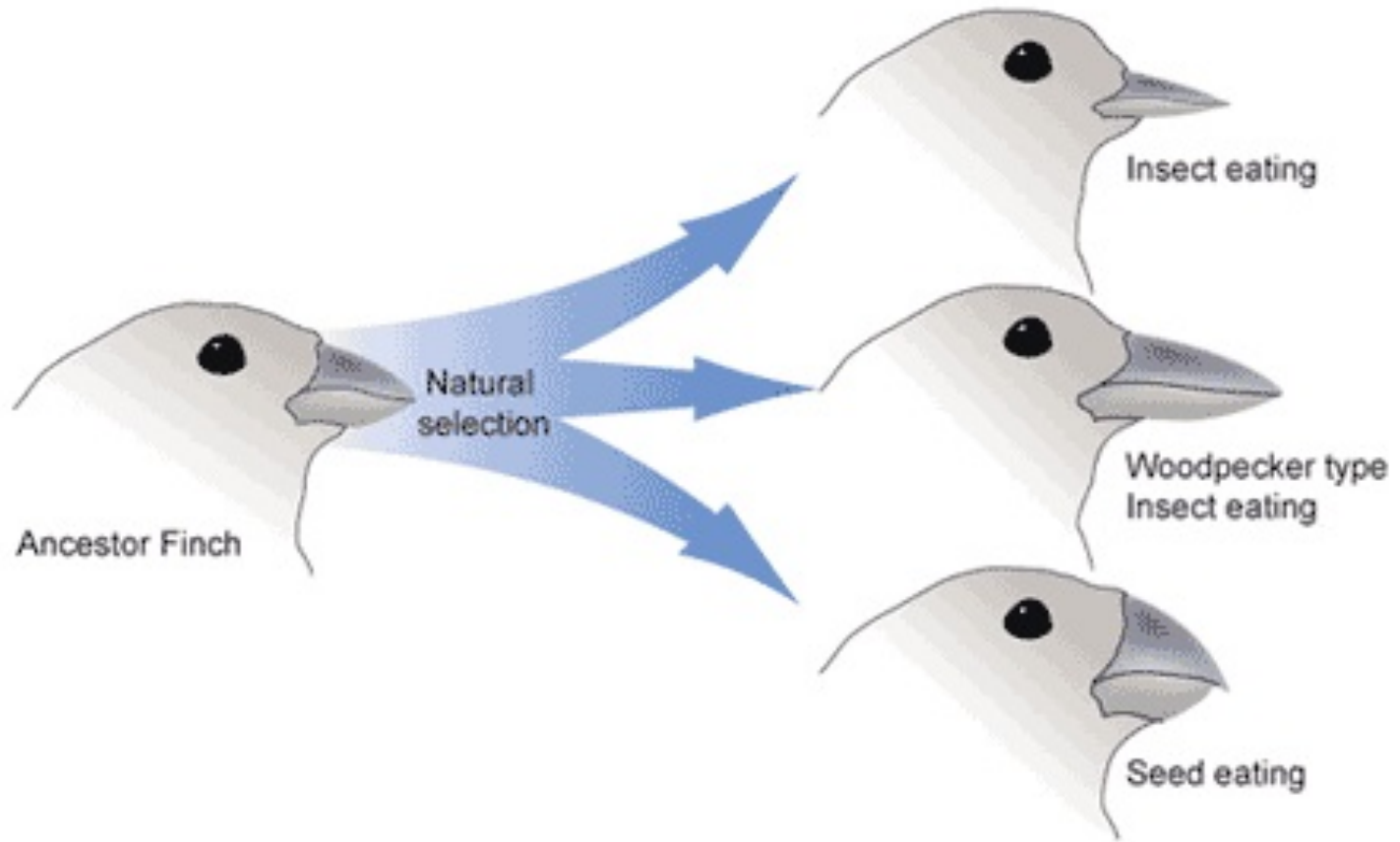


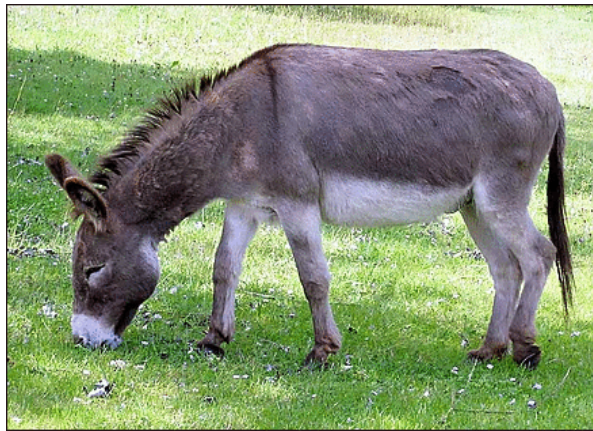
# Speciation



# What is a species?

## One Biological definition

- Members of a population that can reproduce to produce viable offspring
- this is difficult to ascertain with bacteria



Donkey  
 $2N= 62$



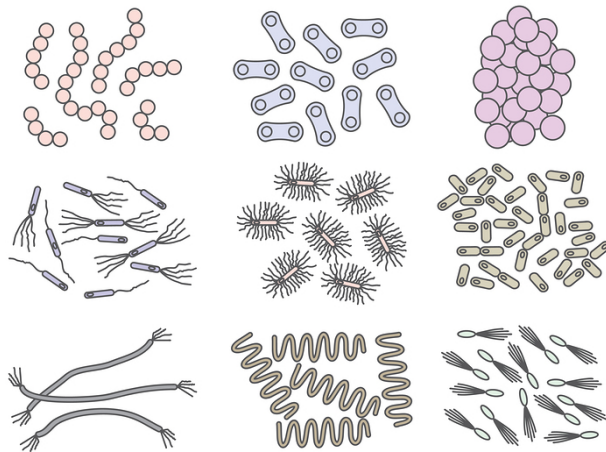
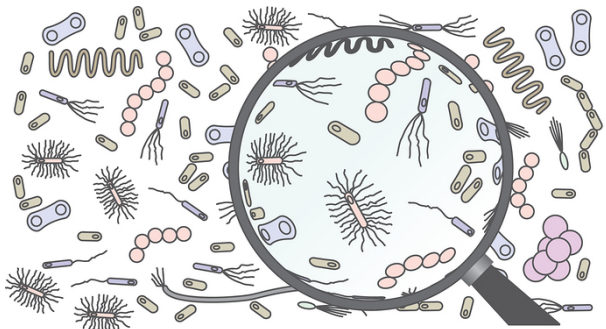
Mule  
 $2N= 63$

Horse  
 $2N= 64$



## One Biological definition

- Members of a population that can reproduce to produce viable offspring
- this is difficult to ascertain with bacteria (asexual)

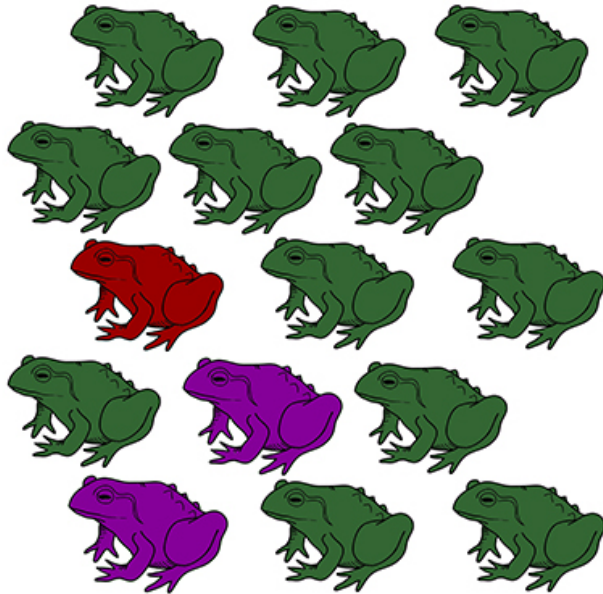


With prokaryotes, anatomical  
biochemical, DNA comparisons  
are used

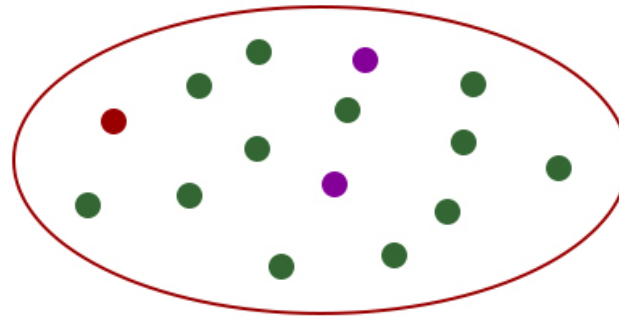
# Gene Pool

- The amount of genes within a population

a population

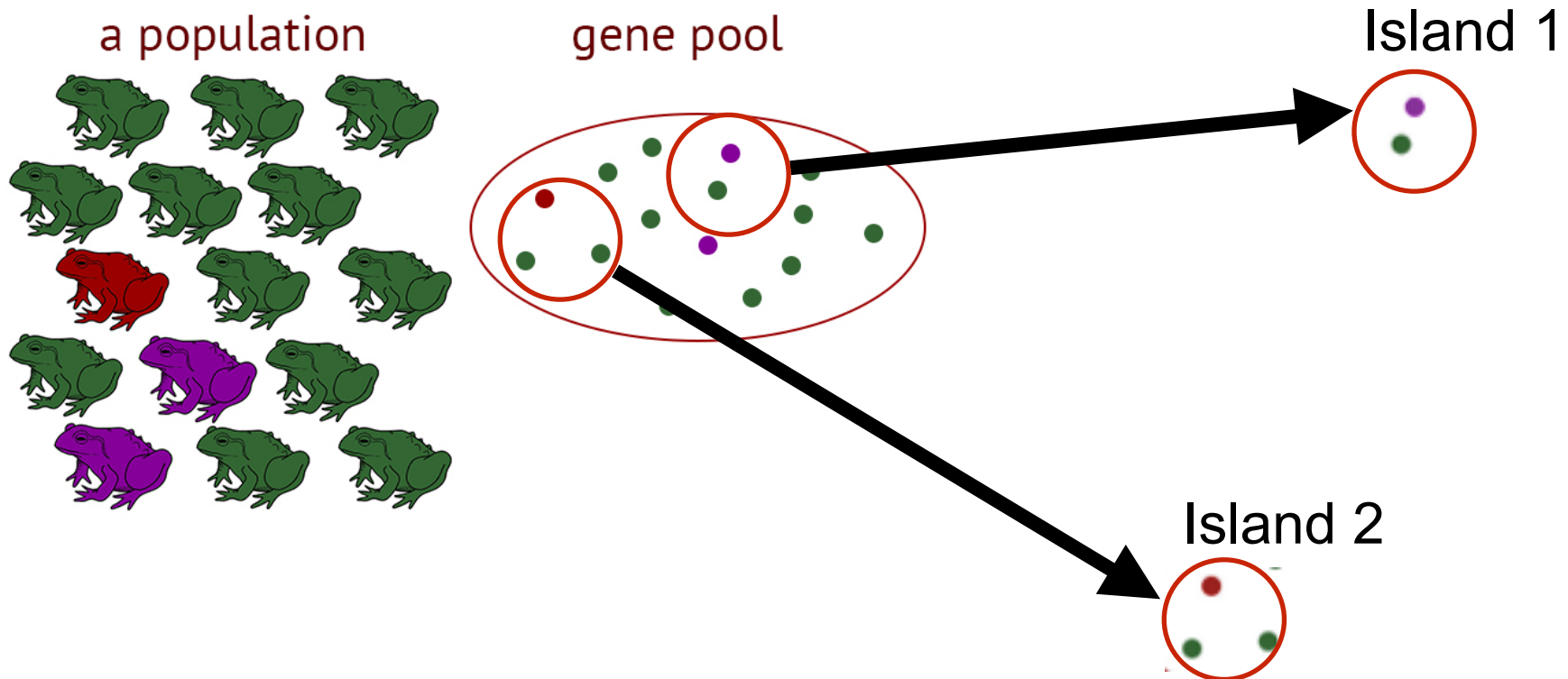


gene pool



# Gene Pool

- If splinter groups of a species population are created, then the gene pool can be reduced in variation and multiple gene pools created.



# Calculation the Alleles in a Population

## The Hardy-Weinberg Principle

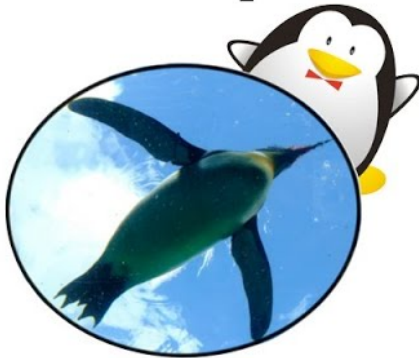
frequency of  
homozygous dominant  
genotype



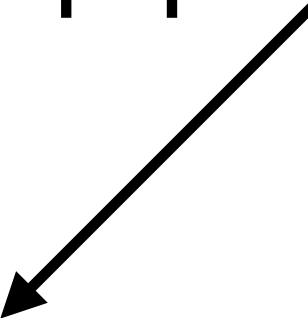
frequency of  
homozygous recessive  
genotype

$$p^2 + 2pq + q^2 = 1$$

frequency of  
heterozygous  
genotype



*A biologist has found that 10% of a population of bats are hairless, which is a recessive trait. Determine the allele frequencies of the population.*

$$p^2 + 2pq + \textcircled{q^2} = 1$$


Represents the recessive individuals

Therefore  $q^2 = 10\%$

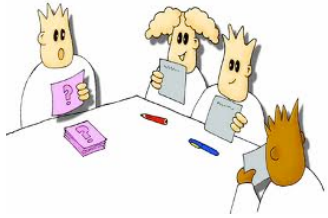
or  $q^2 = 0.1$

That mean the frequency of the recessive allele

is  $q = \sqrt{0.10}$

$q = 0.316$  or 32%

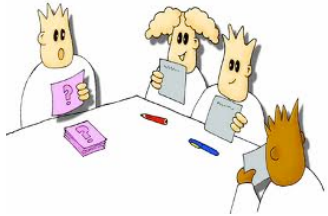
Therefore  $p = 68\%$



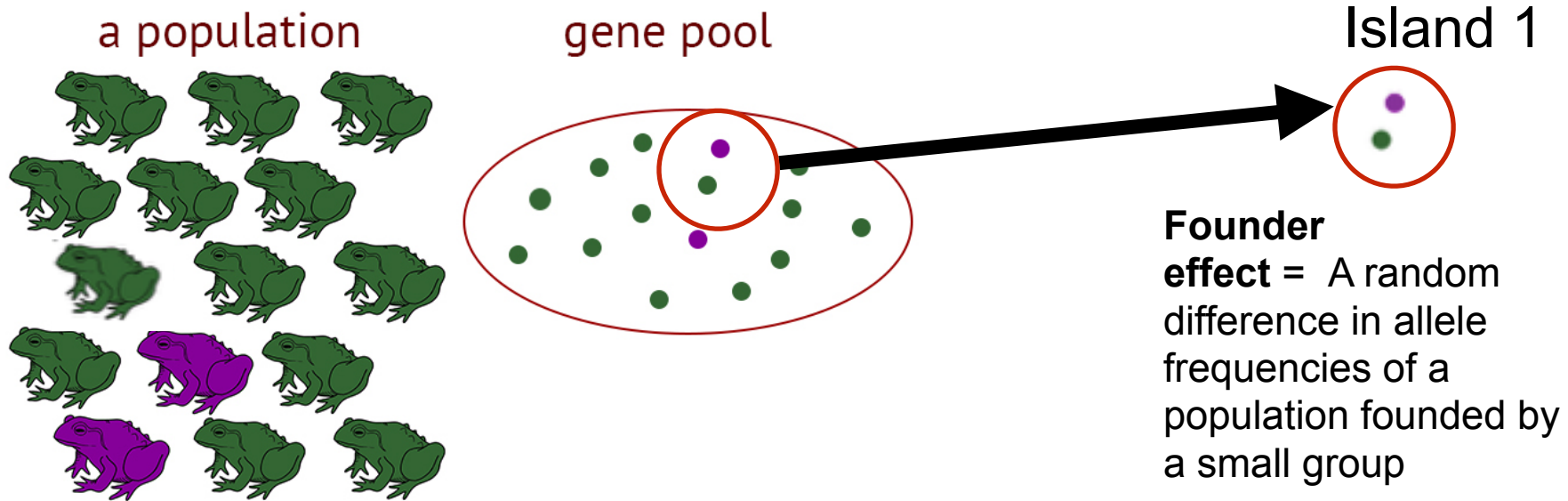
*A biologist has found that 4% of a population of Riverside Students have red hair, which is a recessive trait. Determine the allele frequencies of the population using the Hardy-Weinberg equation.*

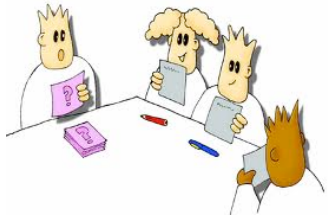
$$p^2 + 2pq + q^2 = 1$$





What is the allele frequency of green is dominant?



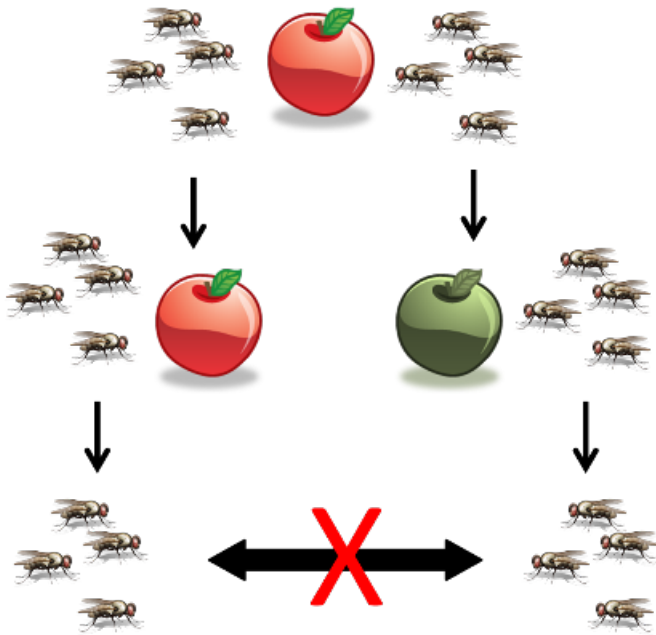


In peas, a gene controls flower colour such that  $R$  = purple and  $r$  = white. In an isolated pea patch, there are 36 purple-flowering plants and 64 white-flowering plants. Assuming Hardy-Weinberg equilibrium, what is the frequency of the dominant allele?

- a. 0.36
- b. 0.60
- c. 0.64
- d. 0.75
- e. 0.8

# Speciation

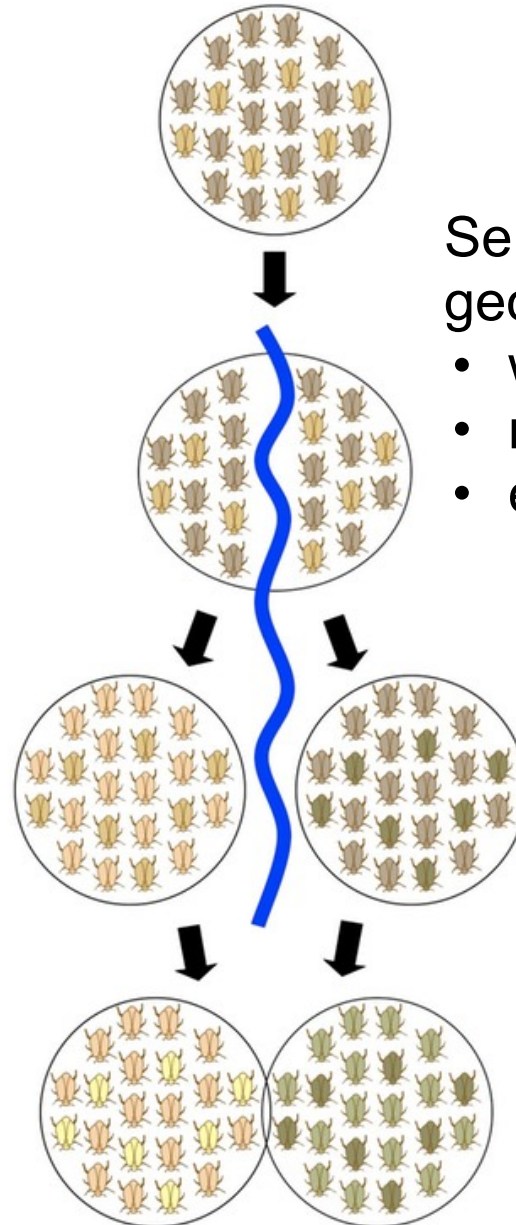
## Sympatric



In the same geographical area,  
but genetically isolated.

- Behaviourally
- Spacial - habitat
- Temporally - In time

## Allopatric



Separated over  
geographical distance.

- water separation
- mountain separation
- etc

# Speciation (or *How New Species Form*)

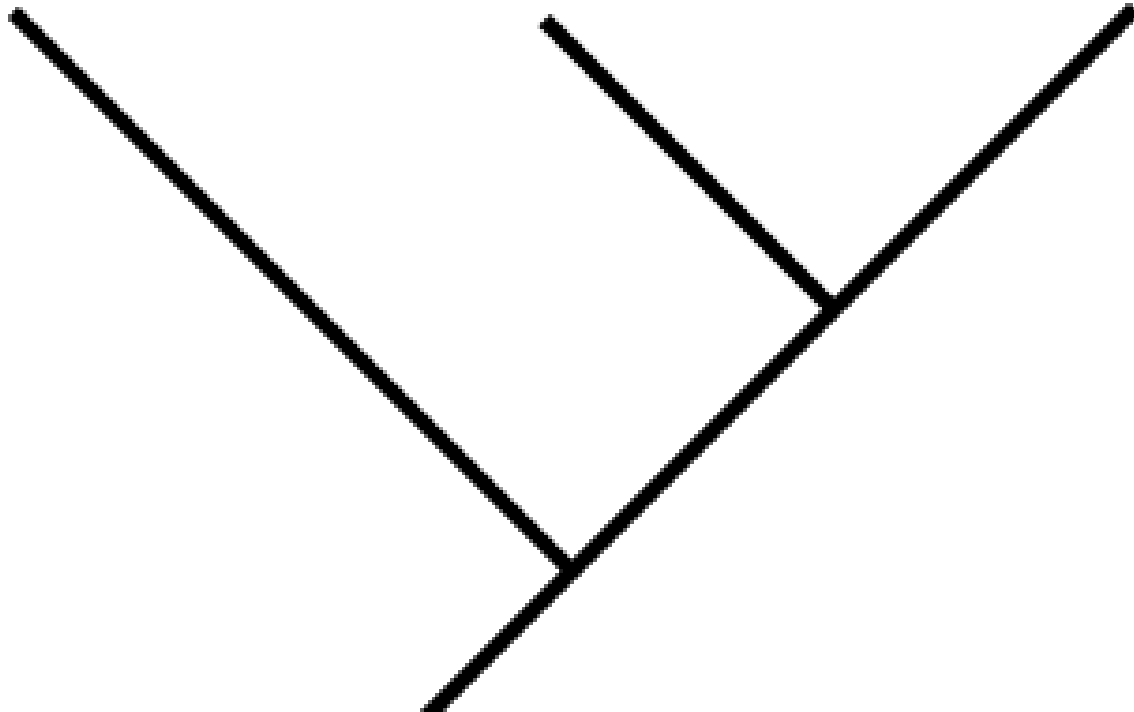
Species A



Species B



Species C



Cheer-cheer-cheer-cheer-cheer-cheer-cheer

Cheer-cheer-cheer chit-chit-chit chit-cheerit

chitchit chikachikachika cheerit

# How do species remain reproductively isolated?

## A. Pre-zygotic Barriers

- mechanisms in place to prevent fertilization from occurring

### 1. Behavioural isolation

- refers to any behaviour that is species-specific

*eg: birds songs, courtship rituals, pheromones*



(a) Myrtle Warbler

(b) Yellow Warbler

(c) Yellow Throated Warbler

# How do species remain reproductively isolated?

## A. Pre-zygotic Barriers

- mechanisms in place to prevent fertilization from occurring

### 1. Behavioural isolation

- refers to any behaviour that prevents interbreeding  
eg: *Frog, birds songs, courtship rituals, pheromones*



(a) Western Meadowlark



(b) Eastern Meadowlark



## 2. Habitat isolation

Within close geographical areas, but different niches  
eg: NA garter snakes (common & northwest)  
-common likes meadows & northwest likes wetlands



### 3. Temporal separation (*timing differences*)

Populations of a species breed at different times.

- common in plants eg. *Dendrobium orchids*
- insects eg Cicada



7 year



13 year



17 year



## 4. Mechanical isolation

- anatomically incompatible result in no mating or gamete exchange
- especially common in insects & plants



## 5. Gamete isolation

- inhospitable environments or chemical signals may reject each other

eg: sea urchins broadcast gametes into water

--> chemicals on egg reject 'foreign' sperm



How do species **remain** reproductively isolated?

## **B. Post-zygotic Barriers**

- mechanisms are in place to prevent zygotes from developing into healthy, fertile adults

### **1. Hybrid inviability**

- genetic incompatibility stops embryo from developing  
eg: sheep & goat hybrid



# Hybrid sterility

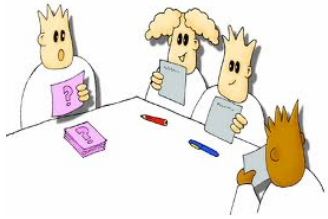
- offspring are infertile

eg: horse + donkey ---> mule



## Classwork:

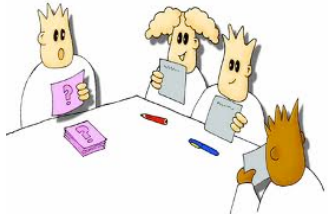
- Data based question 459
- Read and try ***Different Populations Have Different Alleles*** on pg. 459



Several closely related frog species of the genus *Rana* are found in the forests of the southeastern United States. The species boundaries are maintained by reproductive barriers. Males of one species sing only when its predators are absent; males of another species sing only when its predators are present. Which type of reproductive barrier does this represent?

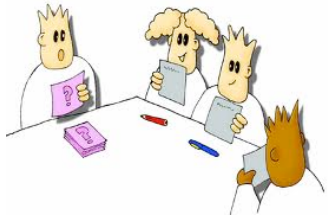
- a. Behavioural isolation
- b. Gametic isolation
- c. Habitat isolation
- d. Temporal isolation
- e. Mechanical isolation





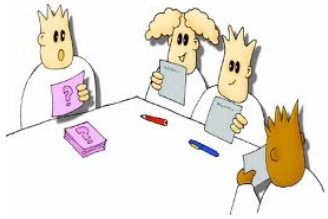
Males of different species of the fruit fly *Drosophila* that live in the same parts of the Hawaiian islands have different elaborate courtship rituals that involve fighting other males and stylized movements that attract females. What type of reproductive isolation does this represent?

- a. Behavioural isolation
- b. Gametic isolation
- c. Habitat isolation
- d. Temporal isolation
- e. Mechanical isolation



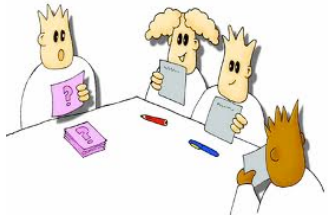
Lupinus tidestromii and Lupinus gracilentus belong to the legume family of plants. L. tidestromii is found in the coastal beach habitat and flowers from May to June, whereas L. gracilentus is found in sub-alpine habitats above 3000 m and flowers from July to August. Which statement correctly describes these lupines?

- a. They are reproductively isolated.
- b. They are geographically isolated.
- c. They are the result of acquired characteristics.
- d. They are both reproductively and geographically isolated.
- e. They are actually one species that reacts differently to cold temperatures.



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- e. They are actually one species that reacts differently to cold temperatures.



Two species of frogs belonging to the same genus occasionally mate, but the eggs develop but fail to hatch. What is the mechanism for keeping the two frog species separate?

- a. Hybrid inviability
- b. Hybrid sterility
- c. Gametic isolation
- d. Mechanical isolation