the book of Genesis. John Doe argues that evolution occurs through mutation, genetic drift, migration and natural selection (Phelan, 2009). He observed that creationism is a doctrine based on faith, which is neither empirical nor replicable.

Questions

As a student in NSCI 120, you will answer a series of open-ended questions about the mechanisms of evolution proposed by John Doe, who has presented evidences in the form of figures and a table to support his claim that mutation, genetic drift, migration, and natural selection lead to evolution. What are the strengths and/or limitations of John Doe's position? What conclusions should be drawn about John Doe's claim? Why? Explain the reasons for your conclusions by explicitly referring to the specific documents, data, and statements on which your conclusions are based. Your answer will be judged not only for the accuracy of the information you provide, but also on how clearly the ideas are presented, how effectively the ideas are organized and how thoroughly the information is covered. Is there a better explanation for evolution, and if so, what are the strengths and/or limitations? Be sure to cite the information in the figures/table as well as any other factors that led you to these conclusions. You are referred to chapters 14-17 of the textbook which focus on the principles and mechanisms of evolution.

Again, why your personal values and experiences are important, you should base your response on the evidence provided in the figures and table.

John Doe contends that:

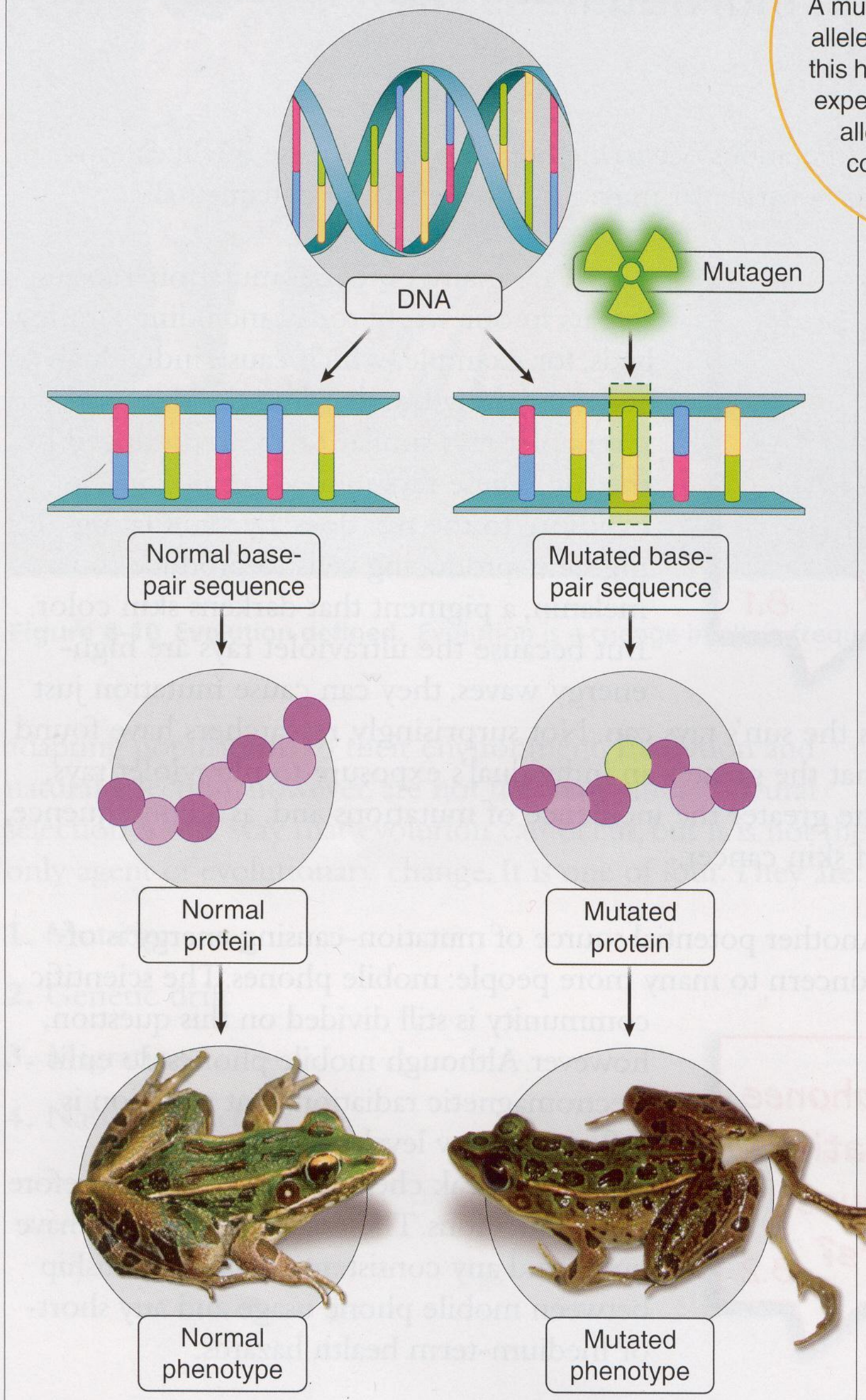
1. Evolution is a change in allele frequencies within a population. It can occur by four different mechanisms: mutation, genetic drift, migration, and natural selection.
2. Mutation is a sudden, inheritable change in the structure of the genetic material of an organism; a change in genotype.
3. Genetic drift is a random change in allele frequencies in a population.
4. Migration or gene flow leads to a change in allele frequencies in a population as individuals move into or out of the population.
5. Evolution by natural selection occurs when three simple conditions are satisfied: variation for a trait, heritability of the trait, and differential reproductive success.

EVOLUTIONARY CHANGE: MUTATION

MECHANISMS OF EVOLUTION

MUTATION

A mutation can create a new allele in an individual. When this happens, the population experiences a change in its allele frequencies and, consequently, experiences evolution.



Despite mutation's vital role in the generation of variation, mutations almost always cause early death or lower the reproductive success of an organism.

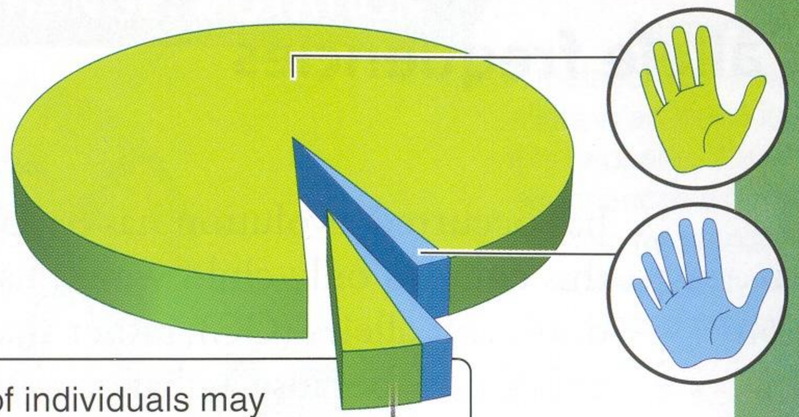
Figure 1 **Agents of evolutionary change: mutation.**

GENETIC DRIFT: FOUNDER EFFECT

SOURCE POPULATION

Allele frequencies:

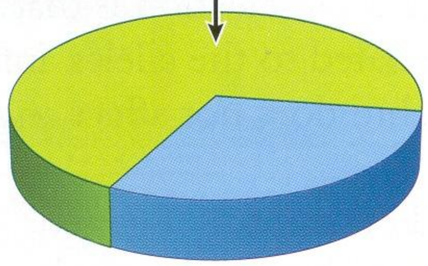
- 5 digits per hand (recessive)
- >5 digits per hand (dominant)

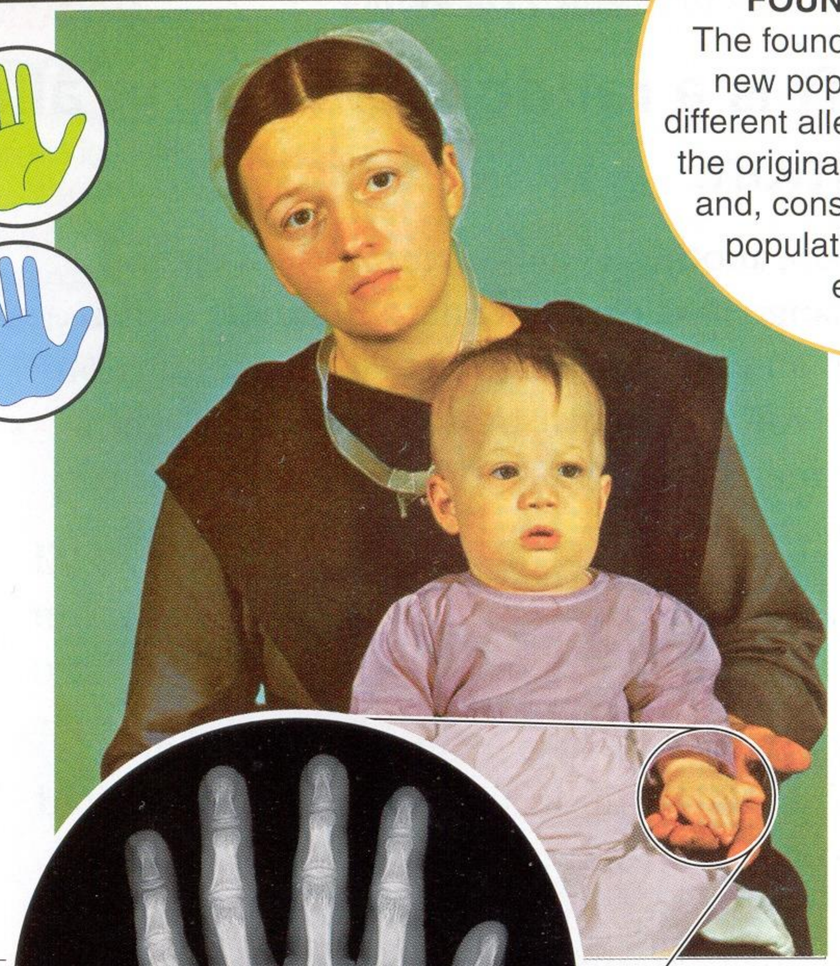


A group of individuals may leave a population and become the founding members of a new, isolated population.

NEWLY FOUNDED POPULATION

The new population will be dominated by the genetic features present in the founding members.





MECHANISMS OF EVOLUTION

FOUNDER EFFECT

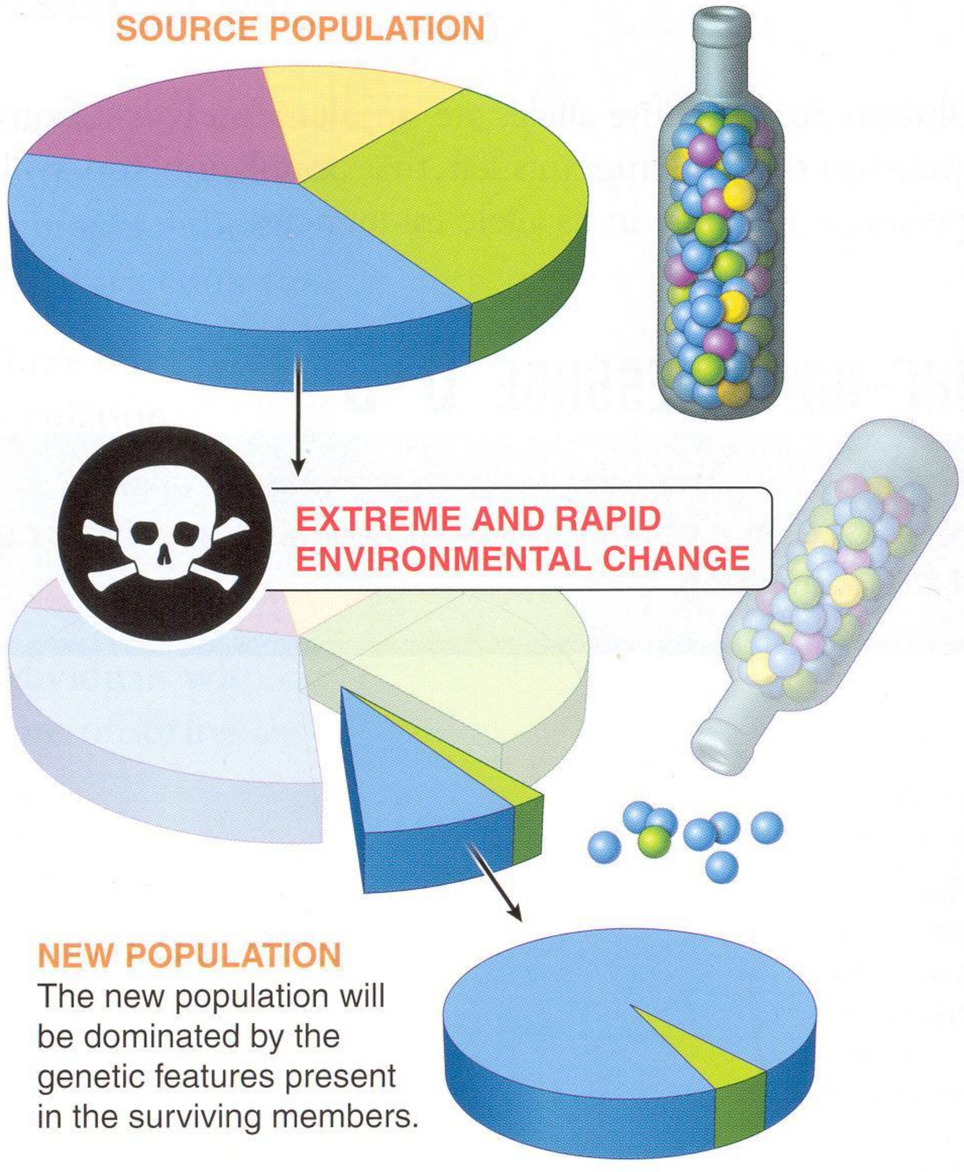
The founding members of a new population can have different allele frequencies than the original source population and, consequently, the new population experiences evolution.

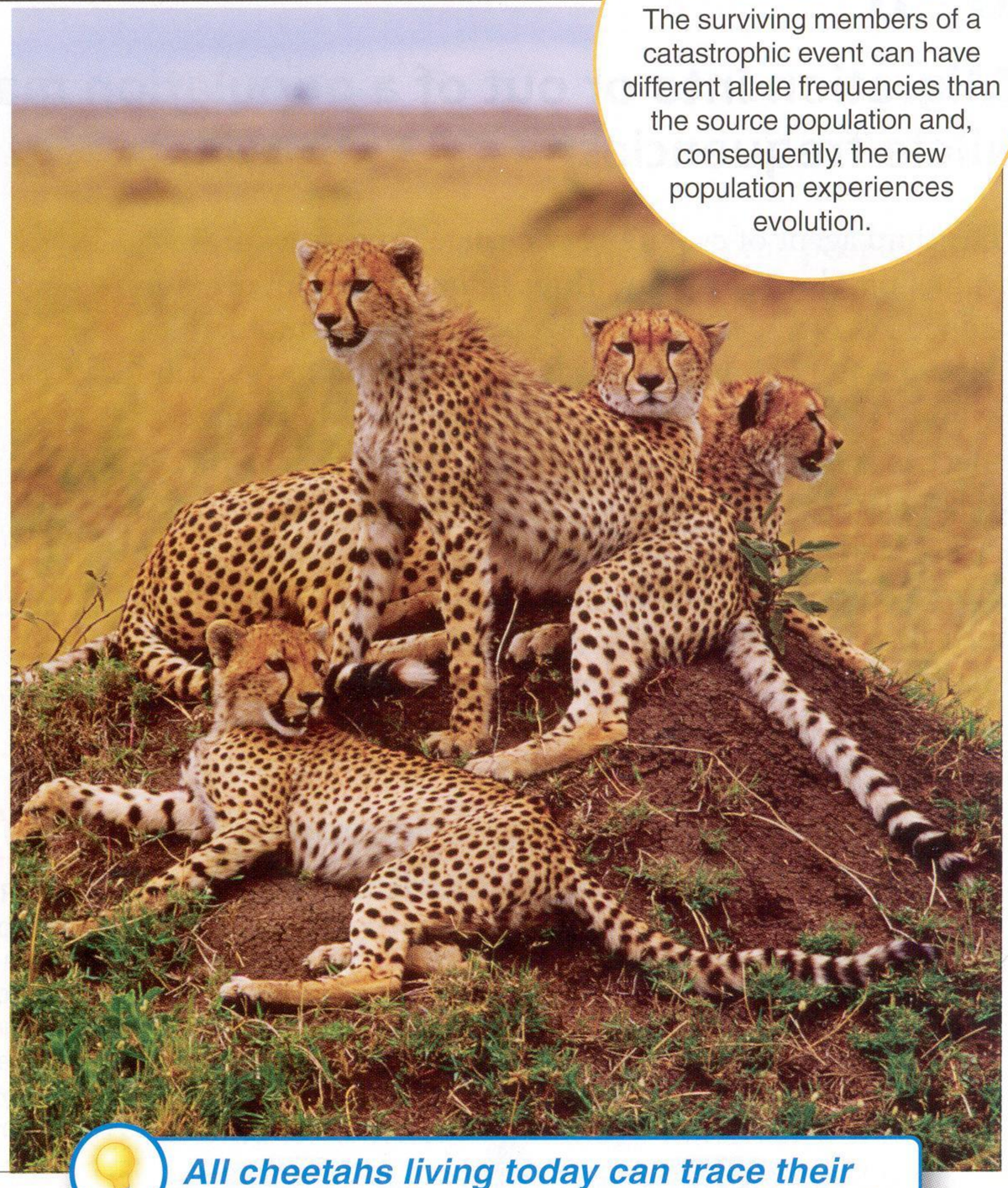
Figure 2 One way that genetic drift occurs: founder effect.

GENETIC DRIFT: BOTTLENECK EFFECT

BOTTLENECK EFFECT
The surviving members of a catastrophic event can have different allele frequencies than the source population and, consequently, the new population experiences evolution.

Occasionally, famine or disease or rapid environmental change may cause the deaths of a large, random proportion of the individuals in a population.





All cheetahs living today can trace their ancestry back to a dozen or so individuals that happened to survive a population bottleneck about 10,000 years ago!

Figure 3 Another way that genetic drift occurs: bottleneck effect.

Figure 4 Necessary conditions for natural selection: 1. Variation for a trait.

MIGRATION (GENE FLOW)

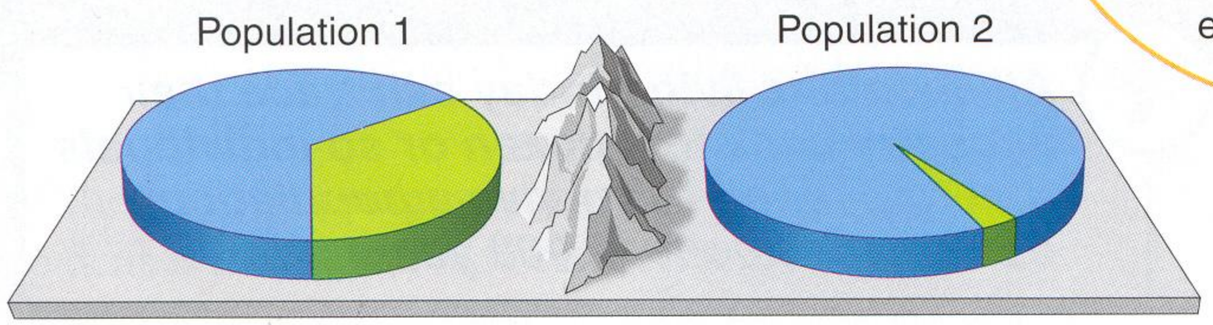
MECHANISMS OF EVOLUTION

MIGRATION

After a group of individuals migrates from one population to another, both populations can experience a change in their allele frequencies and, consequently, experience evolution.

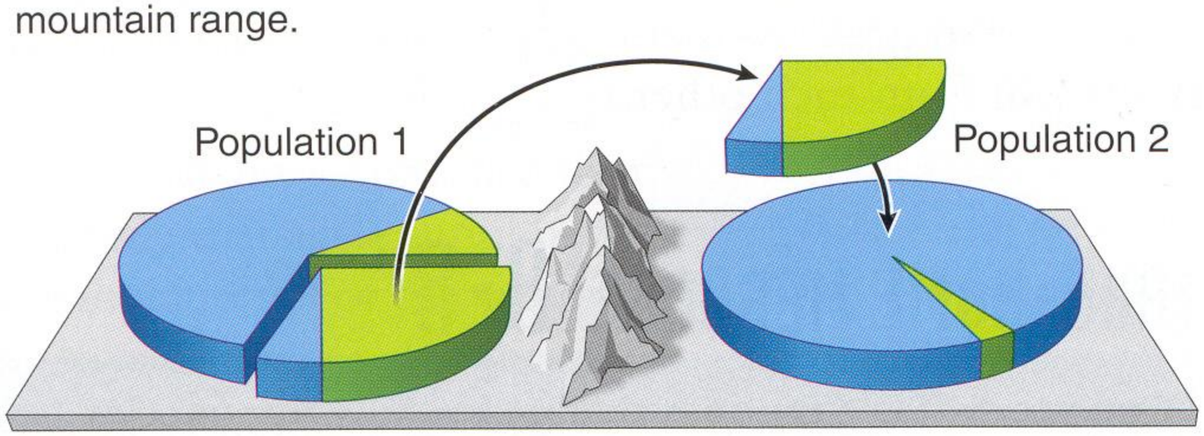
1 BEFORE MIGRATION

Two populations of the same species exist in separate locations. In this example, they are separated by a mountain range.



2 MIGRATION

A group of individuals from Population 1 migrates over the mountain range.



3 AFTER MIGRATION

The migrating individuals are able to survive and reproduce in the new population.

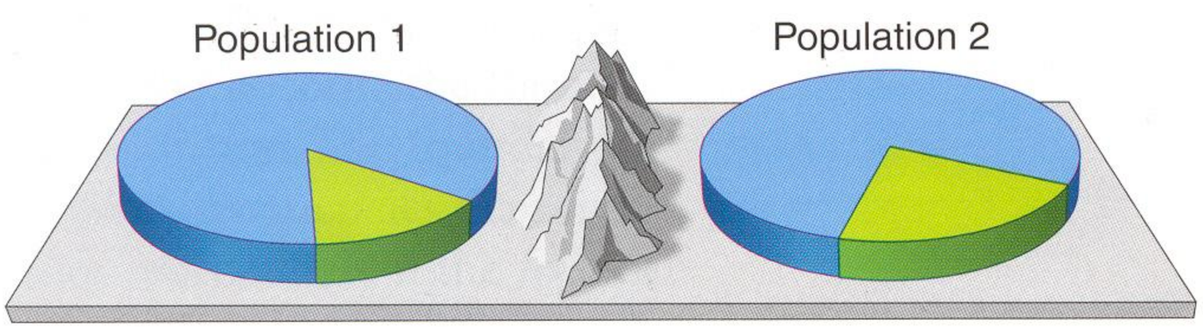


Figure 5 **Agents of evolutionary change: migration (gene flow).**

Figure 6 **Necessary conditions for natural selection: 2. Heritability.**
Goldie Hawn and daughter Kate Hudson resemble each other.

Figure 7 **Necessary conditions for natural selection: 3. Differential reproductive success.**

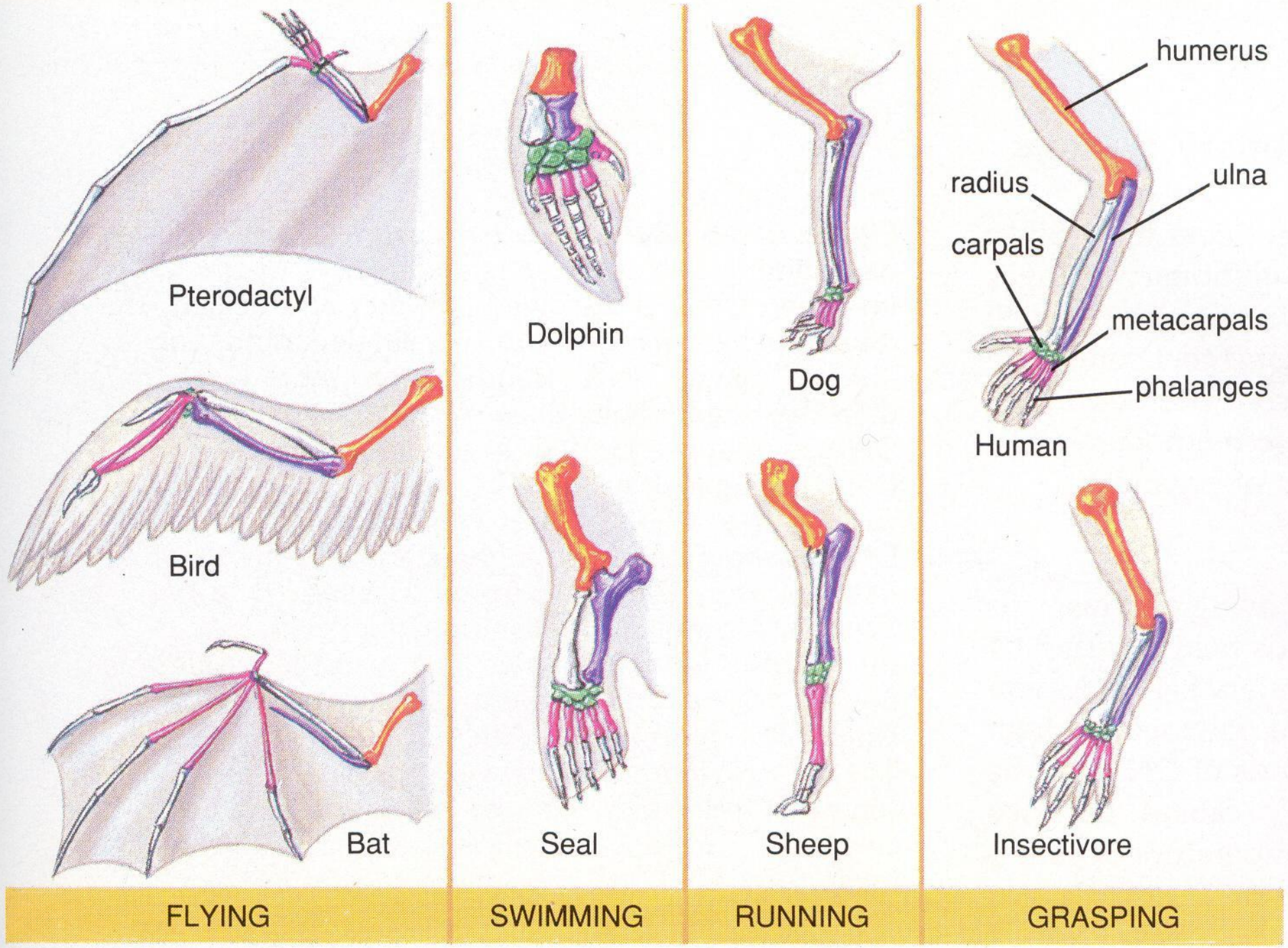
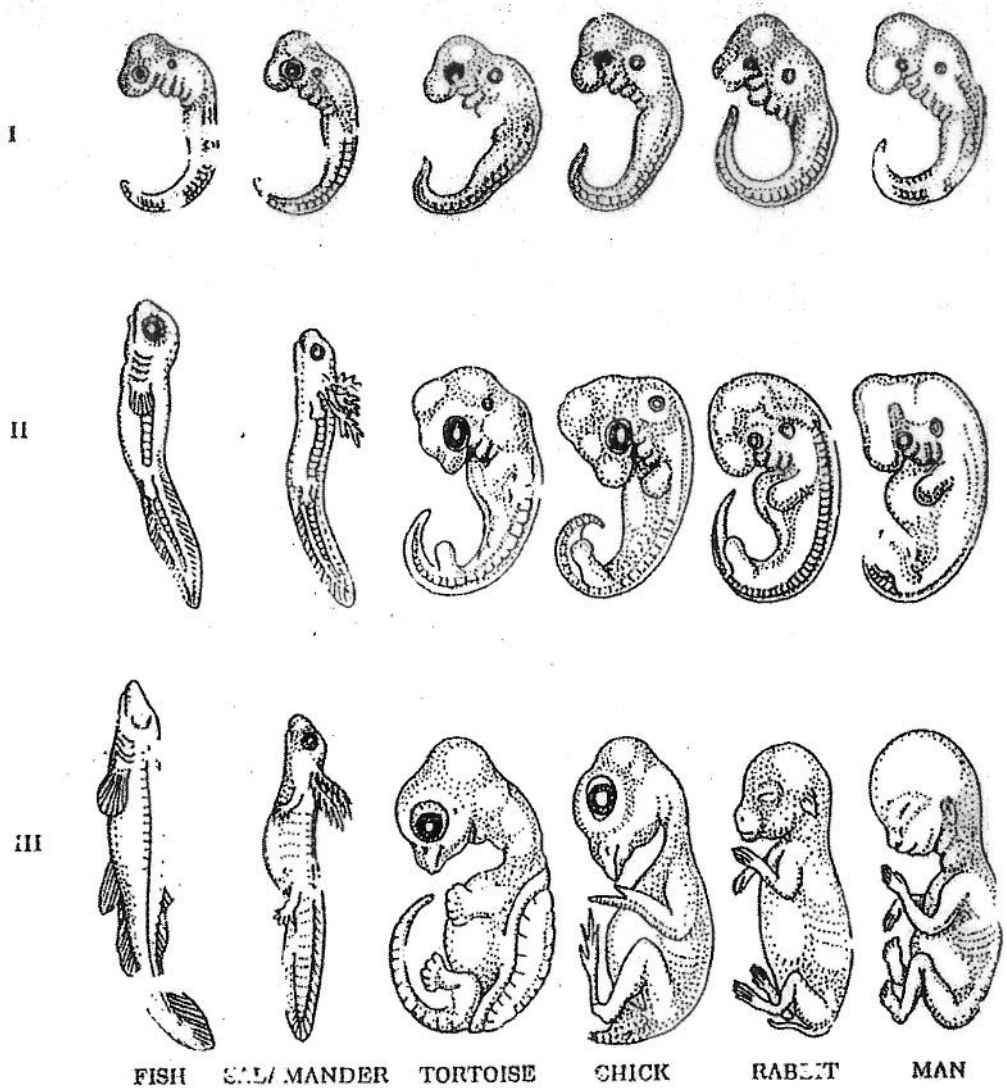


Figure 8 Homologous structures. The bones in the forelimbs of amphibians, reptiles, birds, and mammals are all similar to one another, despite wide differences in function. The bones have been tinted different colors to highlight the similarities among the various species.

human	0															
monkey	1	0														
pig, bovine, sheep	10	9	0													
horse	12	11	3	0												
dog	11	10	3	6	0											
rabbit	9	8	4	6	5	0										
kangaroo	10	11	6	7	7	6	0									
chicken, turkey	13	12	9	11	10	8	12	0								
duck	11	10	8	10	8	6	10	3	0							
rattlesnake	14	15	20	22	21	18	21	19	17	0						
turtle	15	14	9	11	9	9	11	8	7	22	0					
tuna fish	21	21	17	19	18	17	18	17	17	26	18	0				
moth	31	30	27	29	25	26	28	28	27	31	28	32	0			
Neurospora	48	47	46	46	46	46	49	47	46	47	49	48	47	0		
typical yeast *Saccharomyces*	45	45	45	46	45	45	46	46	46	47	49	47	47	41	0	
Candida	51	51	50	51	49	50	51	51	51	51	53	48	47	42	27	0
	human	monkey	pig, bovine, sheep	horse	dog	rabbit	kangaroo	chicken, turkey	duck	rattlesnake	turtle	tuna fish	moth	*Neurospora*	typical yeast *Saccharomyces*	*Candida*

Figure 9 **Significance of biochemical differences.**

This diagram shows the amino acid differences in cytochrome *c* among the organisms listed. The number where the two organisms intersect (see listing on bottom and sides) indicates the number of amino acid differences. The more closely related the species, the fewer the biochemical differences.



10.16. A comparison of vertebrate embryos at three stages of development. [Redrawn from G. J. Romanes, *Darwin and after Darwin*, Open Court Publishing Co., 1901.]

figure 10 -

Table - 1 **Chronology of Physical and Biological Evolution**

Event	**Approximate Time (Billions of Years)**
Origin of our system	5.0
Formation of the earth	4.5
Formation of the earth's crust	4.0
Age of the oldest mineral	3.6
Earliest manifestation of life	2.7
Oldest Fossils (microorganisms)	1.6
Formation of Oxygen containing atmosphere	1.0
First hard-shelled animals	0.6
Age of dinosaurs	0.151
Earliest Appearance of man	0.001