Biodiversity and Evolutions

المرحلة الثانية

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Biodiversity and Evolutions

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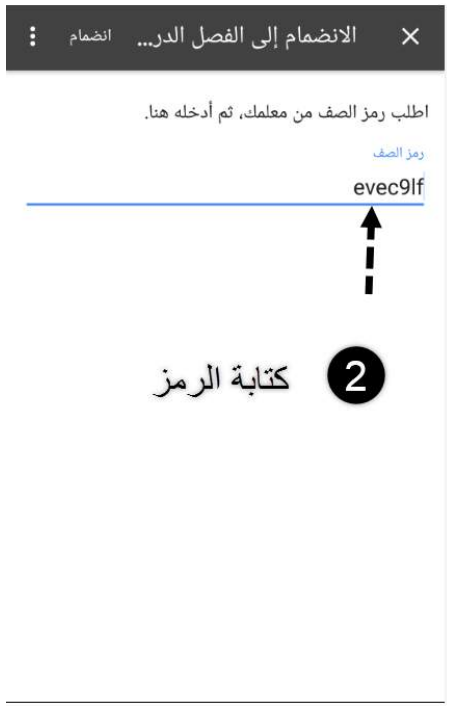
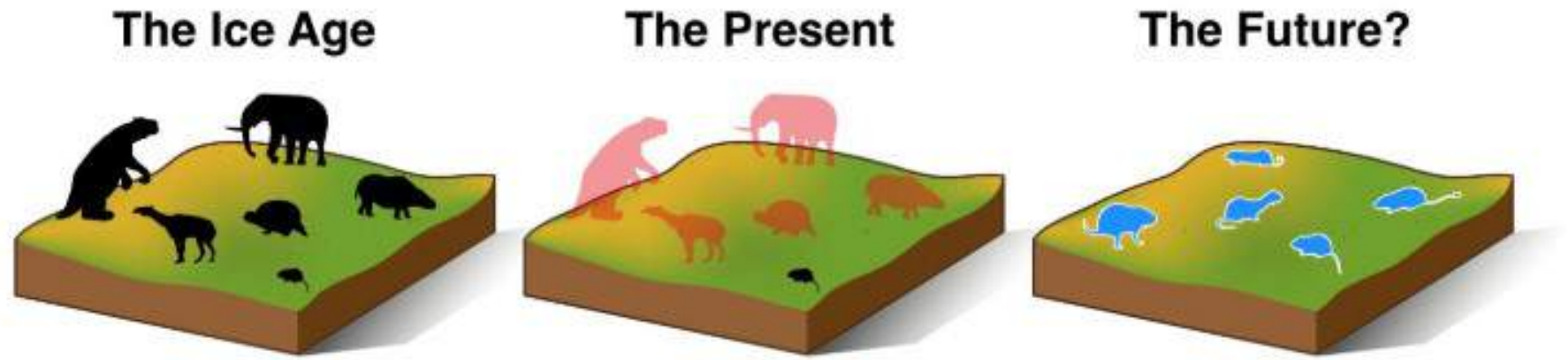


Introduction on diversity and bioregulation

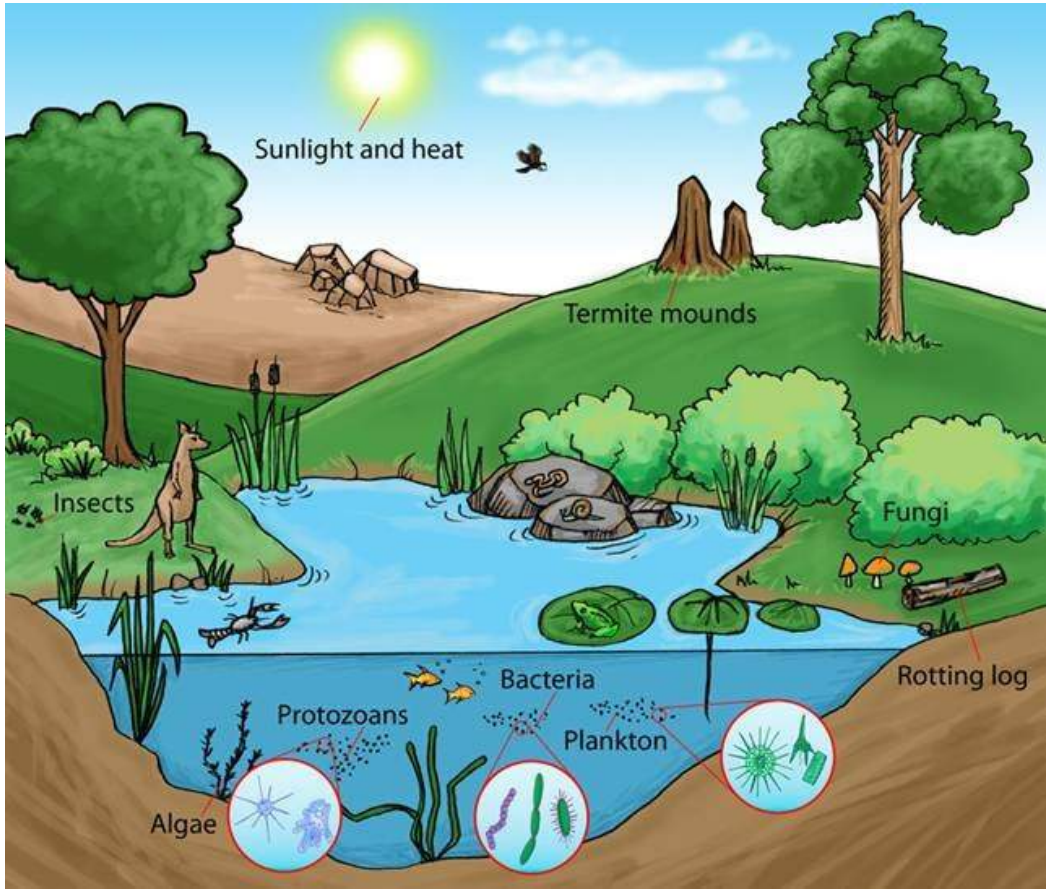
General interest in biodiversity has grown rapidly in recent decades?!

because of its great importance for understanding the relationship between human and species in the environment where he lives. Life on earth depend on balanced regime in diversity and loss of any type of species or population in any ecosystem will be reduce the biodiversity and makes defect on the planet.



The science of **biodiversity** originates largely from

- **Ecology** (the study of the relationship between organisms and their environment)
- **Evolution** (the study of the origin of diversity).



Biodiversity: is defined as the variety of all forms of life from genes to species, through to the broad scale of ecosystems (this simple definition to Gaston, 1996)

while (Hanisou *et al.*, 2004) define
biodiversity as whole number of species **lives in earth now** (animals .plants , microorganisms)

So far, about 1.75 million species have been identified, mostly small creatures such as insects. Scientists estimate that there are actually about 13 million species have been not identified yet.

Biologists most often define

biodiversity as the "totality of **genes, species, and, ecosystems** of a region".

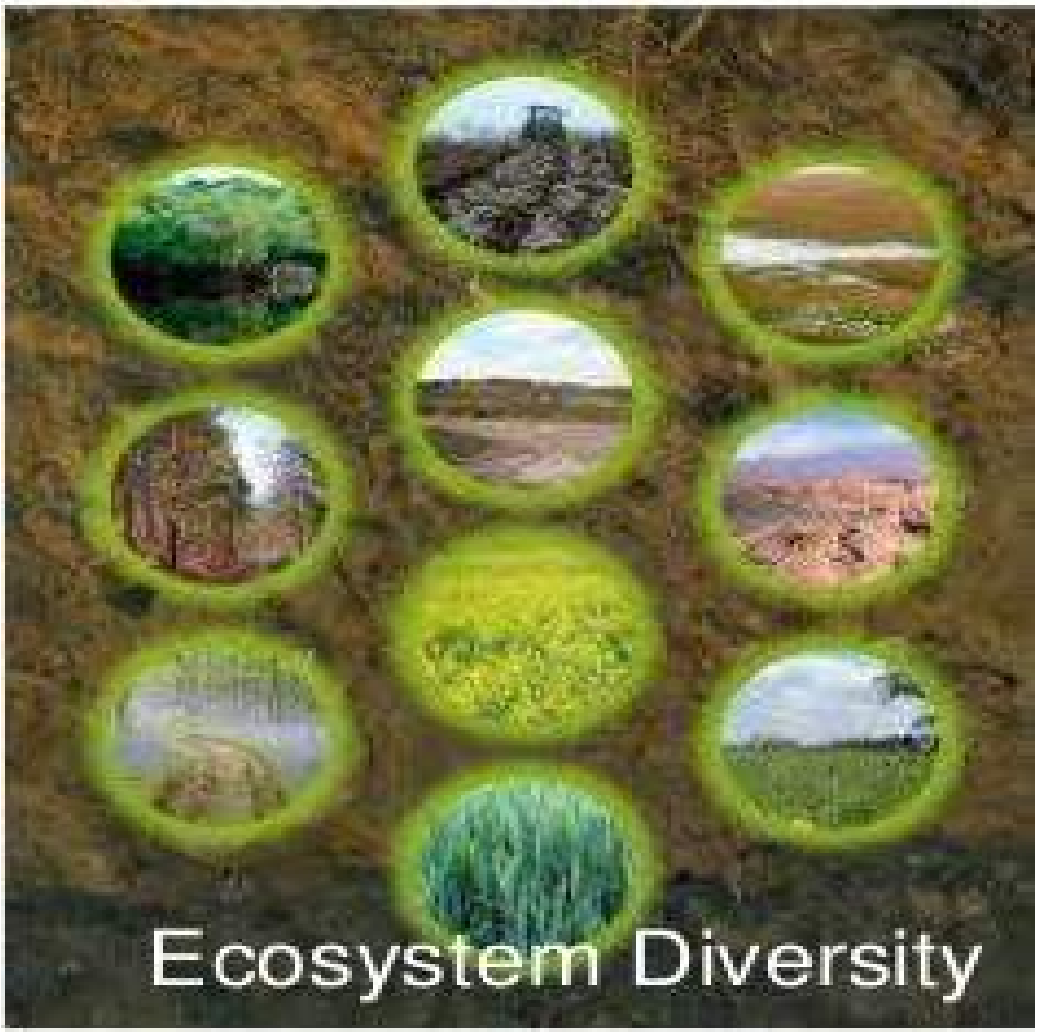
An advantage of this definition is that it seems, to describe most circumstances and presents a unified view of the traditional three levels at which biological variety has been identified

- genetic diversity
- species diversity
- ecosystem diversity

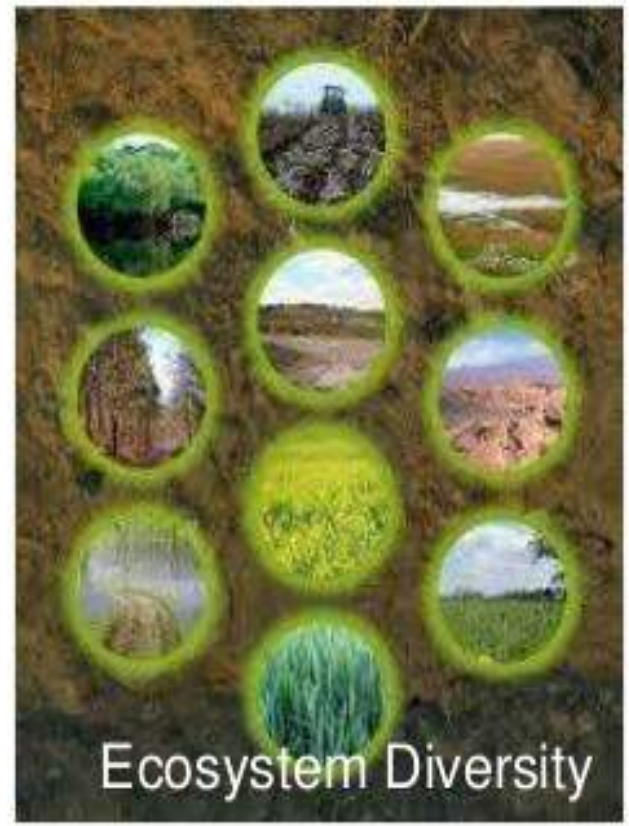
Genetic diversity: is the different genes (**genotype**) found within a population of a single species, and the pattern of variation found within different species

Species diversity: is the variety of **phenotype** and **genotype** (form, genes) among different species which inhabit an area. Its mean the number of exist species on earth *(*animals, plants, microorganisms)

Ecosystem diversity: the variety of ecosystem or habitats that occur within a region, and the relationship of species with this ecosystems.

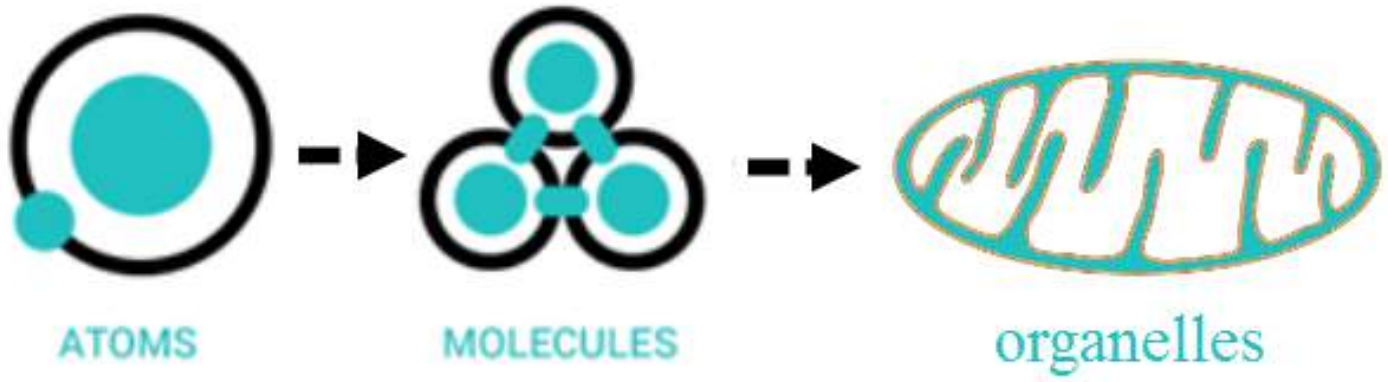


Biodiversity Types

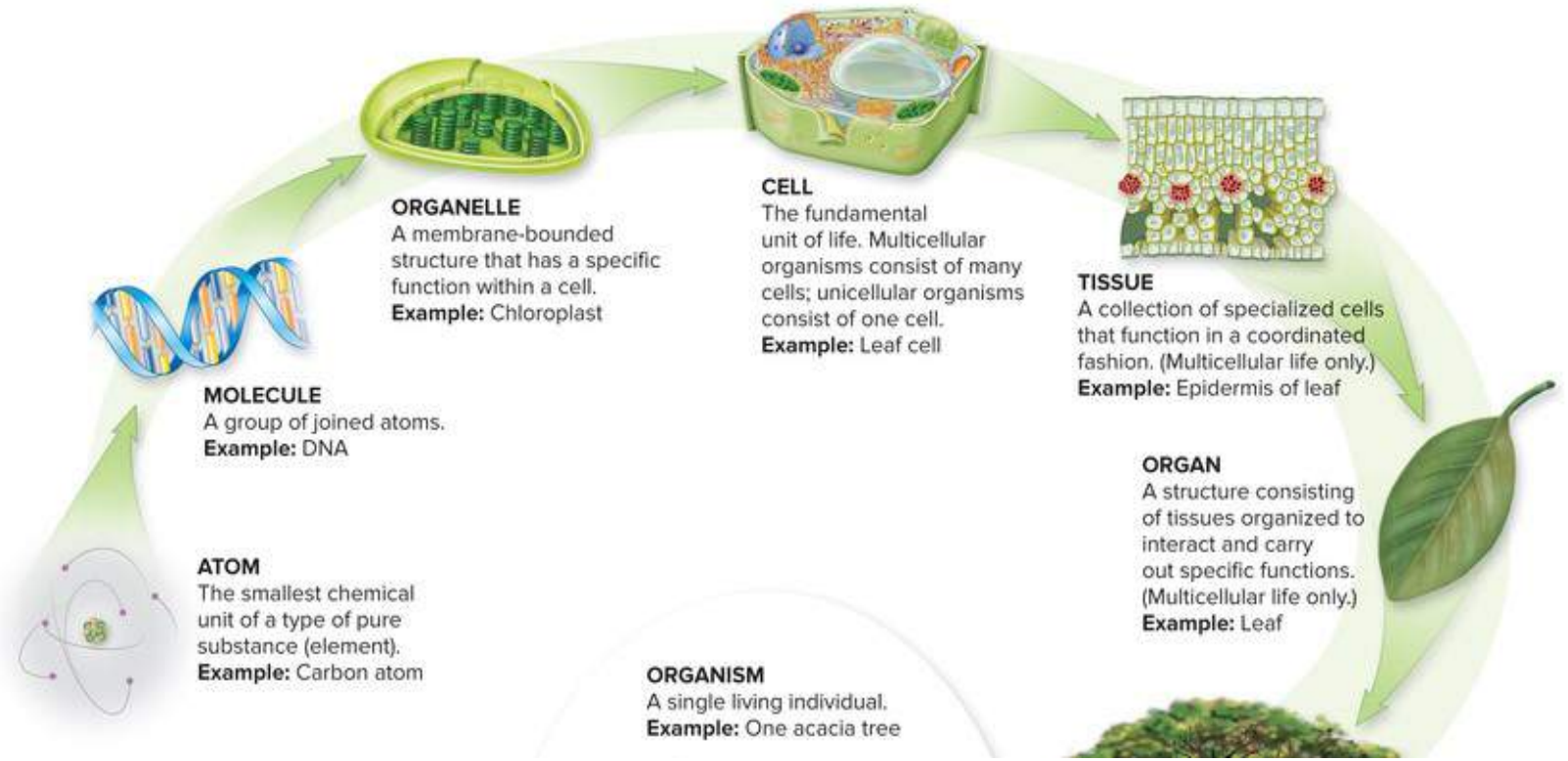


Bioregulation

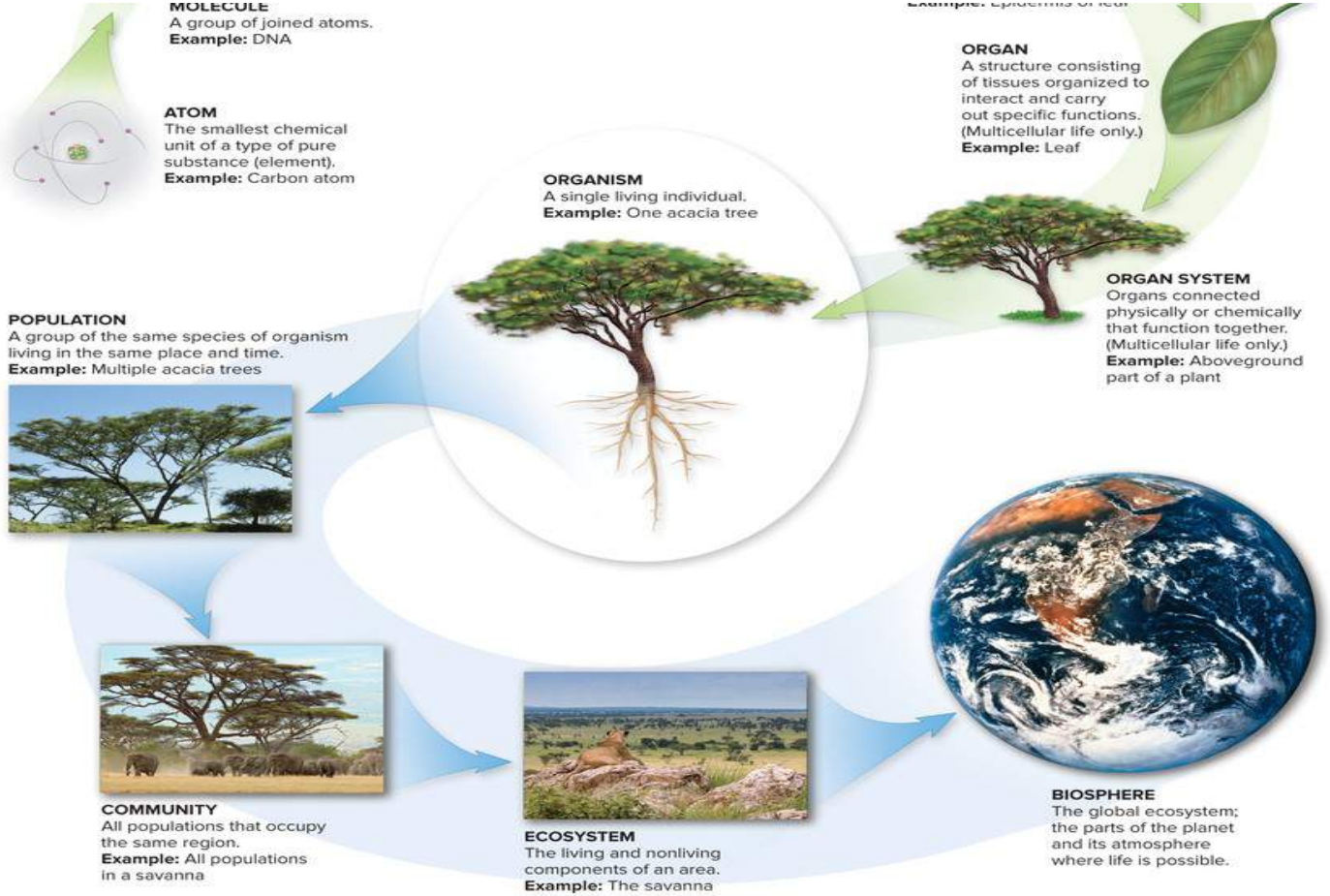
The scientist analyzed the component of living and nonliving materials they found that no different between them at atomic level, and all the types of atoms that found in living materials also found in non-living materials that means living organism characteristics found in molecular level but not found in atom level the molecule at molecular levels arranged to be more complex component (organelles).



The atoms of living organisms bound with each other by special type of bound to form more complex molecules that also produce complex which represent characteristics of life, this structure called (cell).

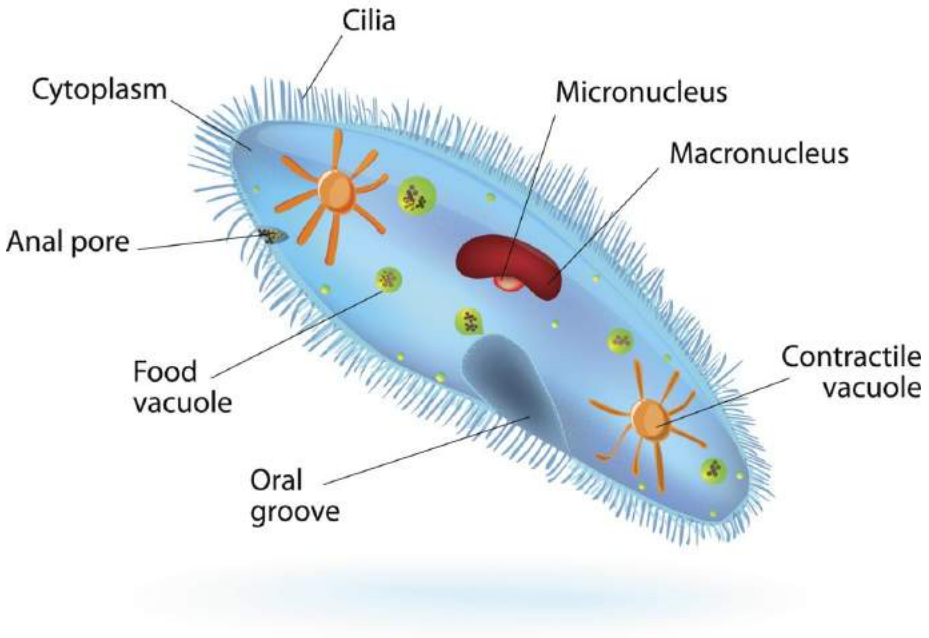


The cell capable of achieving different life activities like reproduction, This process represent the life character, in cell level, Cells organization in multicellular organisms from simplest to complex, to be, tissue, organ, organ system, organism (individual), population, community, ecosystem, biomes biosphere. See form (1)



In bioregulation levels, there is a difference in specific details in each level but similar in essential structures and functions?!

for example: the general structure of cell in protozoa **is similar to** cell in human body in general structure, **but they different** from each other in their functions.



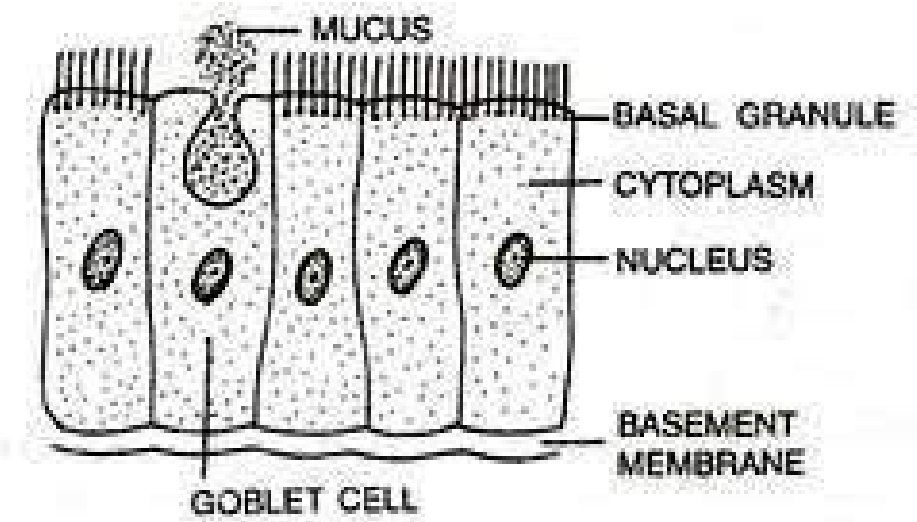
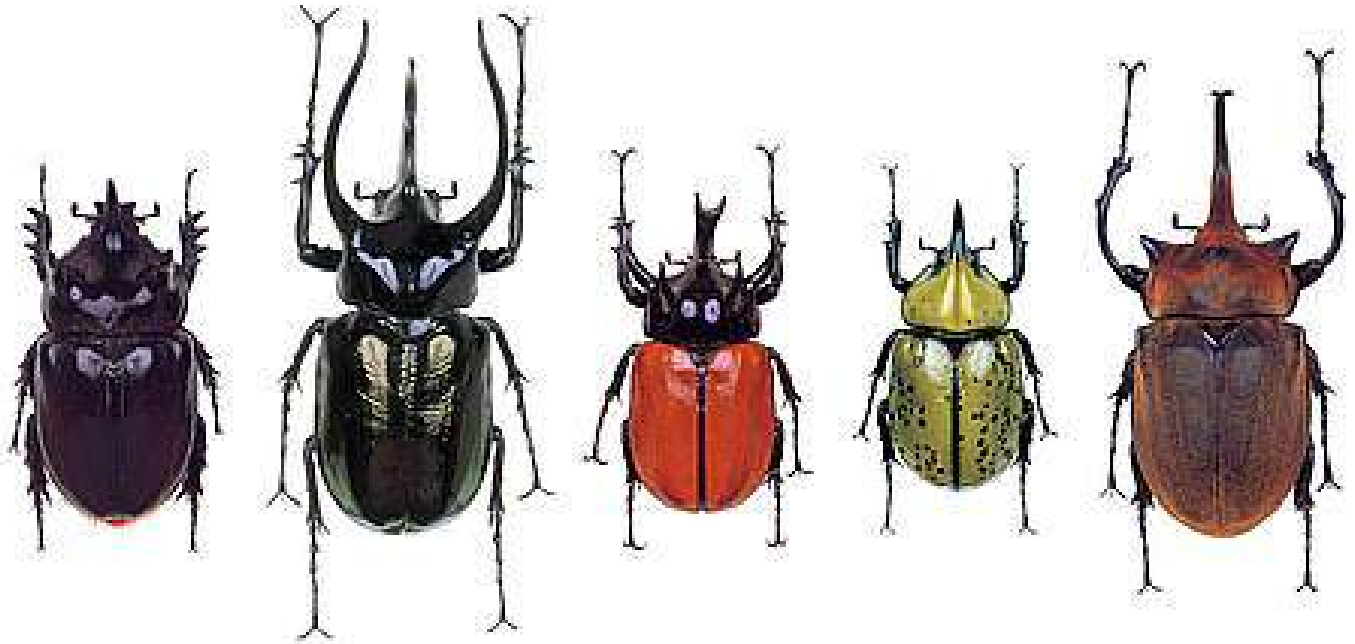


Fig. 7.9. Ciliated Columnar epithelium.

The sources of biodiversity



In nature the difference between individuals in one species and between different species **caused** by numbers of factors as follows:

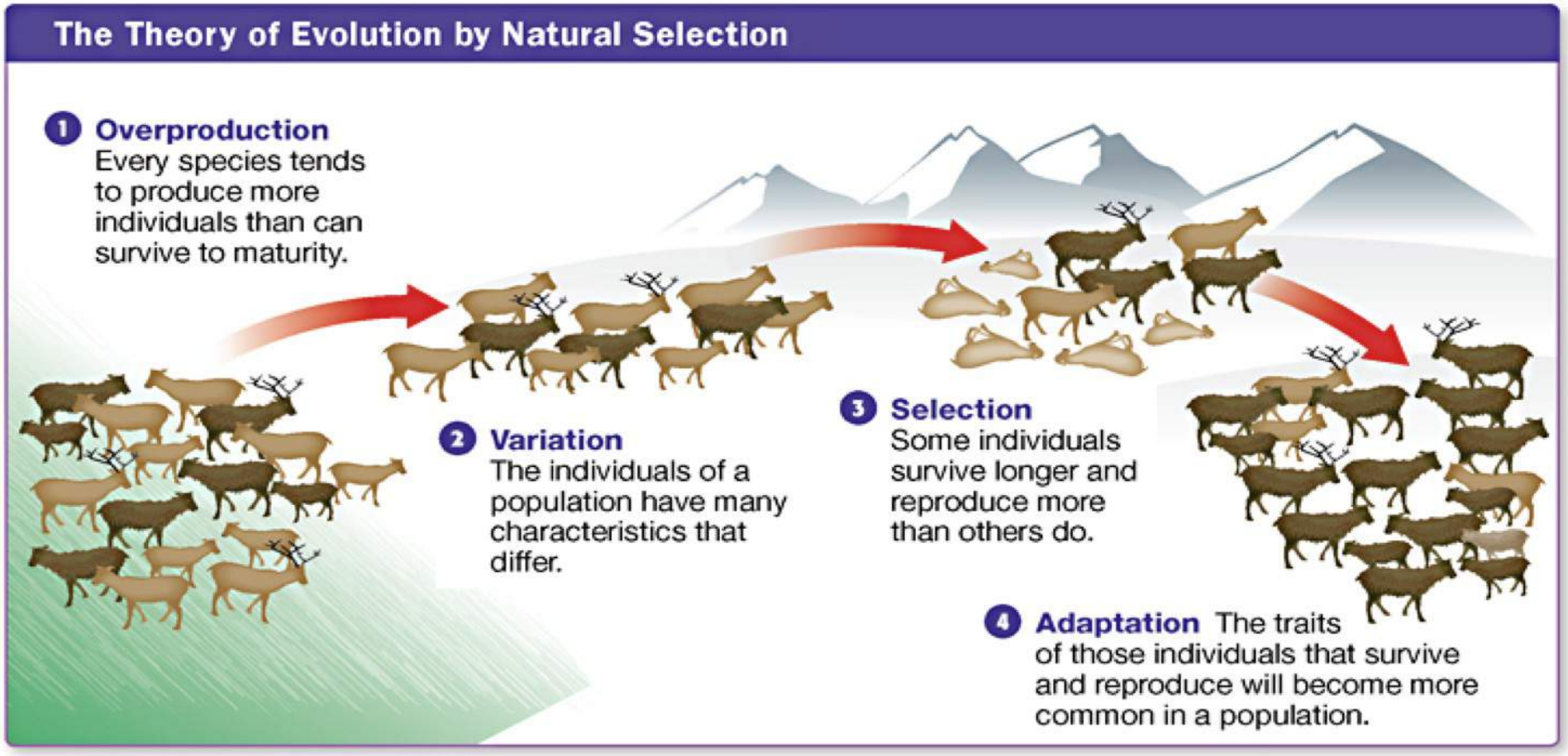
1. Natural selection
2. Mutation
3. Gene flow
4. Recombination Genetic
5. Genetic Drift

1.Natural Selection

Natural selection is one of several different mechanisms that cause change in populations.

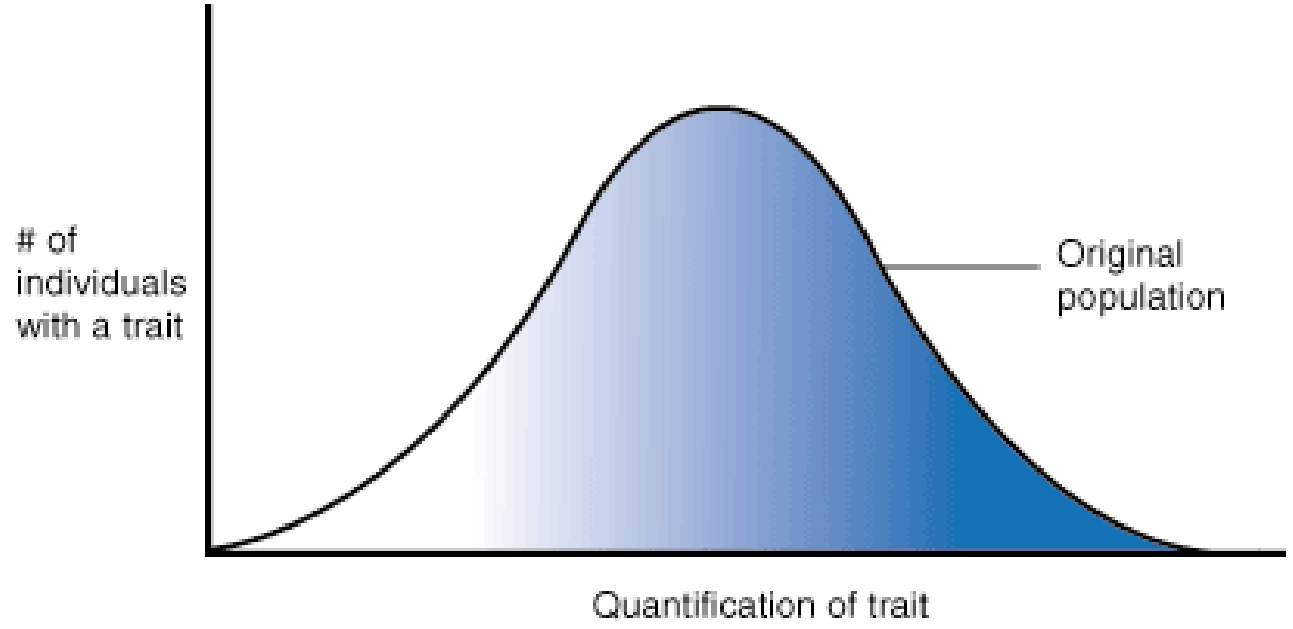
Natural selection operates to produce individuals that are better adapted to their environment, it is important to keep in mind that natural selection does not act on individuals; it acts on populations. Individual organisms cannot become better adapted to their environment **because** they cannot change their genes.

Natural selection produces changes in the genetic composition of a population from one generation to the next. As a result, organisms become better adapted to their environment.

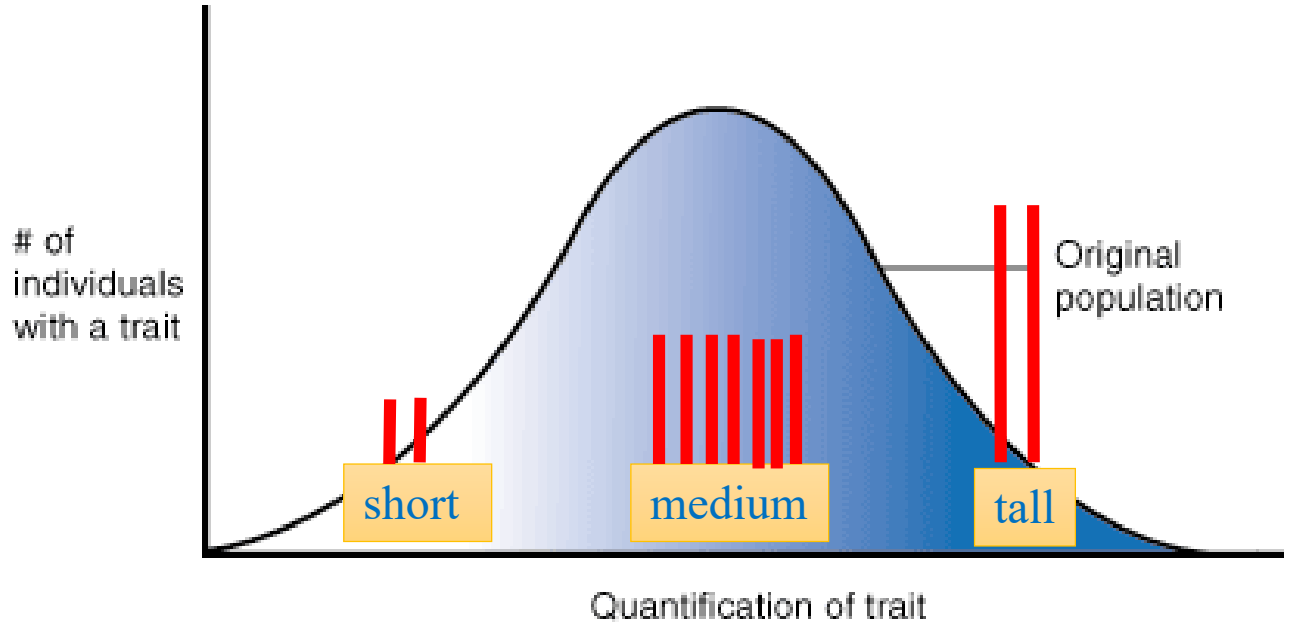


Types of Natural Selection

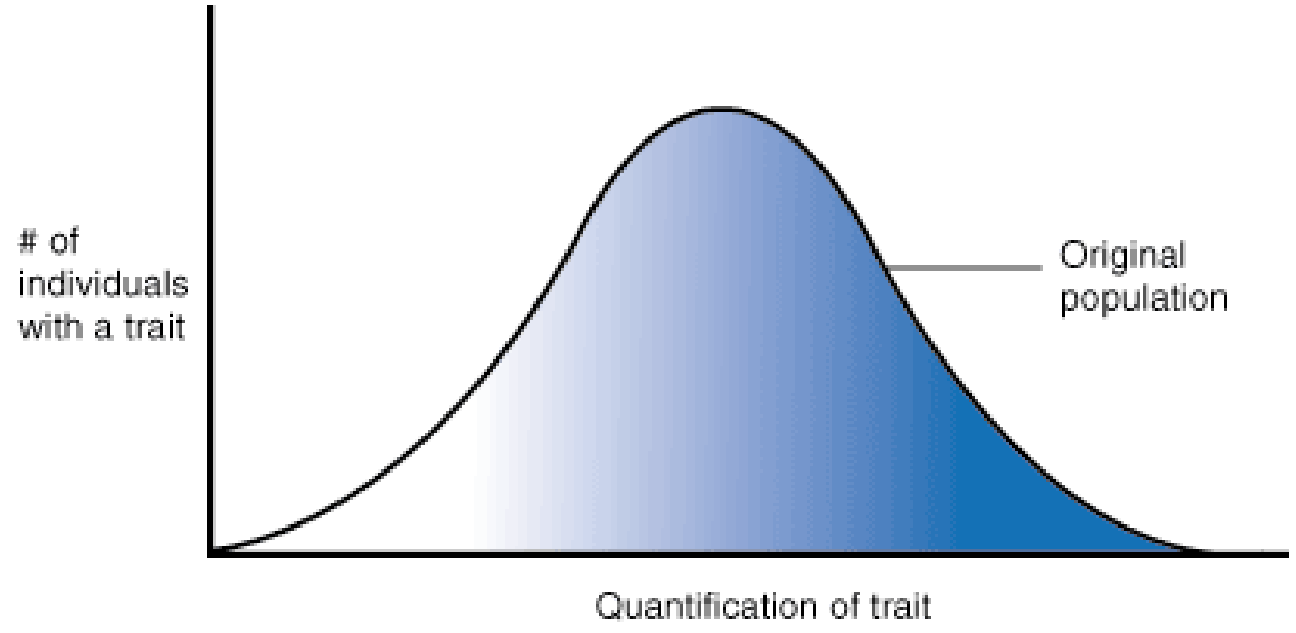
Natural selection can take many forms. To make talking about this easier, we will consider the distribution of traits across a population in graphical form. In we see the normal bell curve of trait distribution.



For example, if we were talking about height as a trait, we would see that without any selection pressure on this trait, the heights of individuals in a population would vary, with most individuals being of an average height and fewer being extremely short or extremely tall.

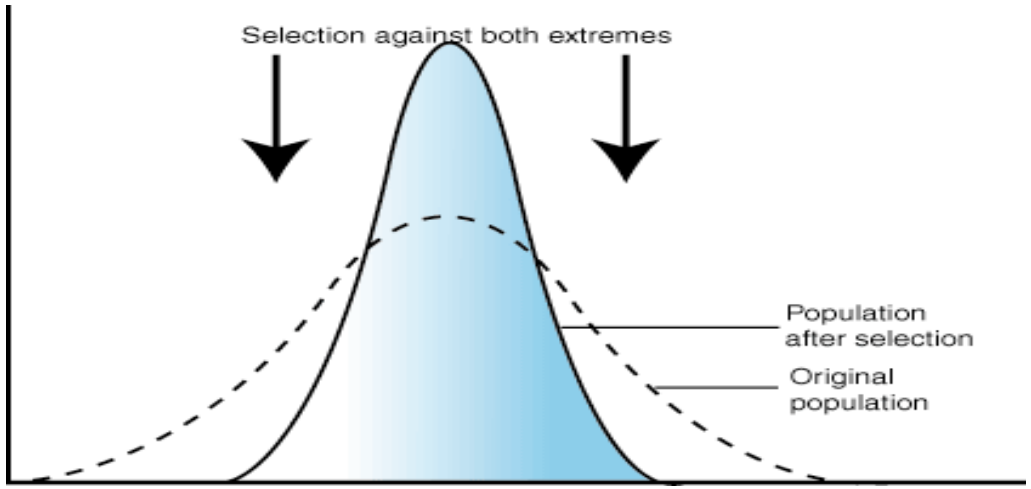


However, when selection pressures act on a trait, this distribution can be altered. Figure l



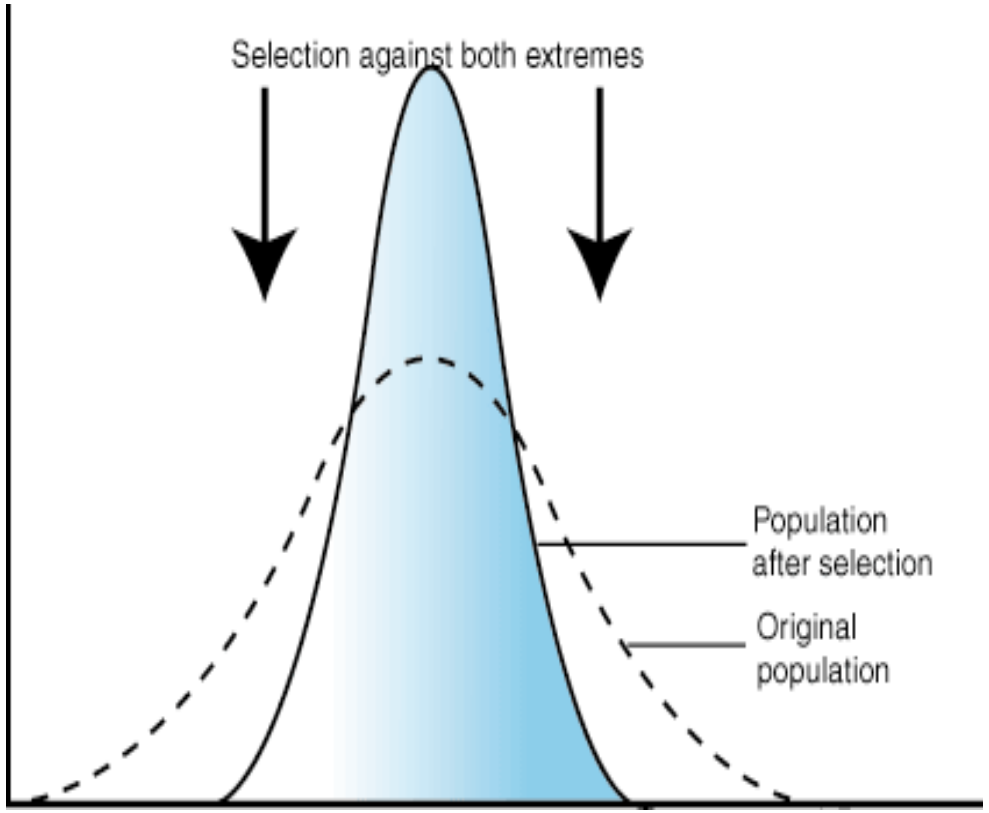
Stabilizing selection

- when selective pressures select against the two extremes of a trait (extremely short or extremely tall), the population experiences stabilizing selection. **For example**, plant height might be acted on by stabilizing selection.



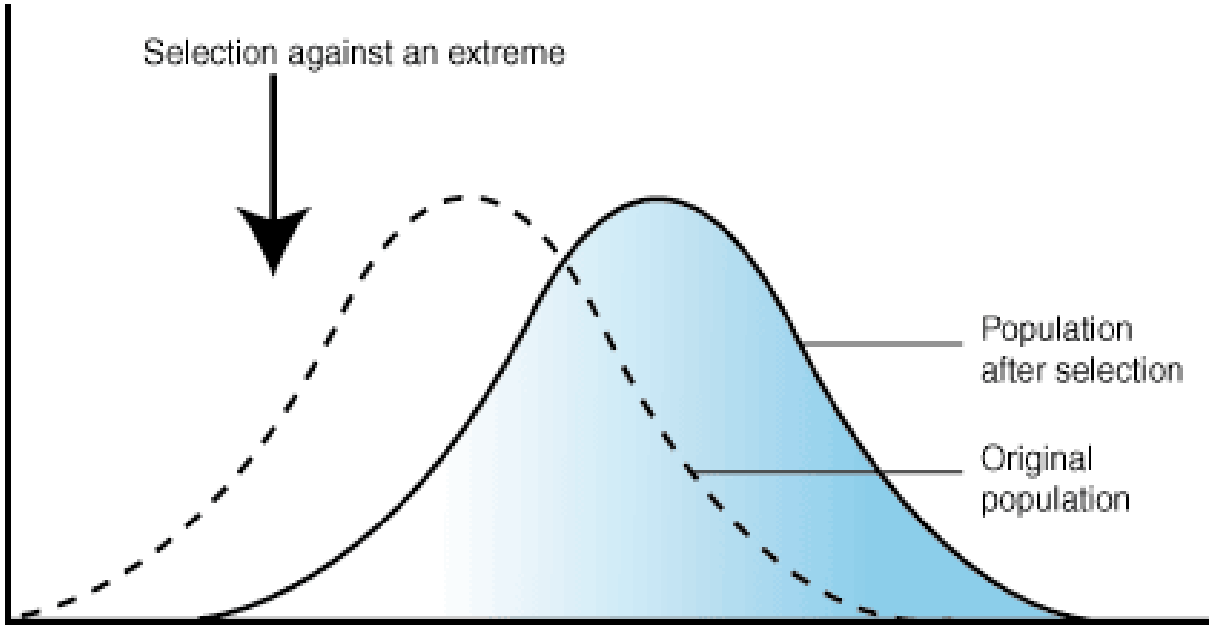
- A plant that is too short may not be able to compete with other plans for sunlight.
- However, extremely tall plants may be more susceptible to wind damage.

- Combined, these two selection pressures select to maintain plants of medium height. The number of plants of medium height will increase while the numbers of short and tall plants will decrease. Figure 2 .

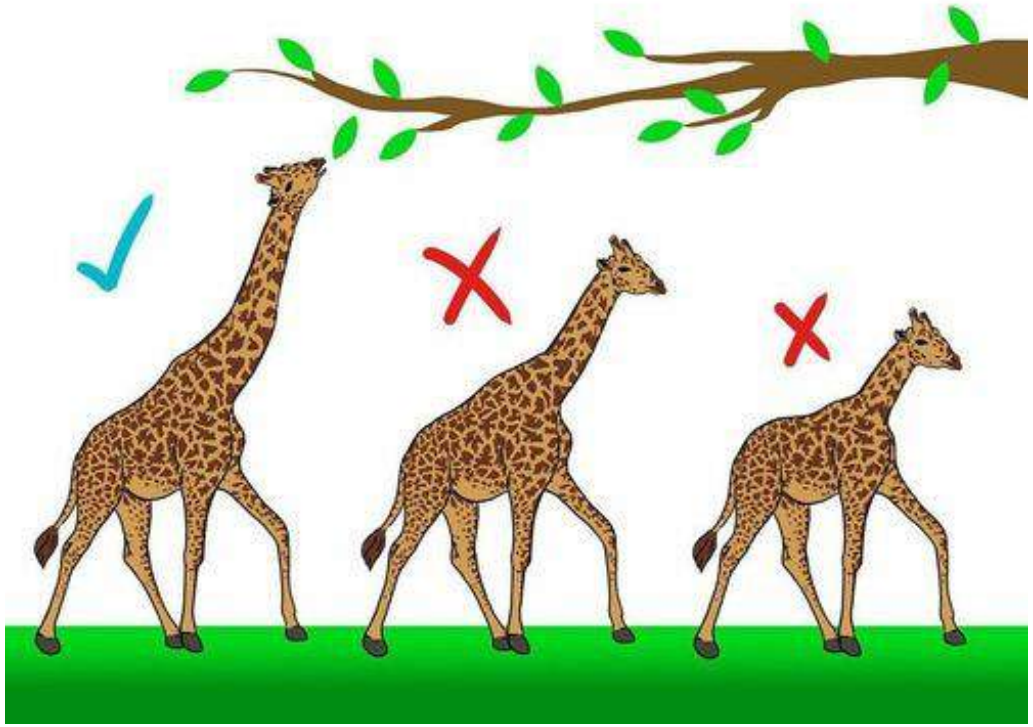


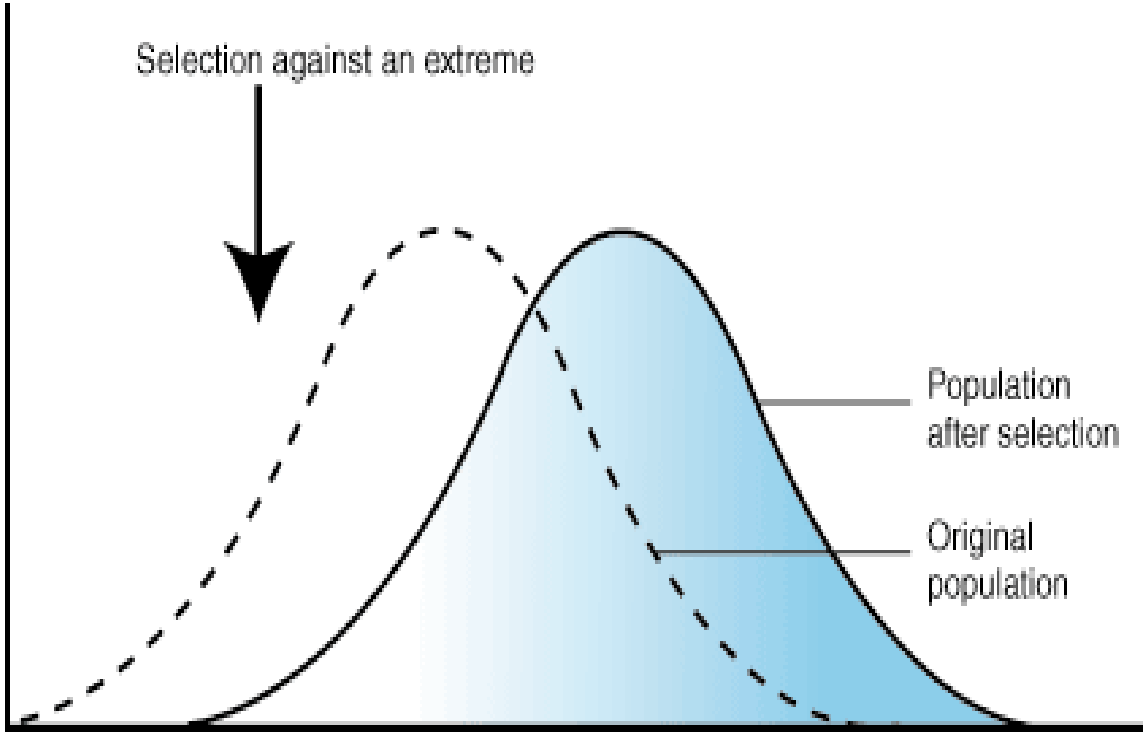
- **Directional selection**

In directional selection, one extreme of the trait distribution experiences selection against it. The result is that the population's trait distribution shifts toward the other extreme.



Using the familiar example of giraffe necks, there was a selection pressure against short necks, since individuals with short necks could not reach as many leaves on which to feed. As a result, the distribution of neck length shifted to favor individuals

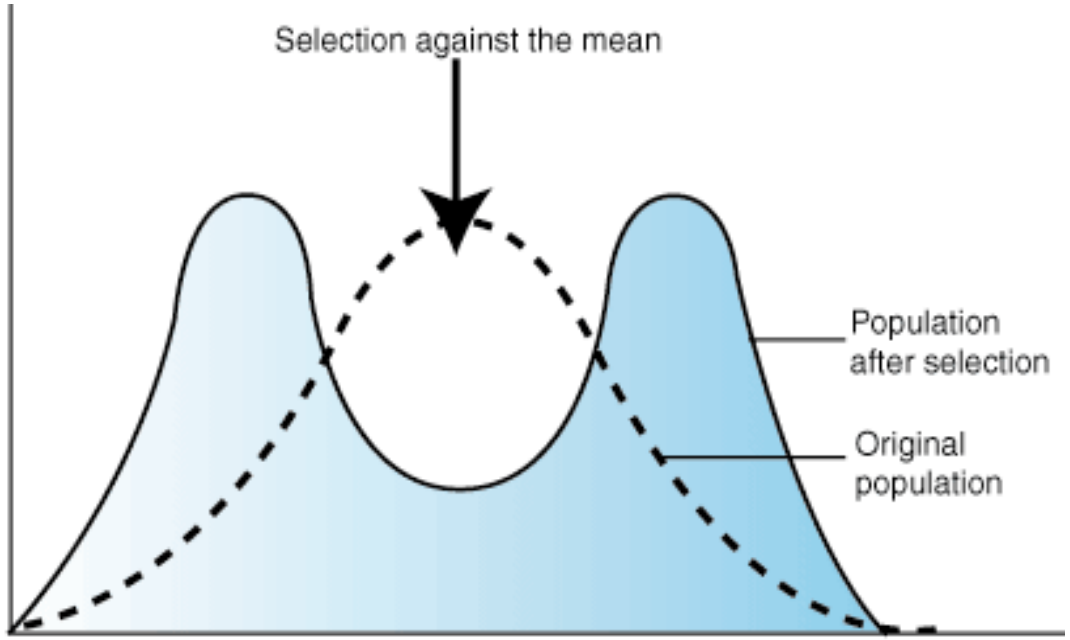




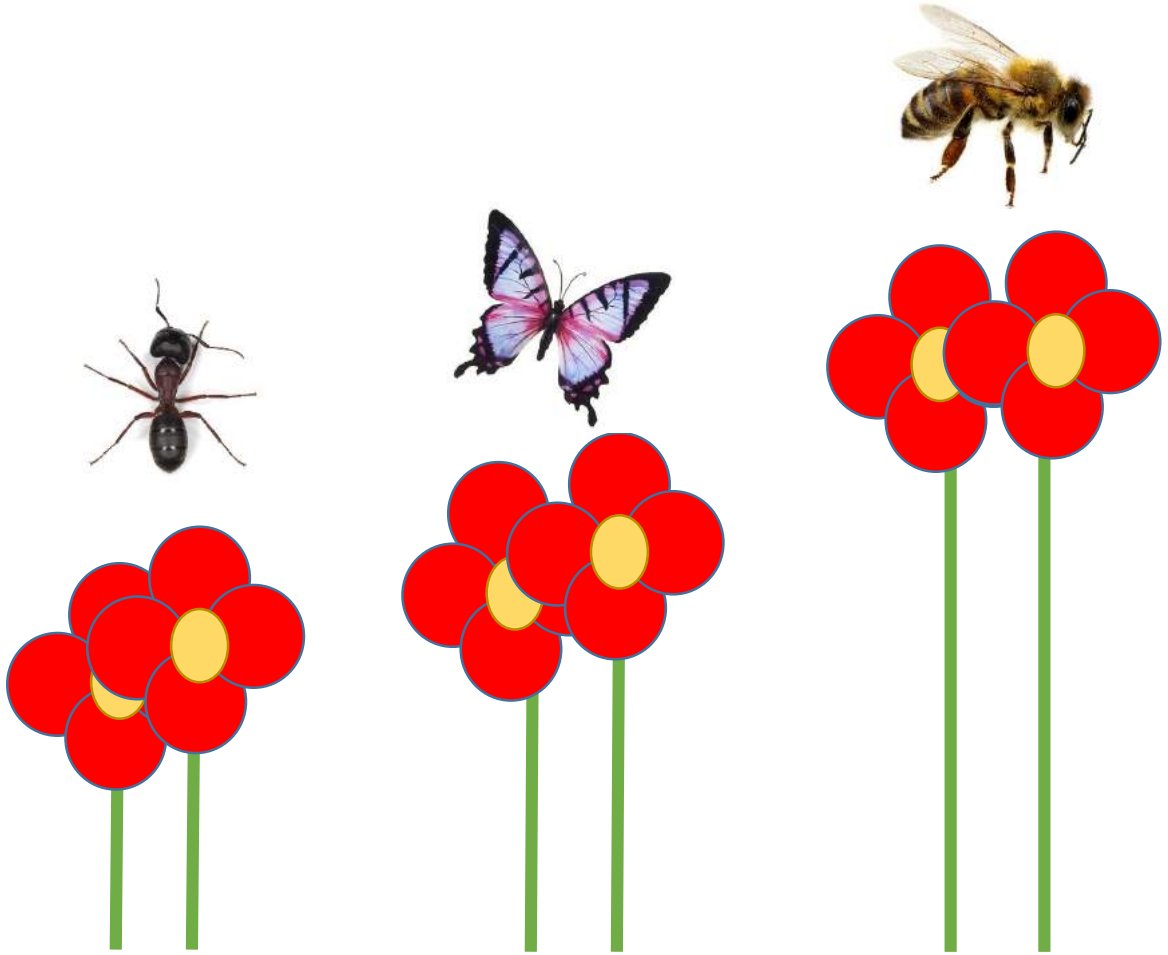
- **Disruptive Selection**

In disruptive selection, selection pressure act against individuals in the middle of the trait distribution.

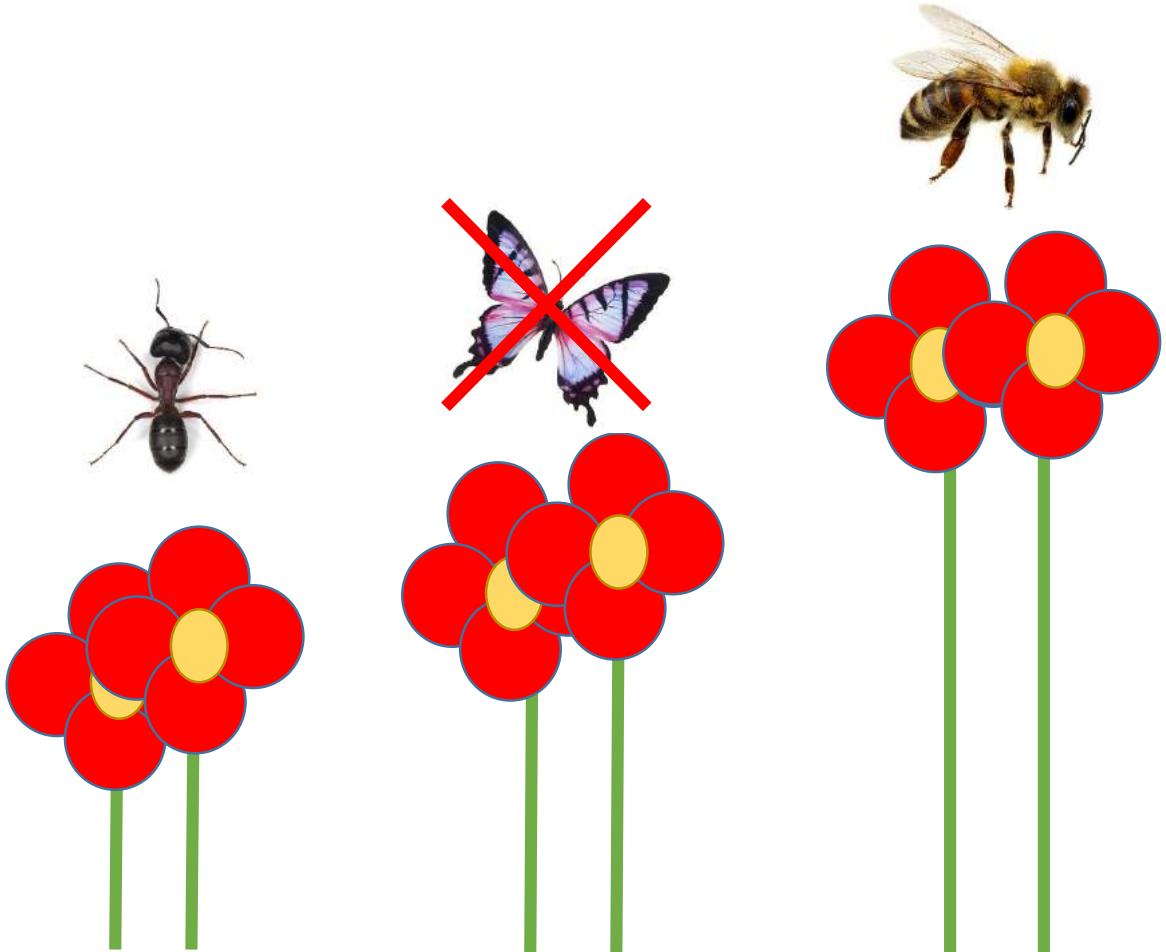
The result is two-peaked, curve in which the two extremes of the curve create their own smaller curves.

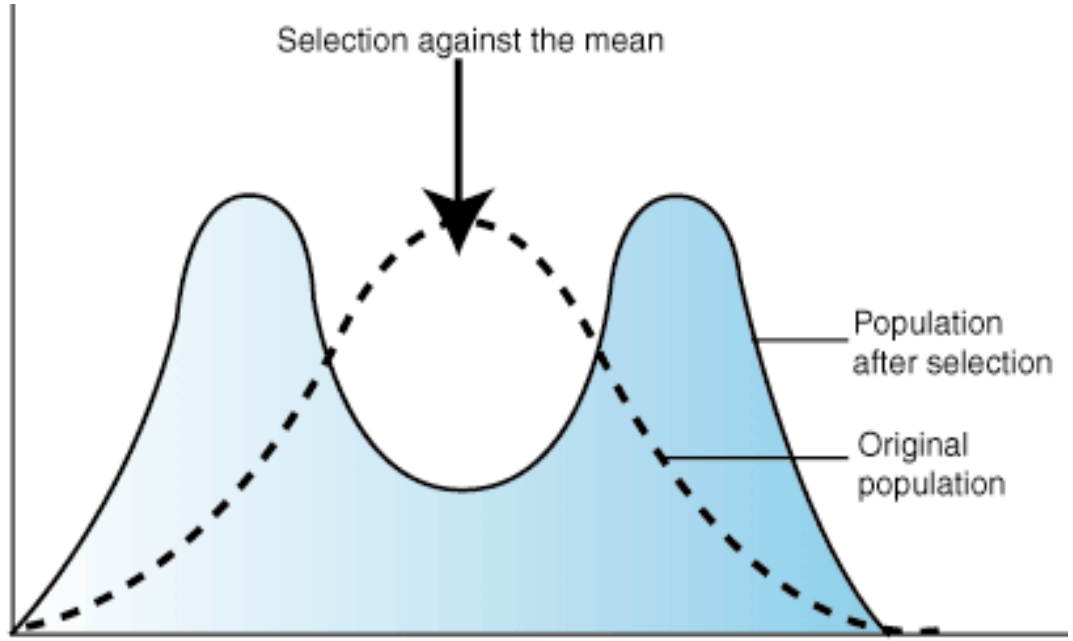


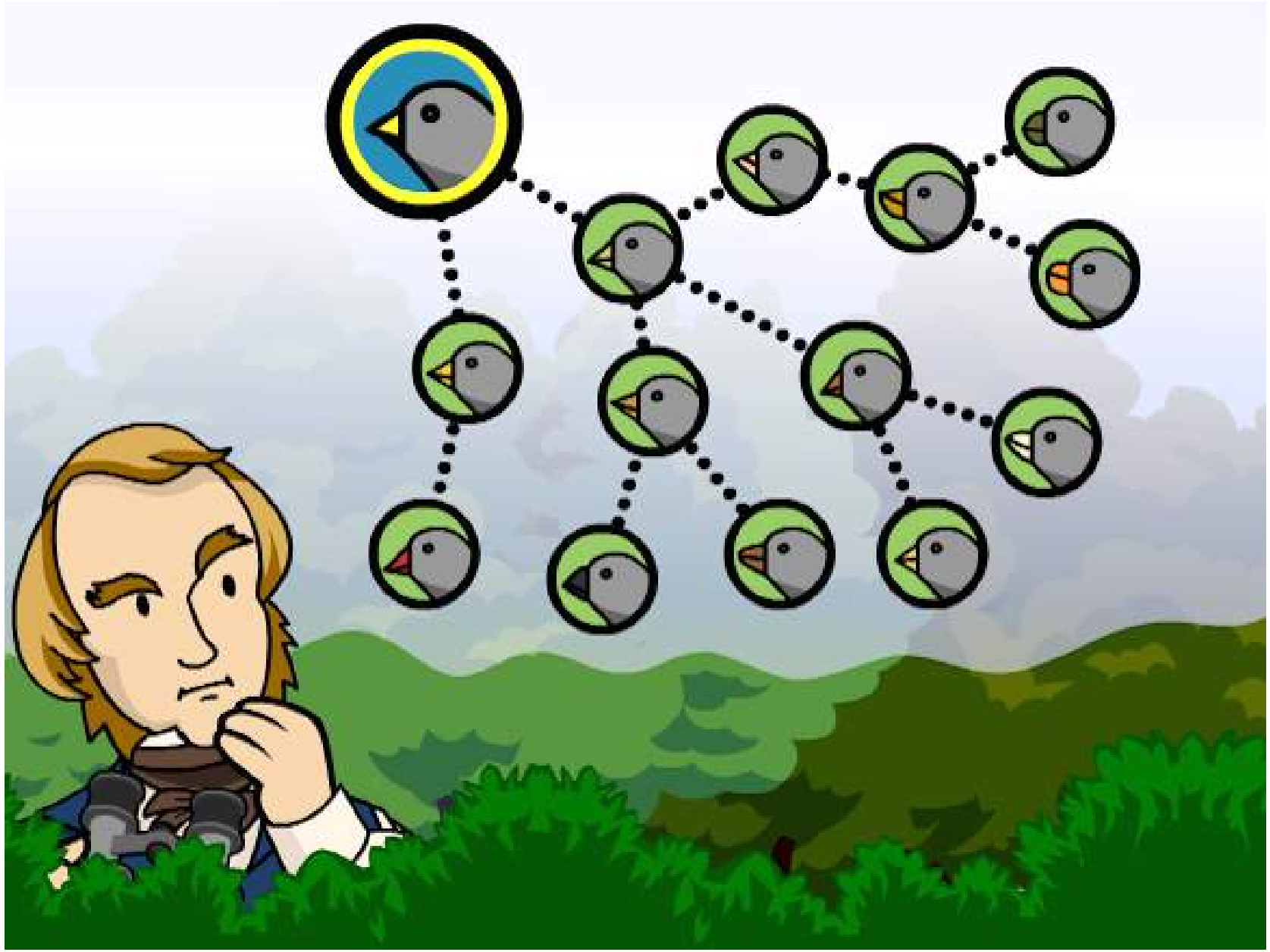
For example, imagine a plant of extremely variable height that is pollinated by three different pollinators, one that was attracted to short Plants another that preferred plants of medium height and a third that visited only the tallest plants.



If the Pollinator that preferred plants of medium height disappeared from an area, medium height plants would be selected against and the population would tend toward both short and tall, but not medium height plants. Such a population, in which multiple distinct forms or morphs exist is said to be polymorphic. Figure4







The sources of biodiversity

2.Mutation

It is a sudden change in genetic material of an organism that results from,

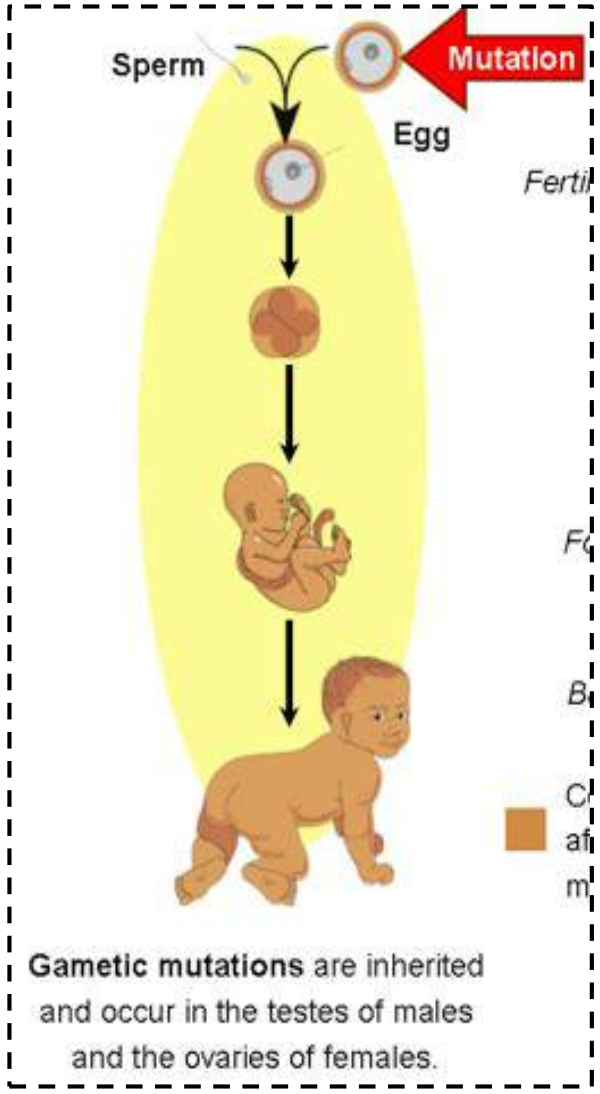
1. An alteration in the nucleotides sequence of the DNA coding for a gene or in the chromosome piece
2. Through a change occurs in normal number of chromosome

Resulting in the creation of a new character or trait not found in the parental type.

Gene mutations occur in two ways

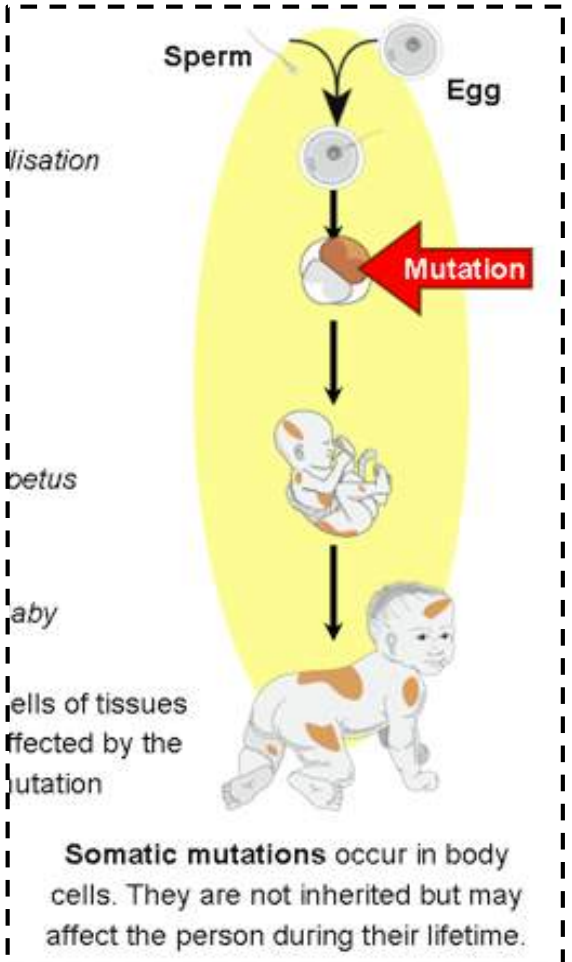
A. Germline mutations: They can be inherited from a parent during a person's lifetime.

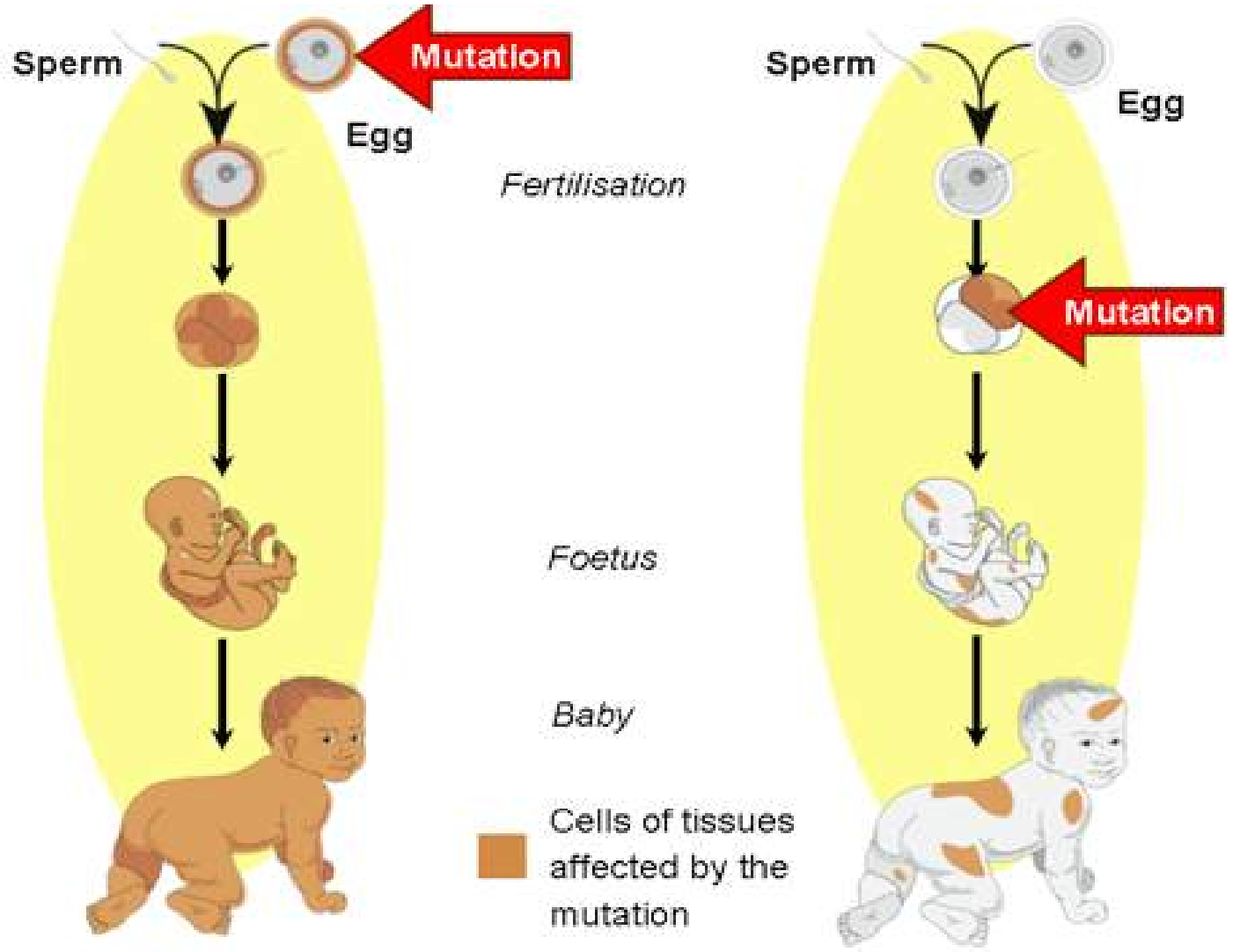
- Mutations that are passes from parent to child are called hereditary imitations or germline mutations **(because they are present in the egg and sperm cells, which are also called germ cells**).
- This type of mutation is present throughout a person's life in virtually every cell in the body



B. Somatic mutations: occur in the DNA of individual cells at some time during a person's life. Mutations in somatic cells (cells other than "sperm and egg cells) cannot be passed on to the next generation, generally mutations are the necessary raw material of evolution.

These changes can be caused by environmental factors such as ultraviolet radiation from the sun, mutagenic chemicals arid heat or can occur if a mistake is made as DNA copies itself during cell division,





Gametic mutations are inherited and occur in the testes of males and the ovaries of females.

Somatic mutations occur in body cells. They are not inherited but may affect the person during their lifetime.

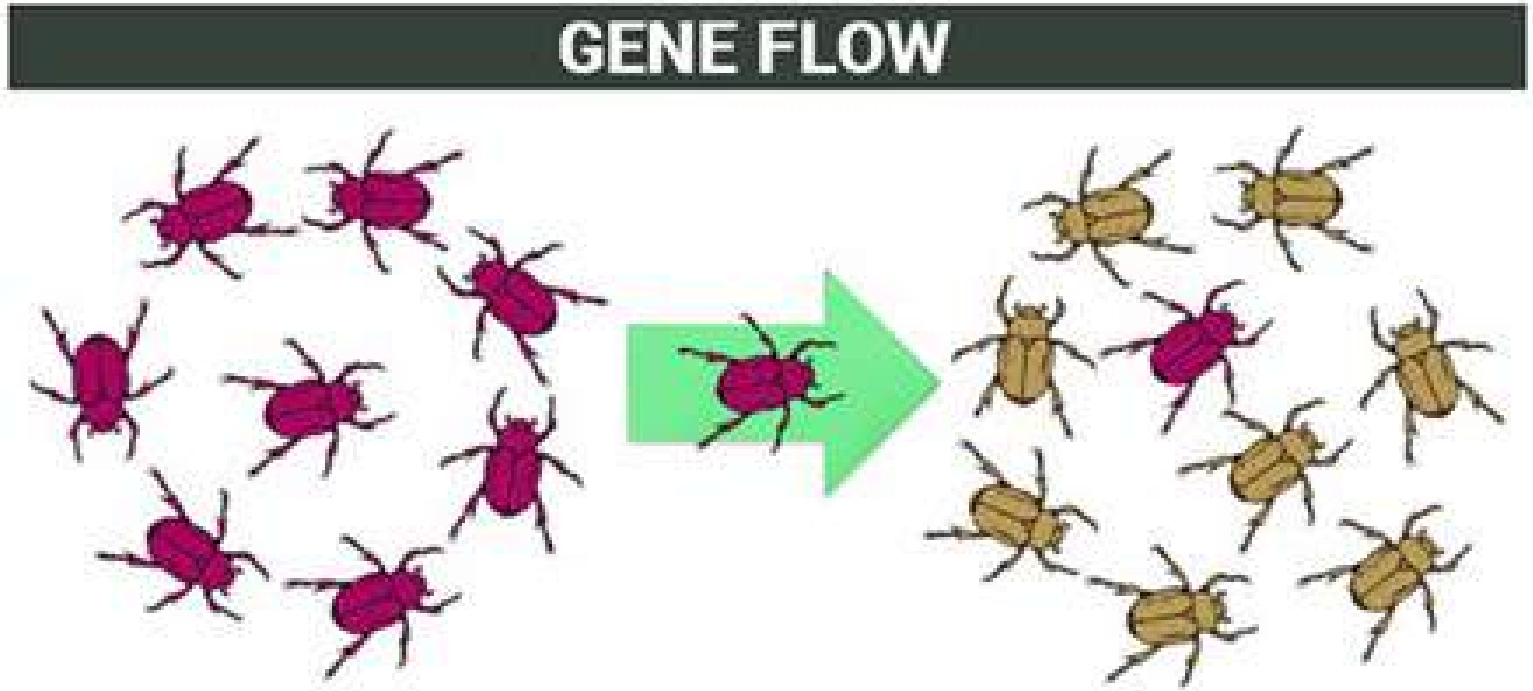
3. Gene flow

Is the transfer of genetic material between separated populations.

For example, in human being, culture differences as well as geographic separation maintain unique populations: It is more likely that a person will marry and have children with someone who lives nearby and speaks the same language.

Migration has been a significant feature of human history in both prehistoric and more recent times. (No gene flow occurs if an individual migrates into a different population but does not reproduce).

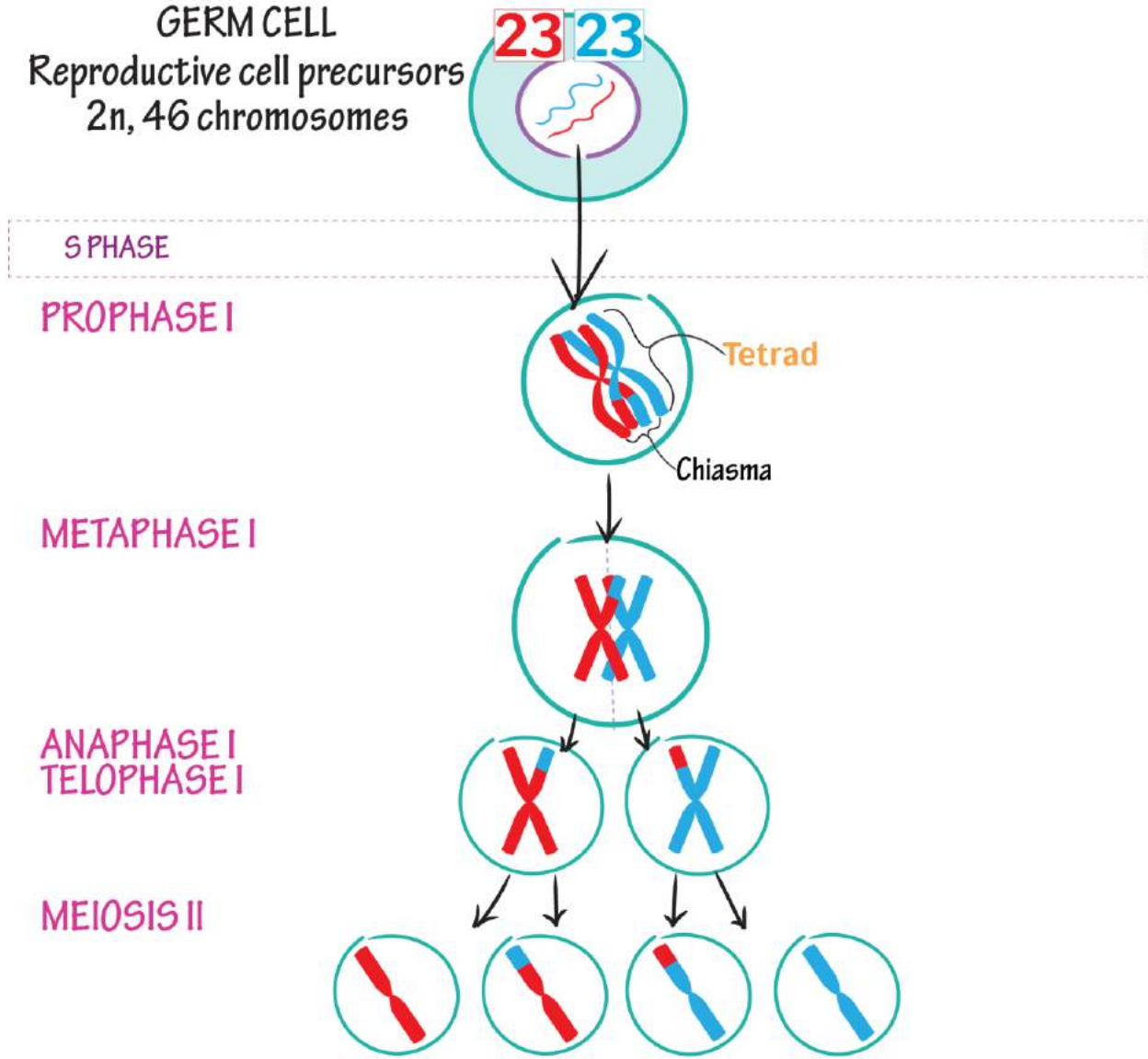
The migrant's genes must become part of the genetic makeup of the population into which it has migrated. If genes are carried to a population where those genes previously did not exist, gene flow can be a very important source of genetic variation, in the graphic below, the gene for brown coloration moves from one population to another.



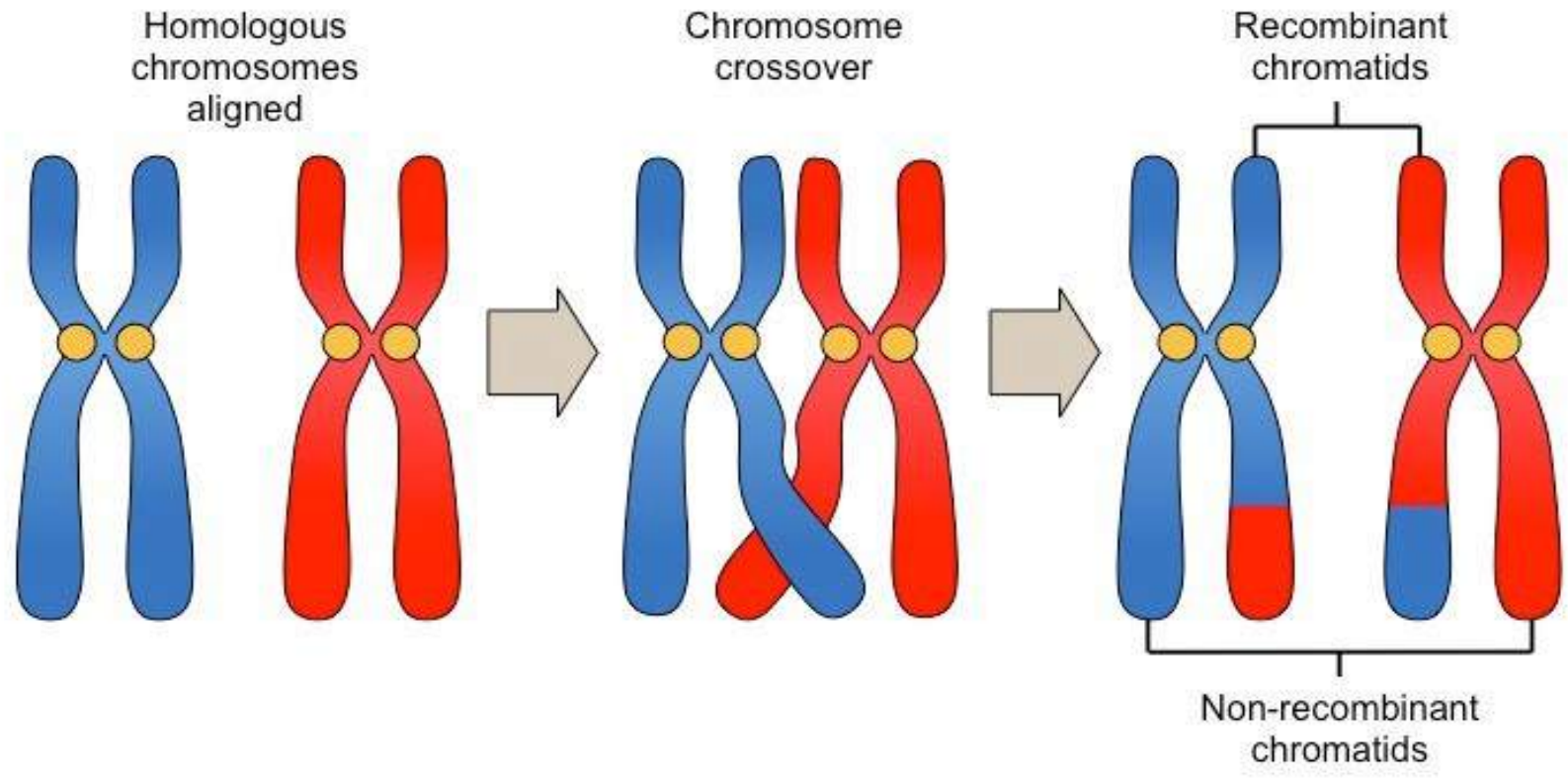
4. Recombination Genetic:

Recombination happens during meiosis, a special type of cell division that occurs during formation of sperm and egg cells and gives them the correct number of chromosomes inside the cells that produce sperm and eggs, chromosomes become paired.

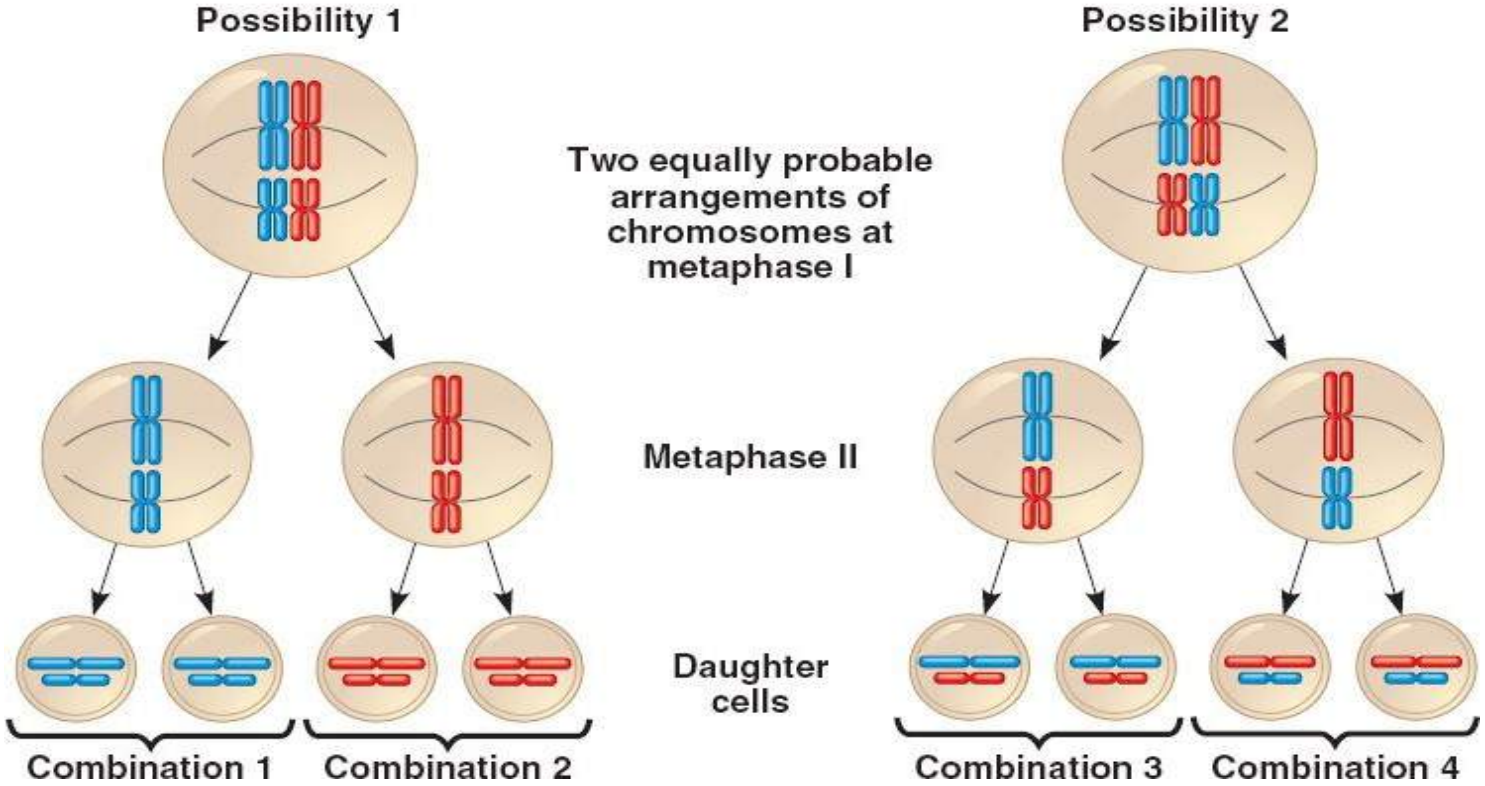
MEIOSIS


GERM CELL
Reproductive cell precursors
2n, 46 chromosomes
23 23
S PHASE
PROPHASE I
Tetrad
Chiasma
METAPHASE I
ANAPHASE I
TELOPHASE I
MEIOSIS II

While they are pressed together, the chromosomes may break, and each may swap a portion of its genetic material for the matching portion from its mate. This form of recombination is called crossing-over.



When the chromosomes glue themselves back together and separate, each has picked up new genetic material from the other. After the chromosomes separate, they are parceled out into individual sex cells. Each chromosome moves independently of all the others a phenomenon called independent assortment.



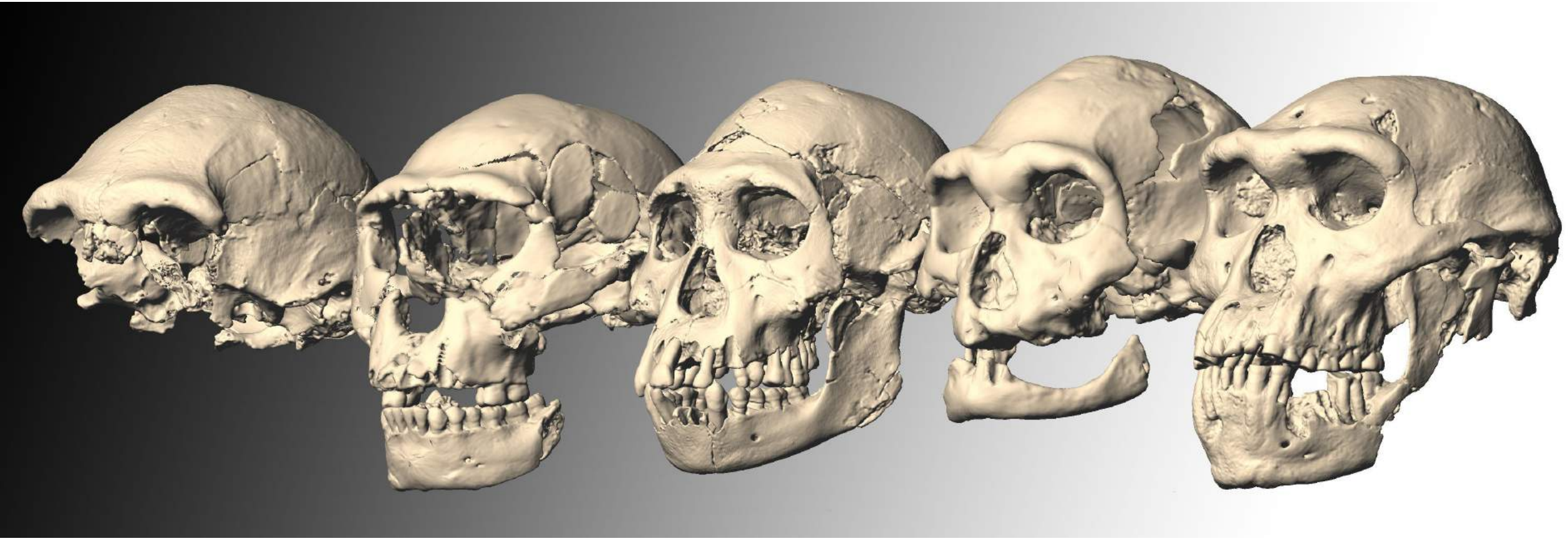
5. Genetic Drift:

A change in allele frequency of new population as compared with origin population due to random happens or by chance.

This is more likely to occur in a small population in each generation, some individuals may just by chance, leave behind a few more descendants (and genes, of course!) than other individuals. The genes of the next generation will be the genes of the "lucky" individuals, not necessarily the healthier or "better" individuals.

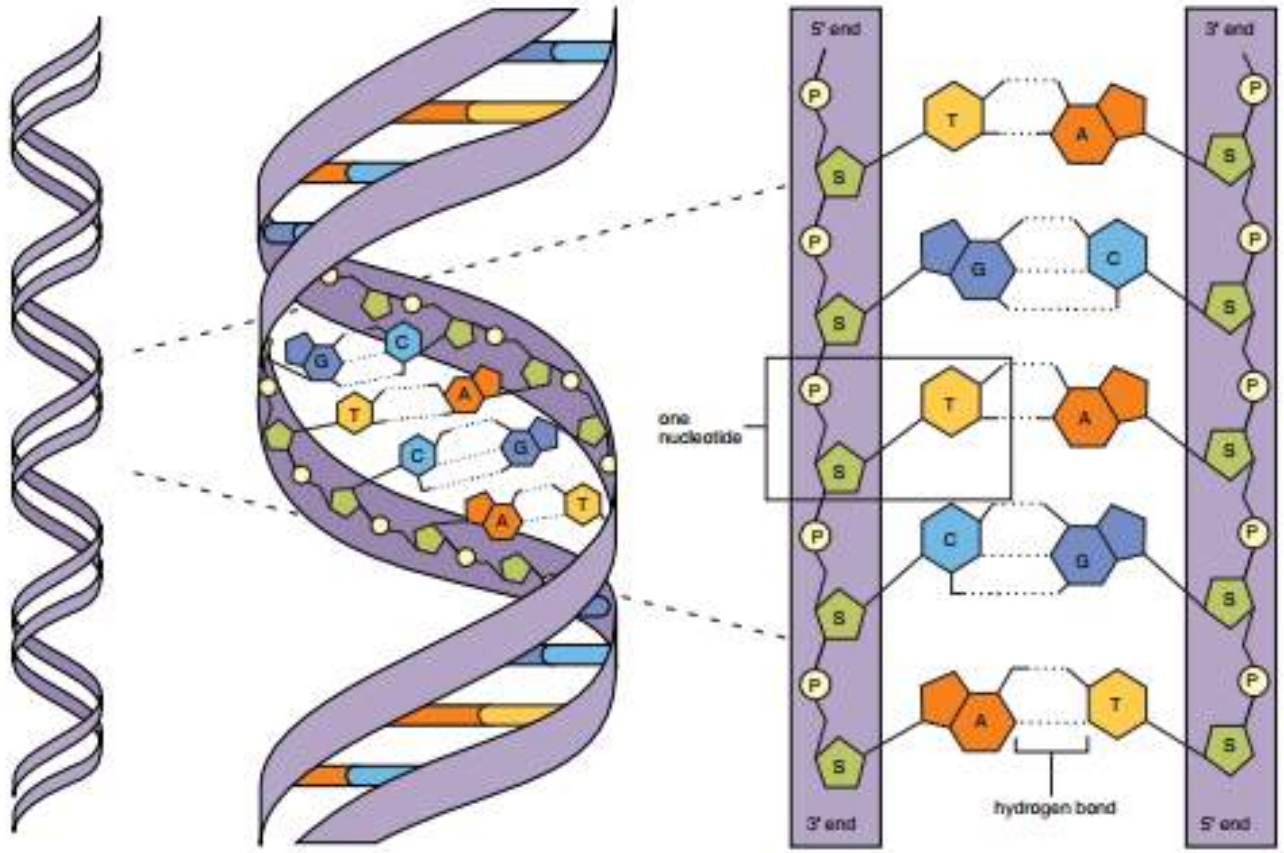
For example. The **brown color** arises during reproduction just by random luck. More brown genes end up in the offspring than **green genes**, providing diversity without any adaptations. Accidents in small populations can change the frequency of some genes. Such variations in a population occur, in diagram at right, brown genes occur slightly more frequently in the offspring than in the parent generation, So although genetic drift is a mechanism of evolution, it doesn't work to; produce adaptations

How Diversity Happened

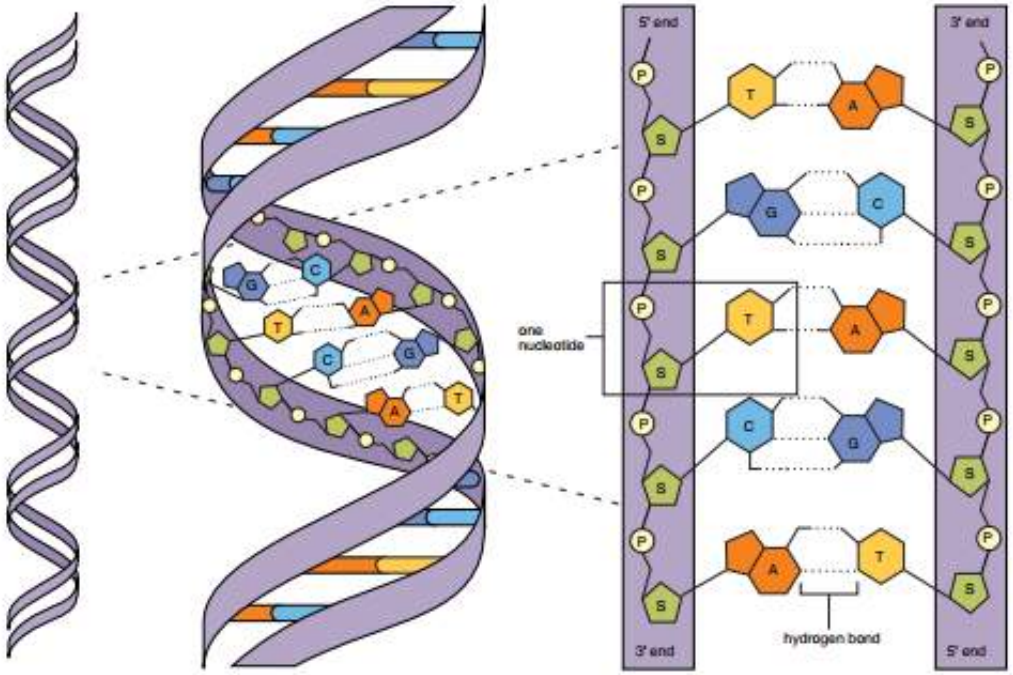


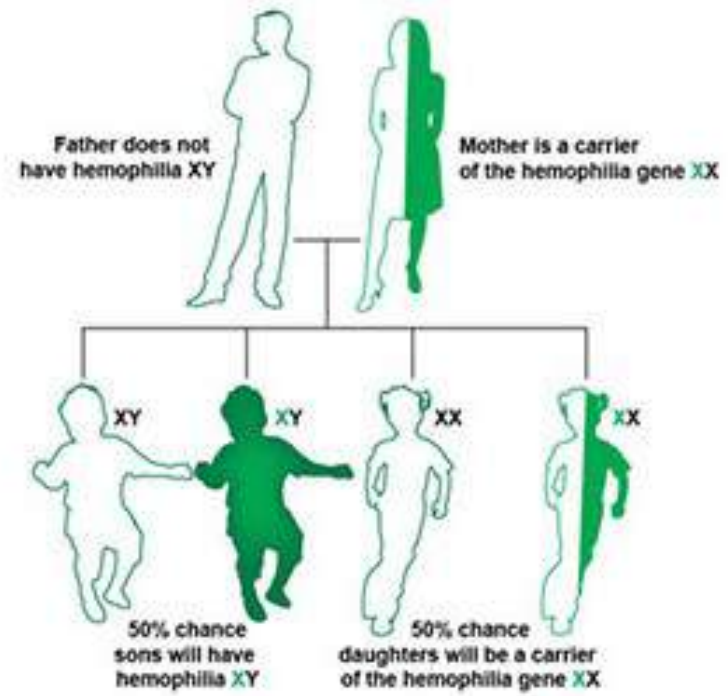
Evolution.

Biological evolution is defined as any genetic-change in a population that is inherited over several generations. These changes may be small or large, noticeable or not so noticeable.



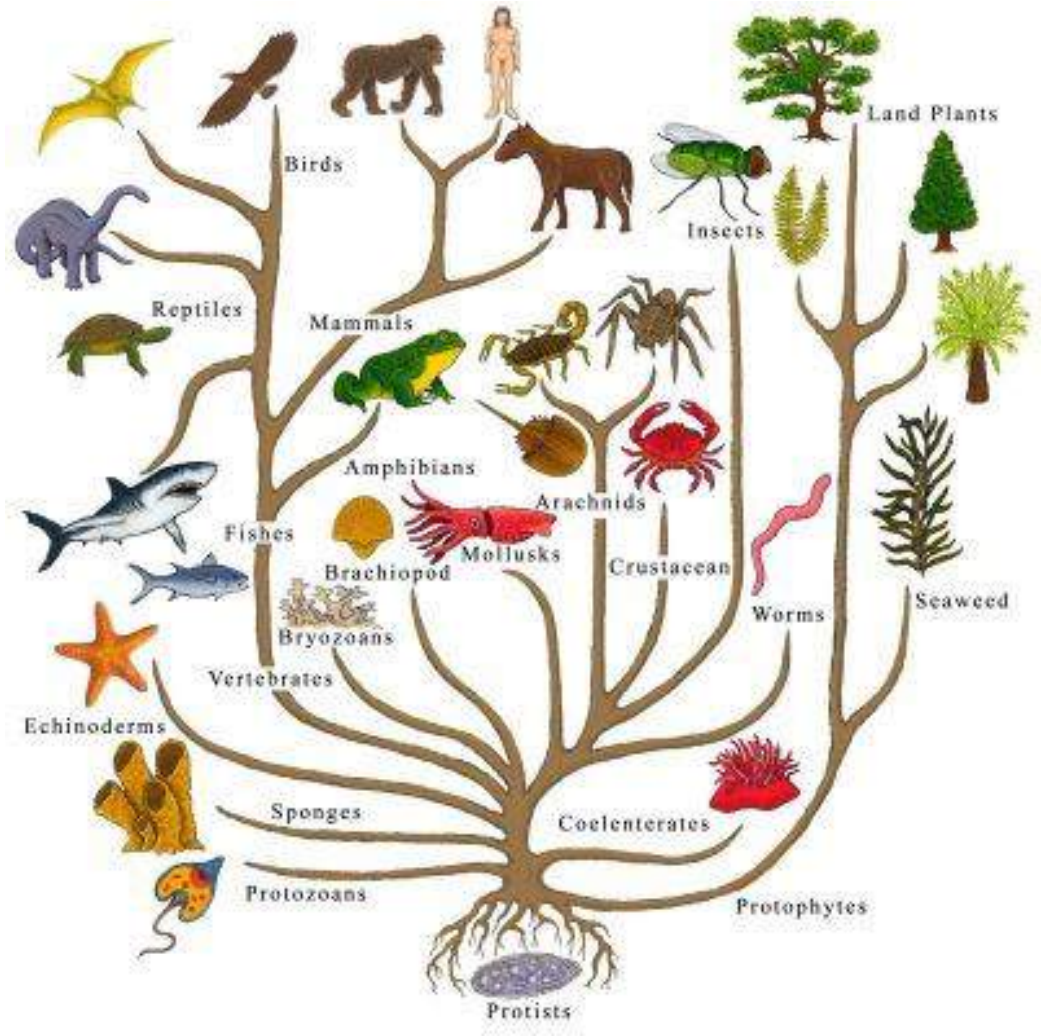
In order for an event to be considered an instance of evolution, changes have to occur on the genetic level of a population and be passed on from one generation to the next. This means that the genes, or more specifically, the alleles in the population **change** and are **passed on.**



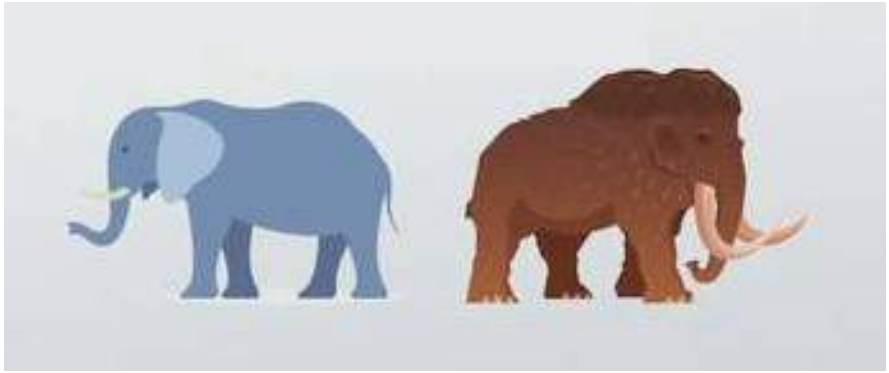


These changes are noticed in the phenotypes (expressed physical traits that can be seen) of the population. A change on the genetic level of a population is defined as a small-scale change and is called microevolution.

Biological evolution also includes the idea that all of life is connected and can be traced back to one common ancestor. This is called macroevolution.



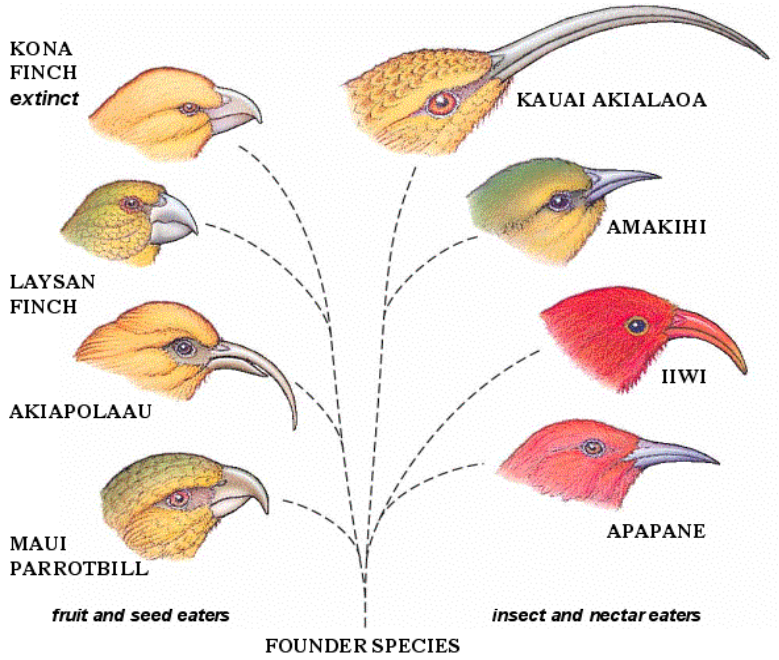
Evolution helps us to understand the history of life. Progressive Evolution is a process. Species adapt and evolve to better survive in their environments, and caused changes in their traits, similar environments can cause similar adaptations. In different species and different environments can cause different adaptation in similar species this differences lead to diversity in environment.



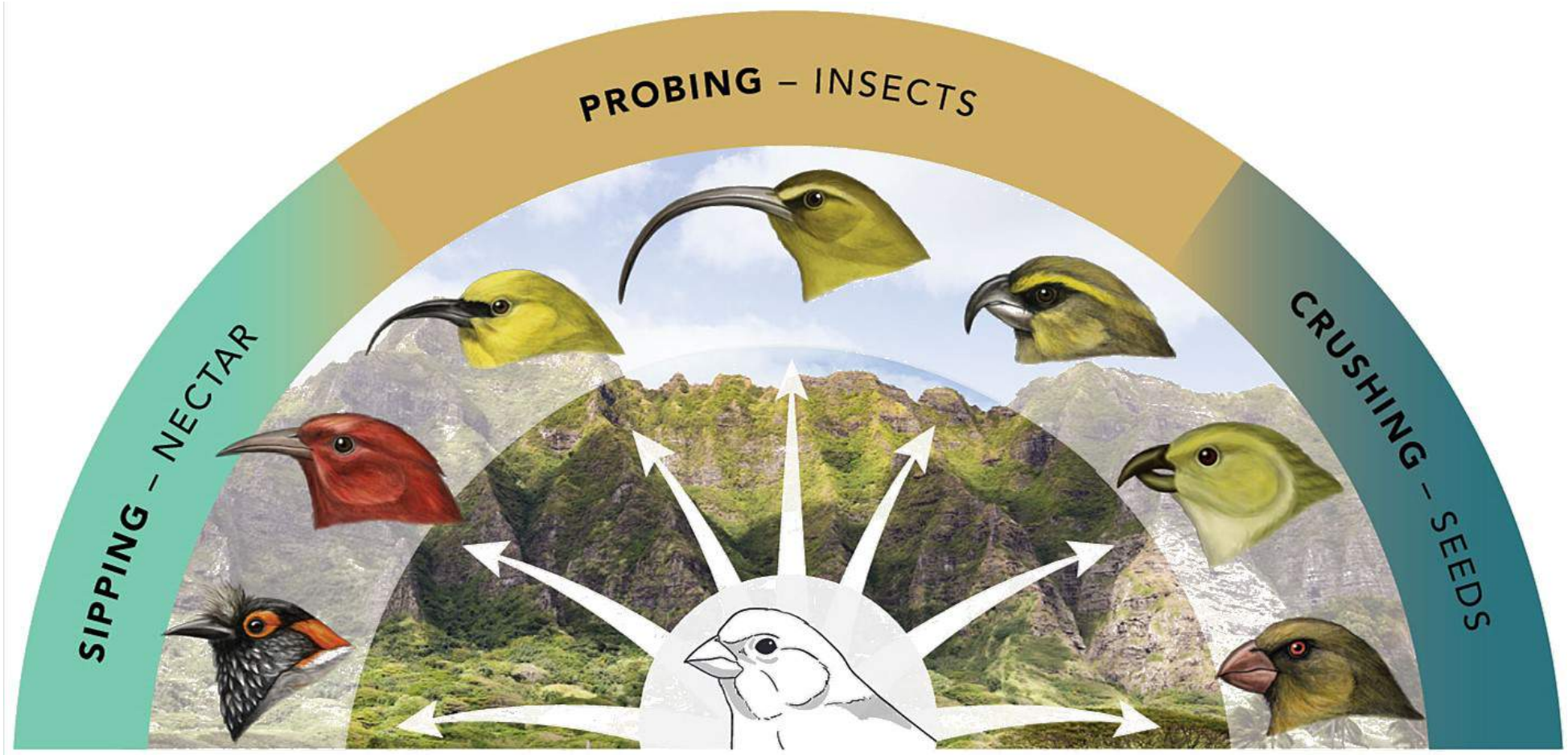
Patterns of Evolution

Natural selection can ultimately lead to the formation of new species. Sometimes many species evolve from a single ancestral species.

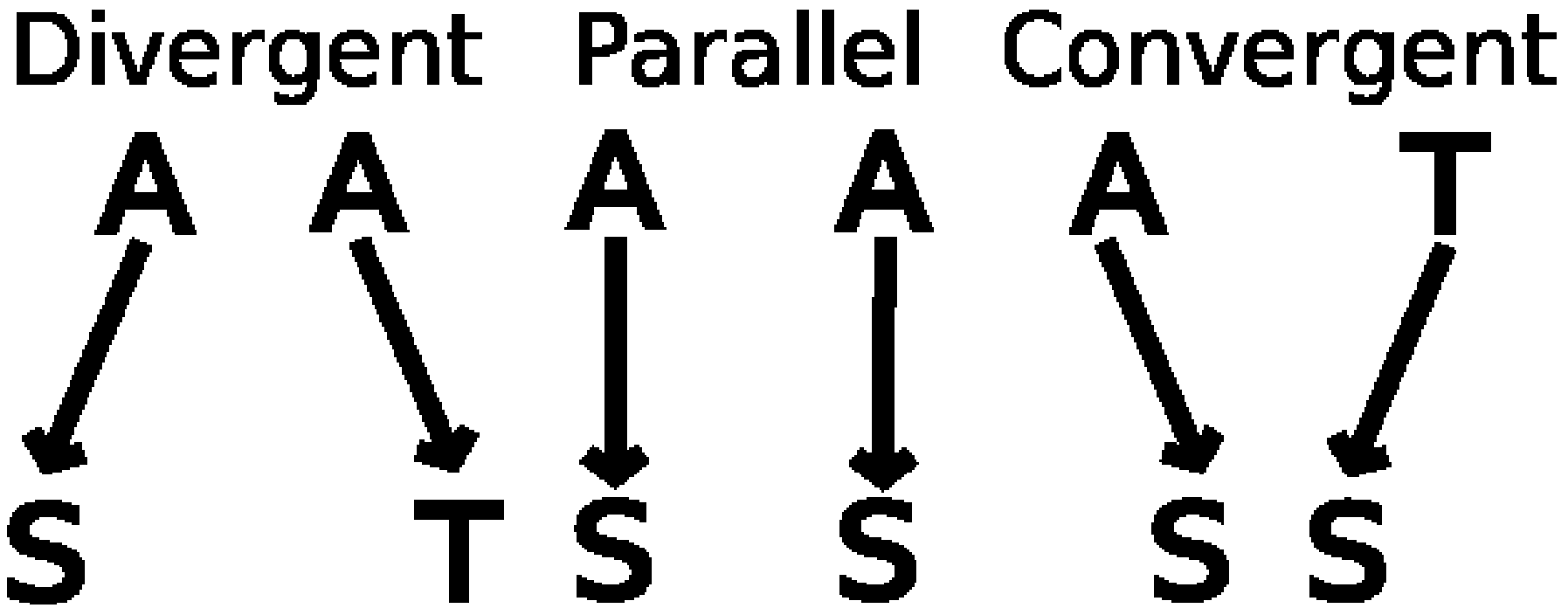
Similarities in skeletal and muscular structure of Hawaiian honeycreepers led scientists to conclude that the 23 species of honeycreepers evolved from one ancestral species. Such an evolutionary pattern, in which many related species evolved from a single ancestral species, is called adaptive radiation.



Adaptive radiation most commonly occurs when a species of organism successfully invades an isolated region where few competing species exist. If new habitats are available, new species will evolve.



Divergent, Convergent evolution and coevolution



Divergent evolution

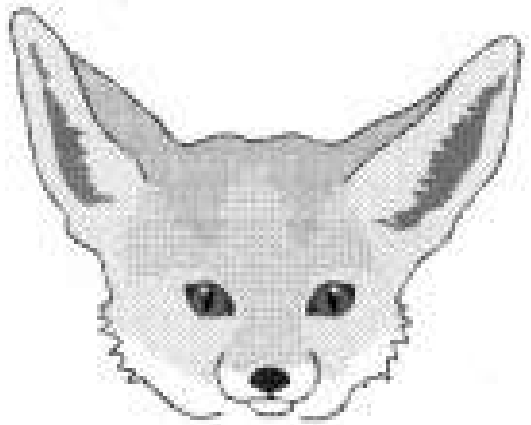
Divergent evolution: is the process of two or more related species becoming more and more dissimilar.

The red fox and the kit fox provide an example of two species that have undergone divergent evolution.

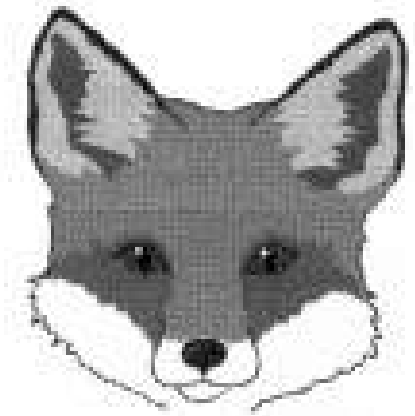
- The red fox lives in mixed farmlands and forests, where its red color helps it blend in with surrounding trees.
- The kit fox lives on the plains and in the deserts, where its sandy color helps conceal it from prey and predators.

- The ears of the kit fox are larger than those of the red fox. The kit fox's large ears are an adaptation to its desert environment. The enlarged surface area of its ears helps the fox get rid of excess body heat.

Similarities in structure indicate that the red fox and the kit fox had a common ancestor. As they adapted to different environments, the appearance of the two species diverged.



Kit Fox



Red Fox

Convergent evolution

Convergent evolution unrelated species become more and more similar in appearance as they adapt to the same kind of environments.

The two unrelated types of plants in the picture have adapted to desert environments.

Notice the resemblance of the cactus, which grows in the American desert, and the euphorbia, which grows in the African deserts. Both have fleshy stems armed with spines. These adaptations help the plants store water and ward off predators.

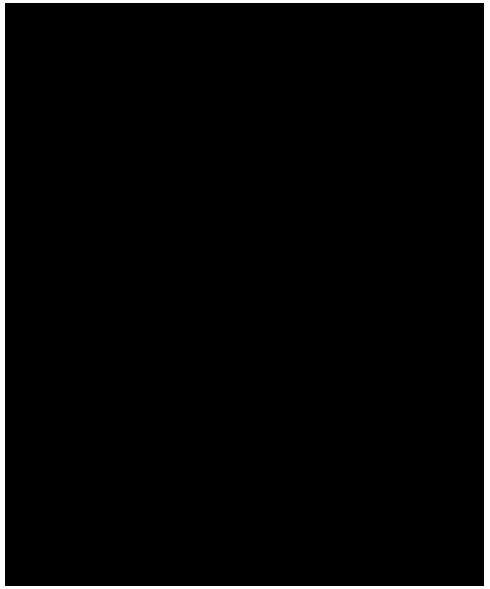
Cactus

Euphorbia

Coevolution

Coevolution is the joint change of two or more species in close interaction predators and their prey sometimes coevolve

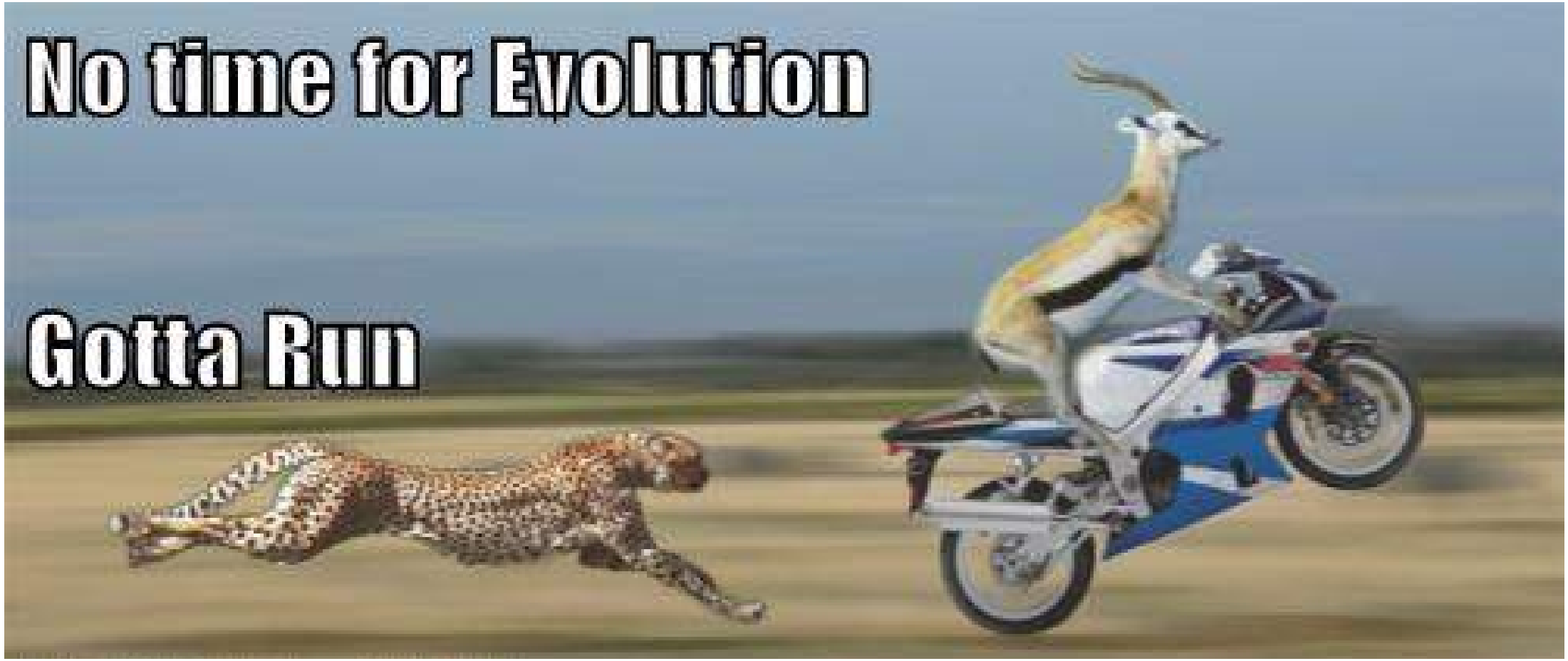
Parasites and their hosts often coevolve. One example of coevolution is between plants and the animals that pollinate them.



In tropical regions bats visiting flowers to eat nectar. The fur on the bat's face and neck picks up pollen, which the bat transfers to the next flower it visits, Bats that feed at flowers have a long tongue with a brushed tip

These adaptations aid the bat in feeding. Flowers that have coevolved with bats are light in color. Therefore, bats, which are active at night, can easily locate them. The flowers also have a fruity odor attractive to bats.

The End



Evidence of evolution

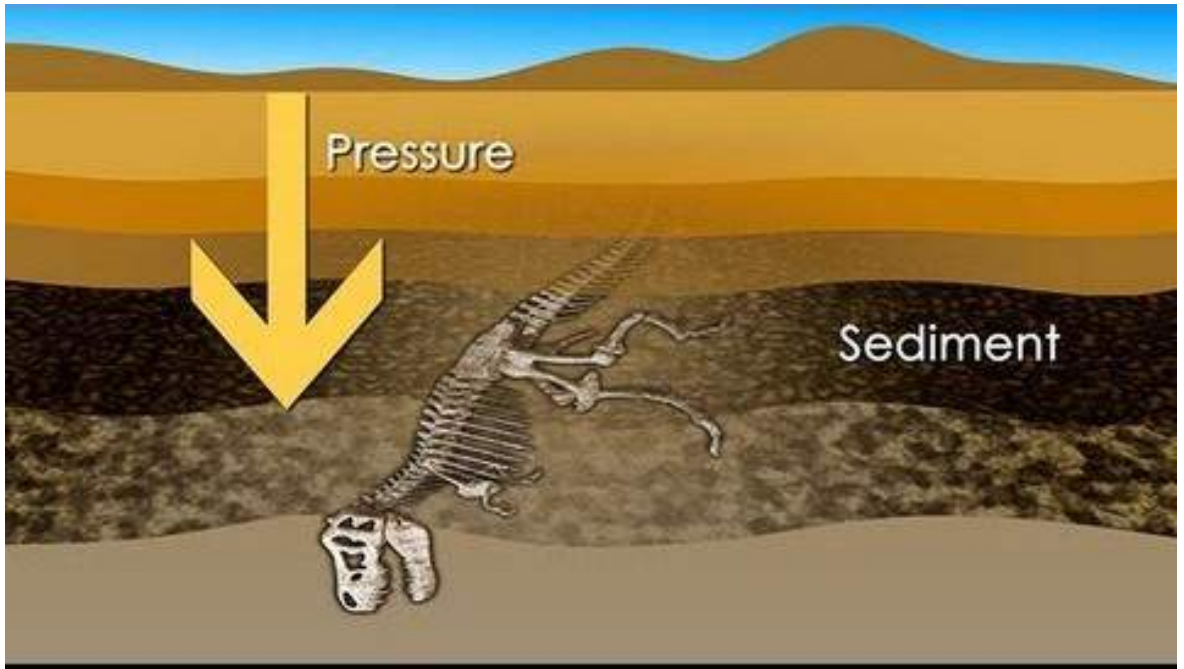
Evidence of evolution

1. Fossils record evidences
2. Biochemistry evidences
3. Comparative anatomy evidences
4. Embryological development evidences
5. Vestigial organs evidences
6. Biosystematic evidences

Fossils record evidences

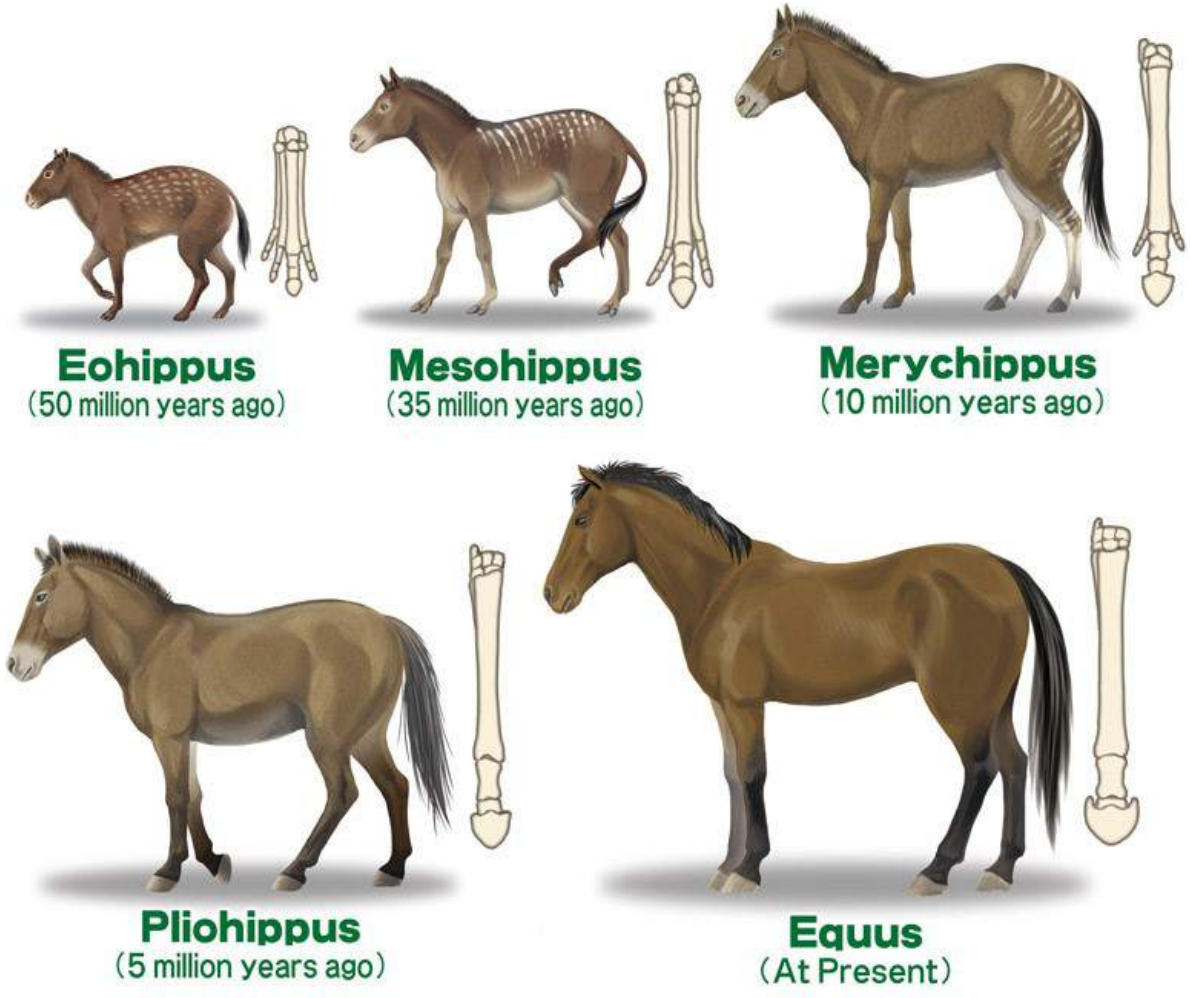
When organisms die, they often decompose rapidly, leaving no permanent evidences of their existence. However, **occasionally**, some organisms are preserved. The remains or traces of organisms from a past geologic age embedded in rocks by natural processes are called fossils.

They are extremely important for understanding the evolutionary history of life on Earth, as they provide direct evidence of evolution and detailed information on the ancestry of organisms.

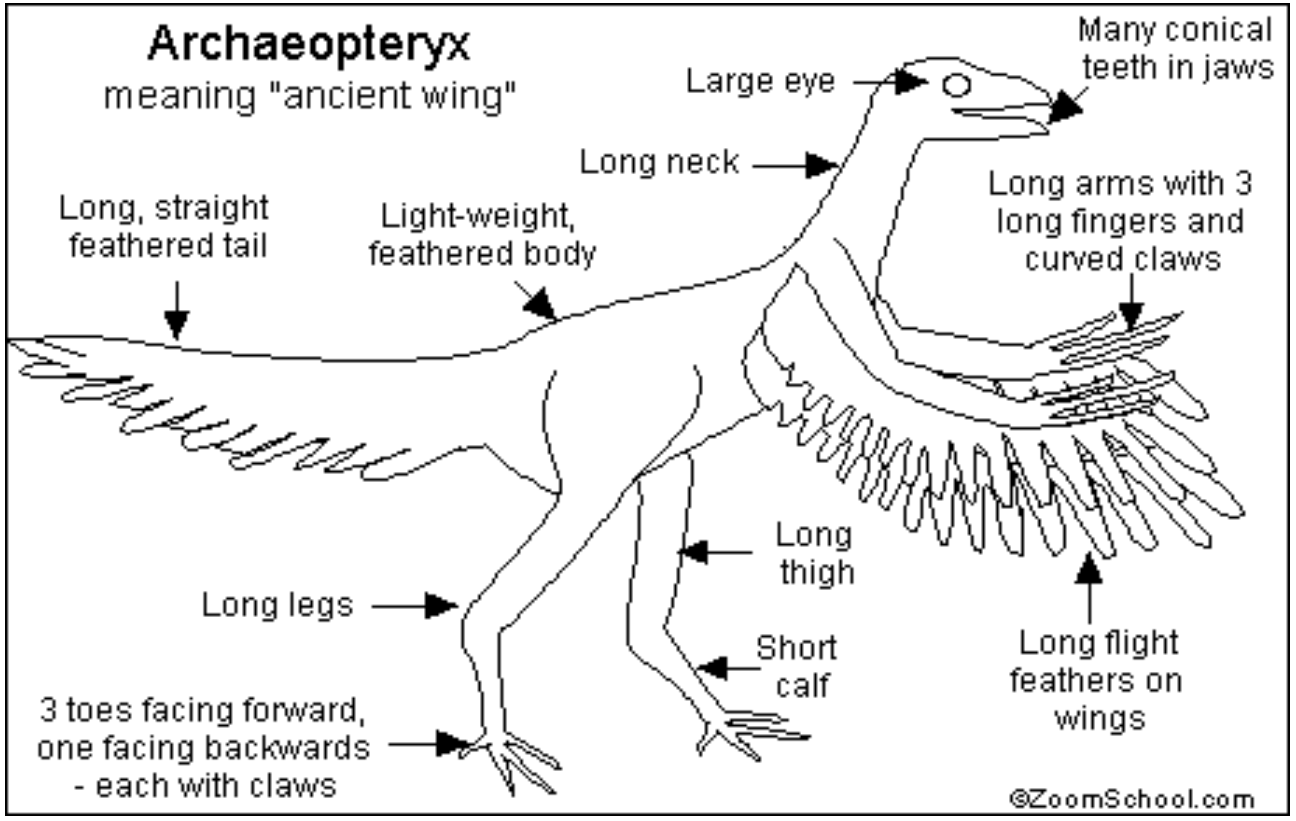


Paleontology is the study of past life based on fossil records and their relations to different geologic time periods.

Due to an almost-complete fossil record found in North American sedimentary deposits, the horse provides one of the best examples of evolutionary history,



also archaeopteryx refers to another examples of fossils and it represent the link episode between birds and reptiles.



Biochemistry evidences

Recent studies indicated that the chemical composition of different-species is similar to each other.

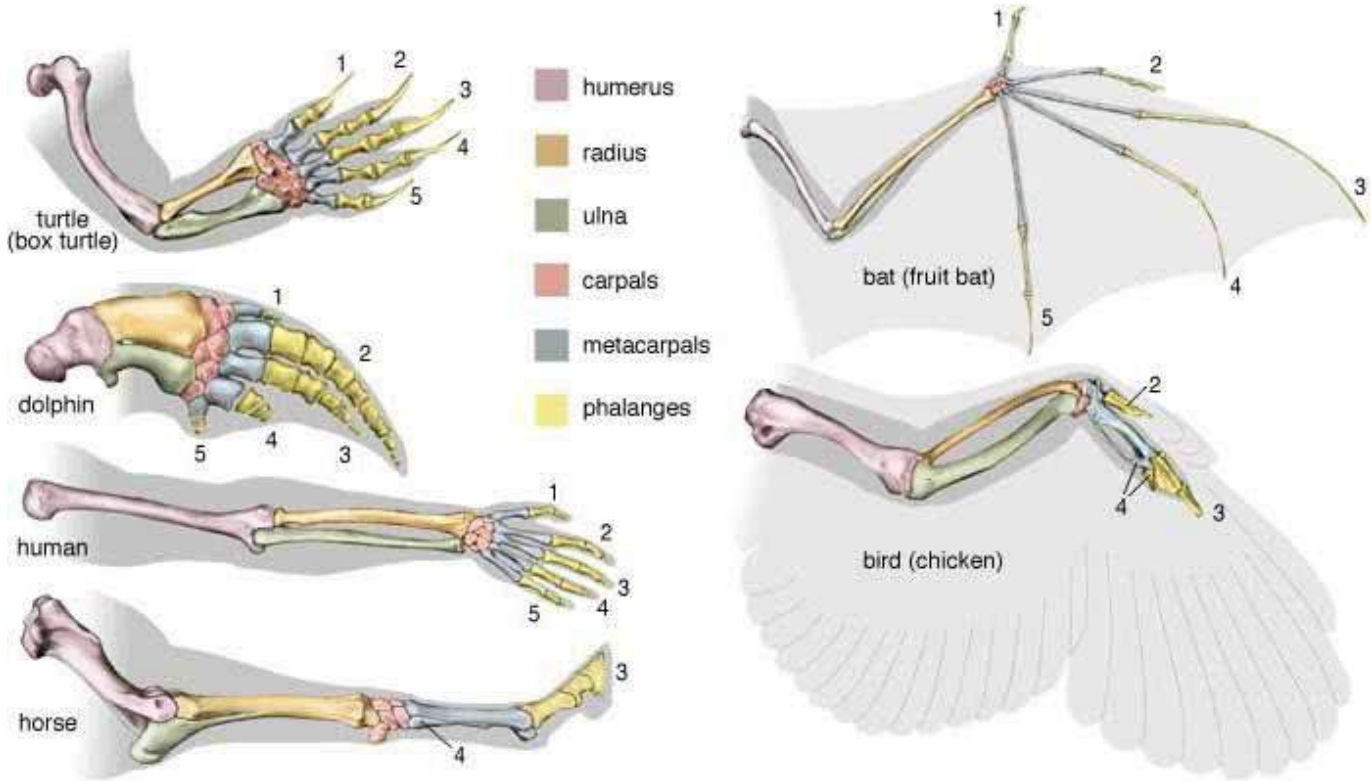
For example, **1)** the chemical composition of chromosomes is similar in all organisms, as well as the enzymes, hormones and the hemoglobin.

2) Also the metabolism in different organisms depend on same chemical component

3) Blood protein gives other example that the organisms back to one ancestor in evolution chain.

Comparative anatomy evidences

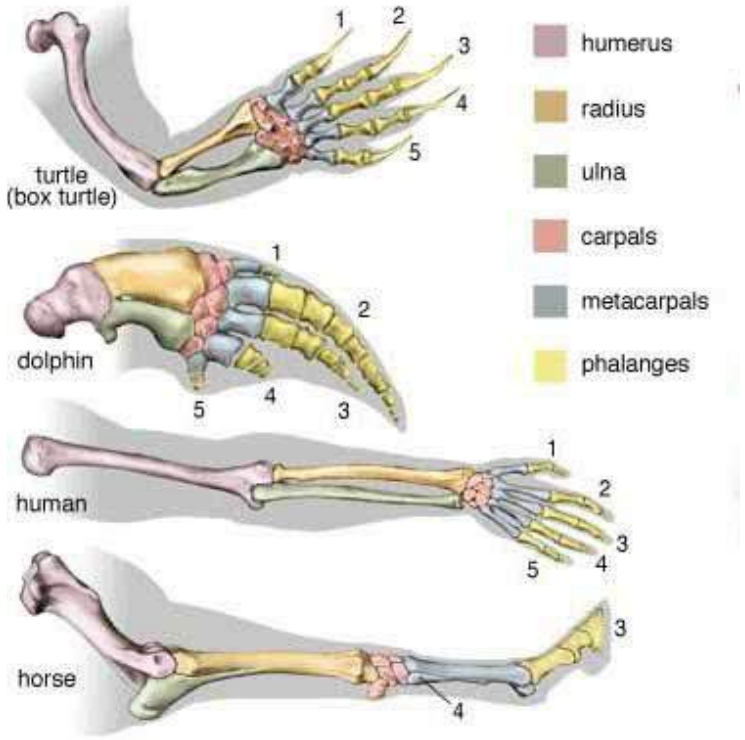
Comparative anatomical studies include, the study of homologous and analogous organs.



Homologous organs

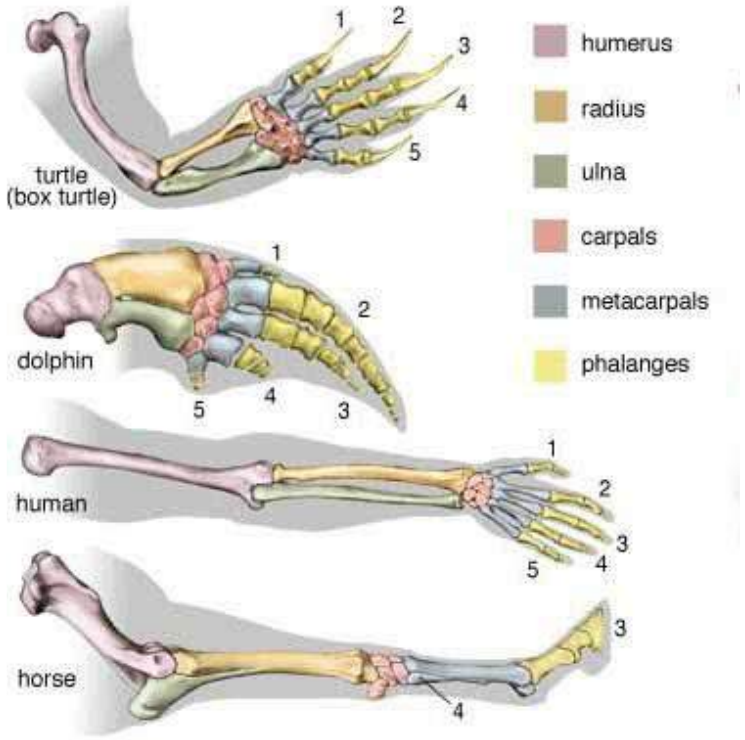
Analogous organs

Homologous organs are those organs which perform different functions but have structural similarities, such similarities can be interpreted to understand whether common ancestors were shared or not For example whales حوت, bats, Cheetah فهدand human share similarities in the pattern of bones of forelimbs as in figure in page 4.



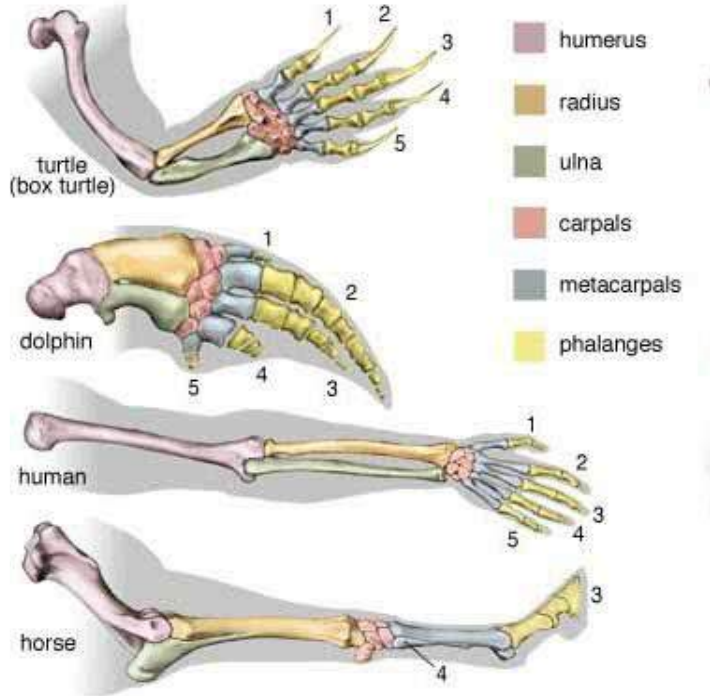
Homologous organs

Though these forelimbs do different functions in these animals, they have similar anatomical structure such, as all of them have radius عظم الكعبرة, ulna عظم الزند, carpal الرسغ, metacarpal المشط and phalanges السلاميin their forelimbs As we know, living forms get adapted to their environmental conditions



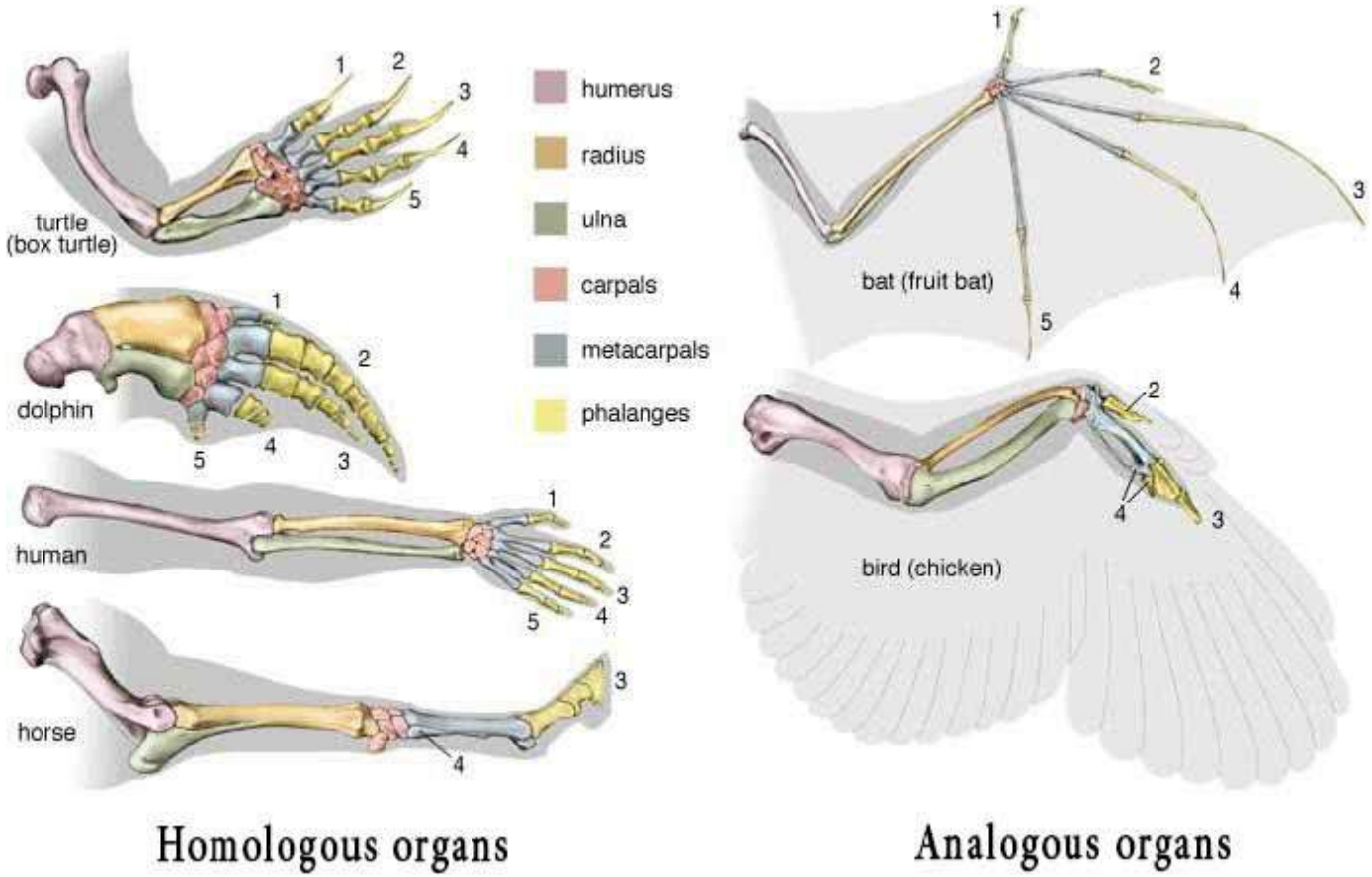
Homologous organs

Man for picking and using tools, cheetah have their four limbs modified into legs for moving purposes, bats have enormously large digits to support a flap of skin to be used for flying, and the whales have their arms modified into flippers.

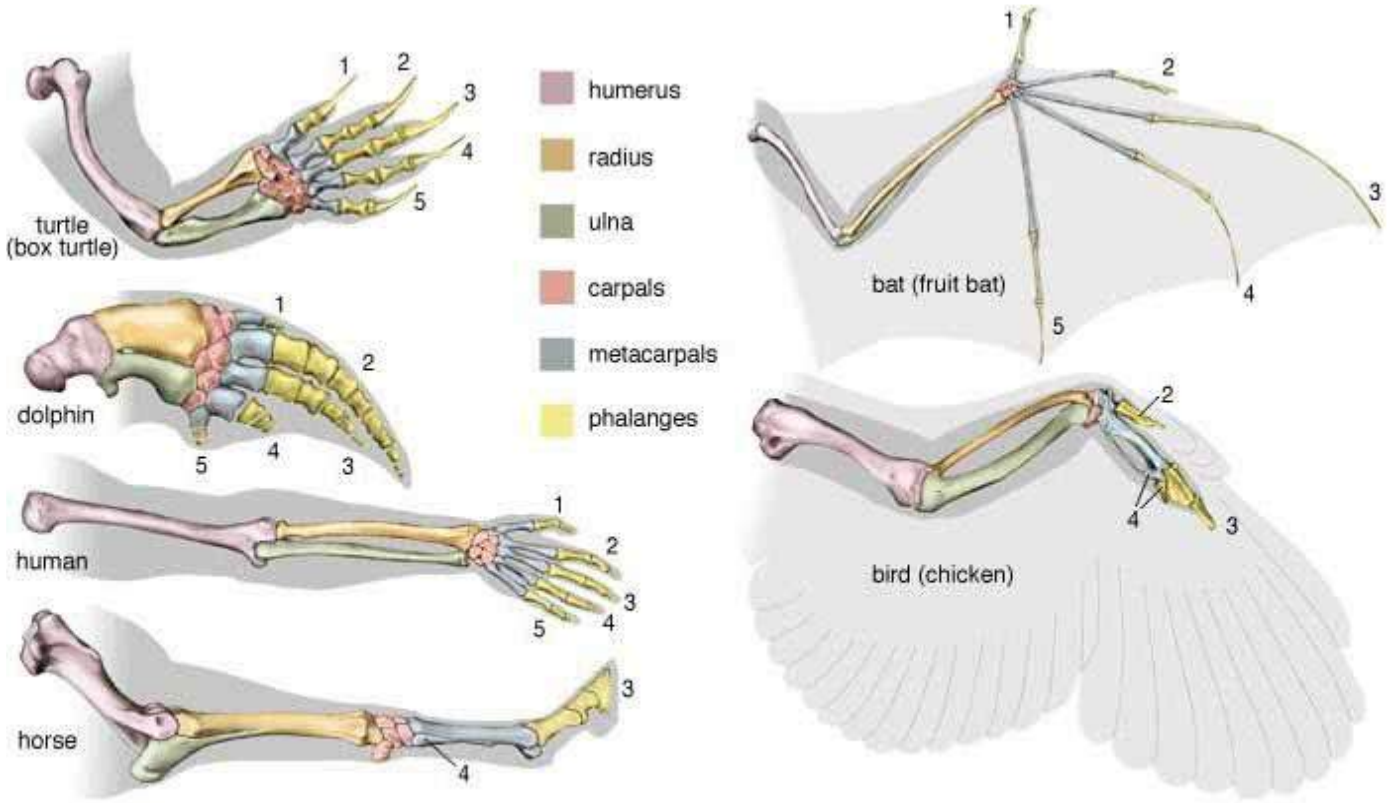


Homologous organs

Analogous organs are those which are functionally similar but have different structural plan. Wings of insects, birds and bats serve the same function but are structurally dissimilar. They are therefore refers to anatomical analogy.



Study of homologous and analogous organs is important for the reason that the former serve as the evidence evolutionary relationship while the latter show evolutionary distance.

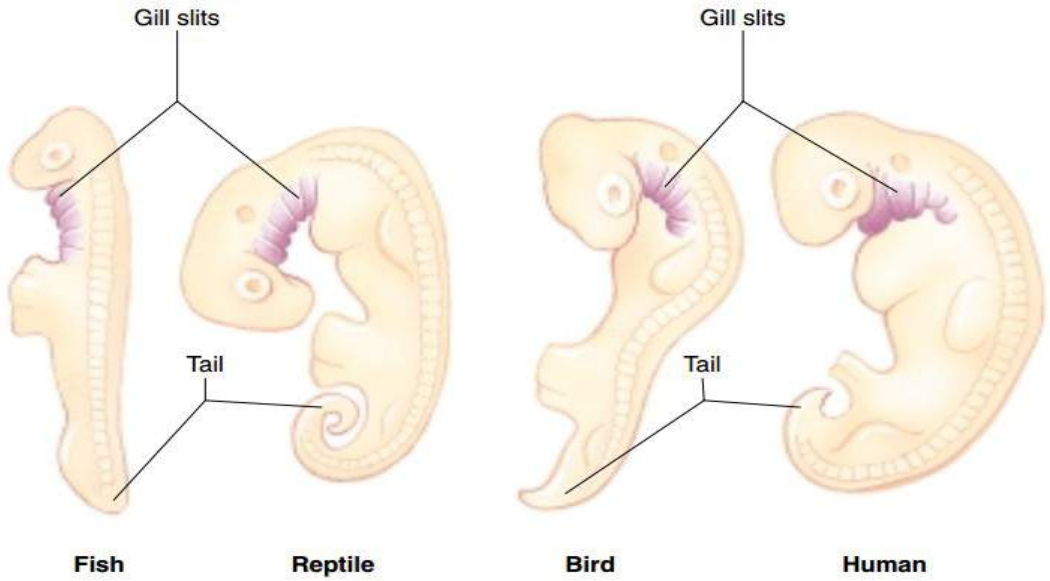


Homologous organs

Analogous organs

Embryological development evidences

The study of the embryos and their development reveal that at the embryonic stages there are features that are absent in the adult form. Series of vertebrate embryos in comparable stages of development, Appears that, all are much alike in the earliest stages, but in advanced stages becomes different from each other.

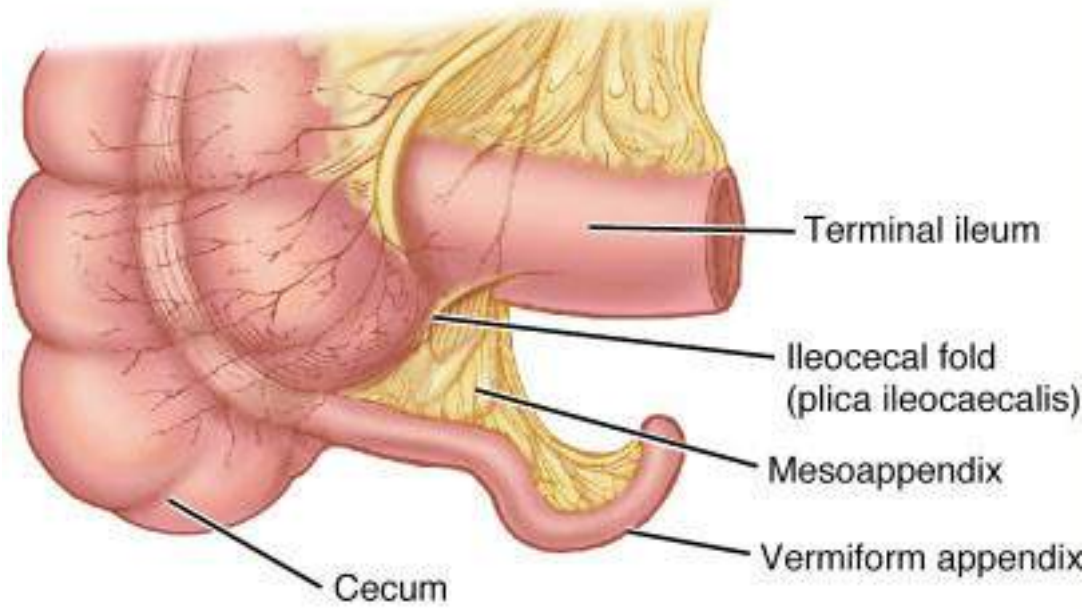


Vestigial organs evidences

Vestigial organs are those organs which are nonfunctional and are of no use to the possessor but are indicative of its use in the ancestral forms of the possessor.

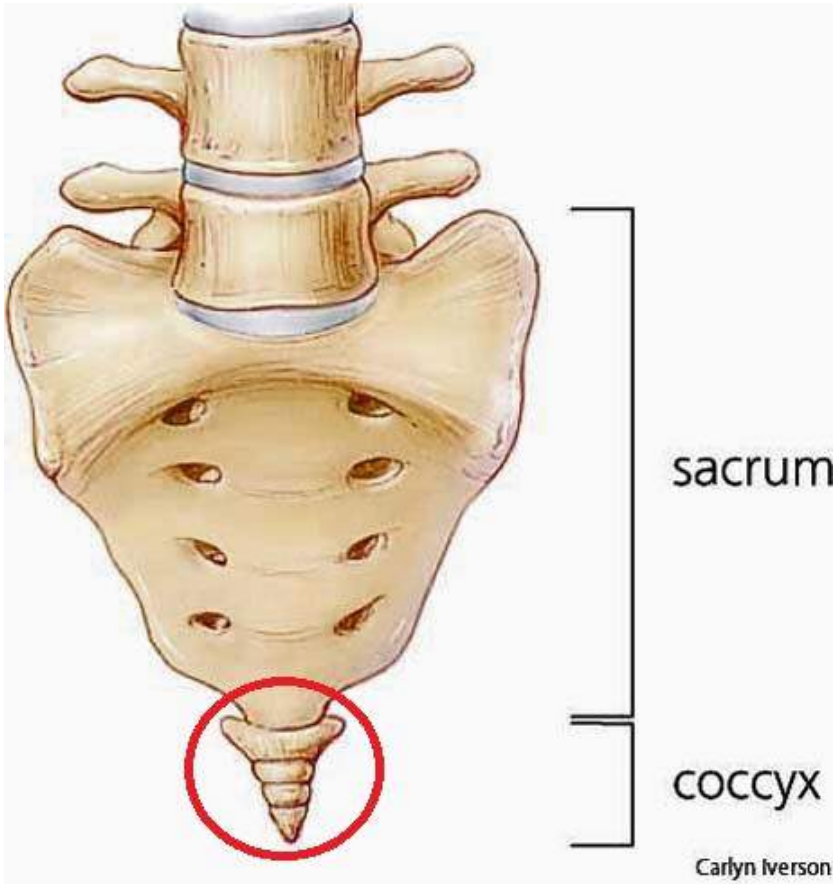
Man has over two hundred such vestigial organs the most prominent of these are

- The vermiform appendix,



- Ear muscles which are useful in moving ears in other animals,
- Abdominal muscles which are nonfunctional in man
- plica semilunaris the nictitating membrane of the eye of ancestors.

Coccyx region of the vertebral column representing tail vertebrae



Biosyatematic evidences:

Biosystematic is depends on classifications of organisms to kingdom, this kingdom classified also to phylum and the phylum classified to classes and the classes to orders and the orders to families and families to genus and genus to species ,

this classifications happened according to sharing traits in each group for example vertebral cord is found in vertebrata .