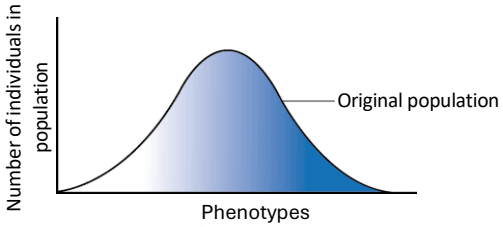
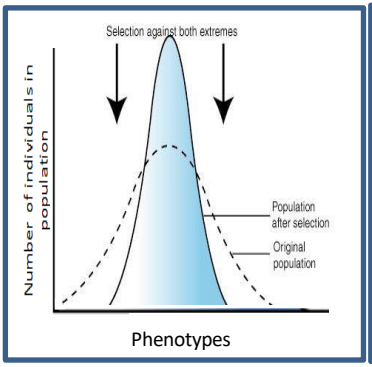
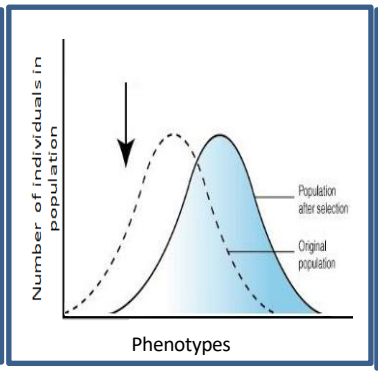
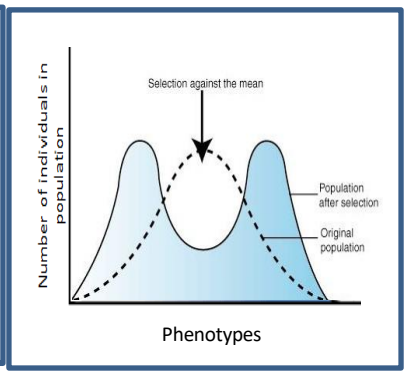
NATURAL SELECTION	a process in which individuals with certain _____ survive and _____ more successfully than other individuals due to those traits _____ as selecting agent



TYPES OF NATURAL SELECTION







Definition :	Natural selection in which intermediate phenotypes _____/reproduce more successfully than extreme phenotypes	Natural selection in which individuals at one of the _____ phenotypes survive/reproduce more successfully than other individuals.	Natural selection in which individuals on _____ extreme phenotypes survive/ reproduce more successfully than individuals with intermediate phenotype.
Chosen phenotype :			
Eliminate phenotype :			
Example :	**Newborn baby weight** • _____ weight in the range of 3-4 kg has higher _____ rate • Babies with _____ birth weight suffer higher rates of mortality • Babies with _____ birth weight show a slight increase in _____ .	**Black peppered moth (*Biston betularia*)** The _____ peppered moth is selected to survive (compared to the light coloured form) and _____ in numbers as the area becomes more industrialized & polluted The white/ light shade will be _____	**Bird beak size** • Birds with _____ beak feed mainly on soft seeds • Birds with large beak mainly feed on _____ seeds. • Birds with _____ sized beak are relatively inefficient at cracking both types of seeds; thus have _____ survival rate
Effect :	Reduce genetic _____	Reduce genetic _____	Increase genetic _____

ARTIFICIAL SELECTION	The _____ breeding of domesticated plants and animals to obtain the _____ traits _____ as selecting agent Also known as _____

TYPES OF ARTIFICIAL SELECTION

Inbreeding	**Outbreeding**
Selective mating between _____ related organisms within the same population	Mating between _____ or distantly related individuals of a species or individuals from different population subspecies to produce offspring known as _____
Promotes _____ (less variation)	Promotes _____ (more variation) and hybrid vigour
Practiced in domesticated animal and crops Examples: ▪ Breeding of 'show' animals such as _____ ▪ Cattle, sheep	Examples: ▪ Horse + donkey = _____ (hybrid) ▪ Hereford X Aberdeen Angus ▪ Oil palm Pisifera sp. (low oil, fruit do not drop easily) + Oil palm Dura sp. (high oil, fruit drops easily) = _____ _____ (hybrid) (Produces fruits with _____ content & the fruits do not _____**)**
Benefits: ▪ Ensures the _____ of advantageous traits ▪ Produces _____ offspring with predictable traits	Benefits : ▪ Increase hybrid _____ or heterosis (hybrid with good/ high quality i.e: increased fruit size, resistance to disease) ▪ Increase genetic _____ ▪ Increase heterozygosity ▪ Better adapted to _____ environments
Effect of prolonged inbreeding : ▪ Reduce _____ ▪ _____ genetic variation ▪ Increase the number of _____ (increase genetic disorders) ▪ _____ adapted to changing environments	Disadvantage: • Pure characters are _____

COMPARISON NATURAL & ARTIFICIAL SELECTION

NATURAL SELECTION	ARTIFICIAL SELECTION
Both selections alter the allele and _____ frequencies of population Both selections may lead to _____	
Selection agent is	Selection agent is
_____ event / by chance events	_____ event on selected organism with desirable phenotype
Selected population basically are _____ as they manage to adapted to environment	Selected population can lead to _____ for prolonged inbreeding

SPECIATION	A process of forming new species from _____ species through evolution. Populations of the same species evolve to become so different that they can no longer _____ with one another to produce _____ offspring _____ is prevented between the new species

MODE OF SPECIATION

ALLOPATRIC SPECIATION (_____ and biologically isolated)	SYMPATRIC SPECIATION (biologically isolated)
Two subpopulations are reproductively isolated Form a _____ species that cannot _____ with parent/pre-existing species	
Formation of new species that occur in populations that are _____ isolated/ separated.	Formation of new species that live in the _____ geographical areas ➢ A small population becomes a new species _____ geographical isolation
A population splits into two subpopulations due to the presence of _____ barrier. Gene flow/_____ from one population to another is prevented Lead to changes in _____ and _____ frequencies. Examples of **geographical barrier**: ▪ _____ shifting their courses ▪ _____ ranges forming ▪ Land bridges forming ▪ Large _____ diminishing into several smaller ▪ Small population migrates or dispersed and colonizes a new area away from original species	They can co-exist as separate species within the same geographical area. _____ /interbreeding between individual is reduced/prevented by factors such as: **i. Polyploidy** A species may originate from mutation during cell division that result in extra sets of _____ Example: allopolyploid speciation in Tragopogon. **ii. Habitat differentiation** Example: Apple maggot flies 200 years ago, the ancestors of apple maggot flies laid their eggs only on hawthorns But today, these flies lay eggs on hawthorns and domestic apples Females generally choose to lay their eggs on the type of fruit they grew up in, & males tend to look for mates on type of fruit they grew up in.

	iii. Sexual Selection: Example: Cichlid fish at East Africa's Lake Victoria Females select males based on the appearance - coloration of males (blue-tinged back VS red-tinged back)

4 PROCESSES THAT LEAD TO SPECIATION:

❖ **REPRODUCTIVE ISOLATION**	▪ The existence of _____ factors (barrier) that prevent closely related species from _____ and produce viable, _____ offspring ▪ Prevent the exchange of genetic materials (_____) between two different species in the _____ geographical area

TYPES OF BARRIER (ISOLATING MECHANISM)

PREZYGOTIC BARRIERS	**POSTZYGOTIC BARRIERS**
Reproductive barriers that _____ mating or fertilization from taking place	Reproductive barriers that prevents a _____ zygote from developing into a viable, _____ adult (after mating & fertilization has occurred)
5 TYPES: **1. _____ Isolation:** Two species that occupy different _____ within the same geographic area rarely meet each other. ▪ Two species of maggot flies in the genus of Rhagoletis occur in same geographic area, but feed, mate & lay eggs on different host plants (apple trees vs blueberry trees) **2. _____ Isolation:** Two species reproduce at different _____ time/ seasons. ▪ Western spotted skunk (Spilogale gracilis) mates in late summer while eastern spotted skunk (Spilogale putorius) mates in late winter **3. Behavioral Isolation:** Two species have different _____ behaviors/ ritual to attract _____ that unique to their species	**3 TYPES:** **1. _____ Hybrid Viability:** Hybrid zygote is produced but fail to _____ into _____ fertile individual (cannot reach sexual maturity) ▪ Most hybrid of _____ in the genus Ensatina do not complete their development **2. Reduced Hybrid _____ :** Hybrid offspring is developed/produced but _____ (fail to produce gamete) ▪ Crossing between _____ (2n=64) and donkey (2n=62) will produce sterile hybrid _____ (n = 63) **3. Hybrid _____ :** Some F_1 hybrids are viable and _____ but F_2 generation are _____ or sterile ▪ F_2 hybrids show hybrid breakdown, cannot _____ due to some defect.

▪ **Blue-footed boobies** (birds): mate only after a courtship display unique to their species. Male is lifting his feet in a ritualized high step that shows off his bright blue feet (for female attention) **4. _____ Isolation:** Two species have structural differences in their _____ . ▪ The shells of two species of snails in the genus Bradybaena spiral in different directions: one spiral in a counterclockwise direction, the other in a clockwise direction. The snail genital openings are not aligned, and mating cannot be completed. **5. _____ Isolation:** Gametes of 2 different species are chemically _____ and fail to fuse ▪ Sea urchins release their sperm and eggs into the surrounding water, where they fuse and form zygotes. Gametes of different species, such as the red and purple urchins are unable to fuse because proteins on the surfaces of the eggs and sperm _____ bind to each other.	

❖ _____ _____	▪ Refers to a gradual change in _____ frequencies of a gene pool within population due to chance from _____ events ▪ Reduce genetic _____ ▪ Shift the _____ equilibrium

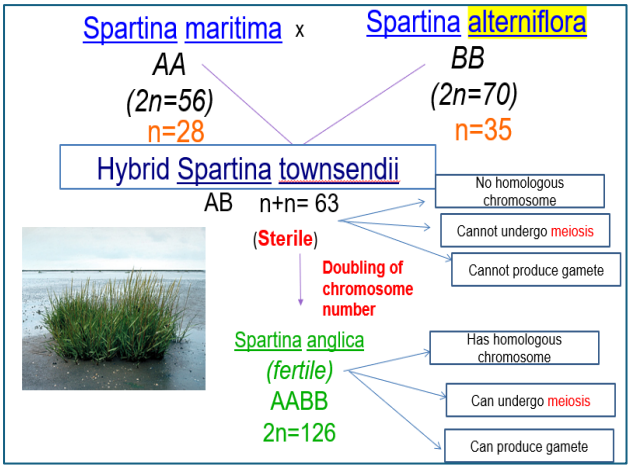
TYPES OF GENETIC DRIFT

BOTTLENECK EFFECT	**FOUNDER EFFECT**
Genetic drift that occurs when the size of a population is _____ by a natural _____ or human actions.	Genetic drift that occurs when a few individuals become _____ from a larger population and form a new population whose gene pool is different from _____ population
▪ Occurs when a population undergoes a _____ decrease in the original population size which is caused by _____ or human action. ▪ Natural disaster _____ eliminates a major proportion of the population	▪ Occurs when _____ population is isolated/ migrated from the original/main population ▪ By chance, the allele frequencies of new smaller population may not be the _____ with original population.

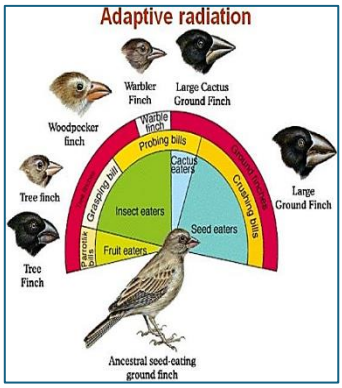
▪ Small _____ population has less genetic _____ from the original population ▪ They contribute genes to the entire future populations. ▪ Certain alleles may be _____ , underrepresented or overrepresented by chance regardless of whether that allele is beneficial or harmful.	▪ They will become _____ organism in the new area ▪ Small pioneer population has _____ genetic variation from original population ▪ Causing certain alleles in the pioneer population maybe eliminated, overrepresented or _____
Example:	Example:

❖ _____	▪ Production of _____ (new species) through interbreeding between 2 different species (that are _____ related)

▪ Crossing between different species produces _____ F_1 hybrids because its chromosomes are not homologous.
▪ _____ during meiosis of F_1 hybrid results in fertile F_2 generation
▪ Allopolyploidy can directly cause speciation because it can overcome hybrid sterility (form new _____)



❖ _____ _____	▪ Evolutionary change of one or a few _____ species forming many new species when they are adapted to different ecological roles/_____ in their communities



▪ These different species share a _____ structure which is modified to perform variety of functions (as _____ to different habitat)
▪ Homologous structure :
Structure in different species that are _____ because they originate from a _____ ancestor

Example: Beak of finches on Galapagos Island

▪ Large ground finch as the _____ and 6 types of finches are formed.
▪ The _____ and _____ of beaks are adapted for specific diet/ feeding mode