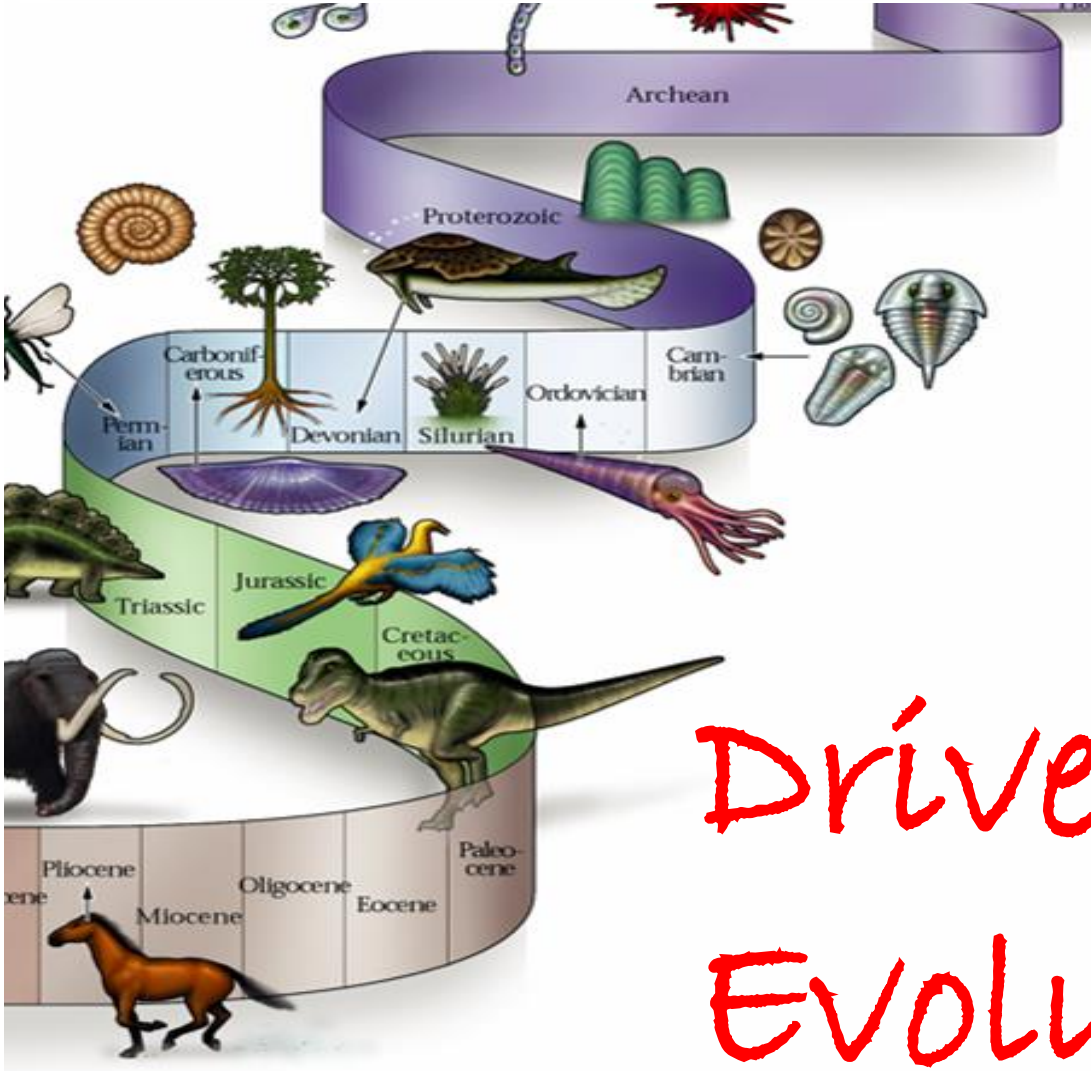


Drivers of Evolution

GENETIC EQUILIBRIUM

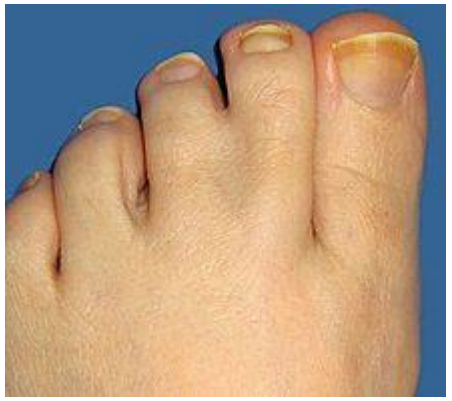
When it comes to numbers and statistics, there is a strong tendency for things to play themselves out, cycle after cycle with a resistance to change. For example, if you flipped a coin 1000 times, there is a pretty good chance that the number of times that heads comes up will be very close to the number of times that tails comes up. This resistance to change also takes place in a gene pool, if there are two alleles and one makes up 70% (TALL-T) of the alleles and the other makes up 30% (SHORT-t) of the alleles. Those two allelic frequencies may get locked in for millions of years, and the gene pool for that species gets locked into –

"GENETIC EQUILIBRIUM"

For a Population to get stuck in a state of "Genetic Equilibrium" certain conditions must be maintained

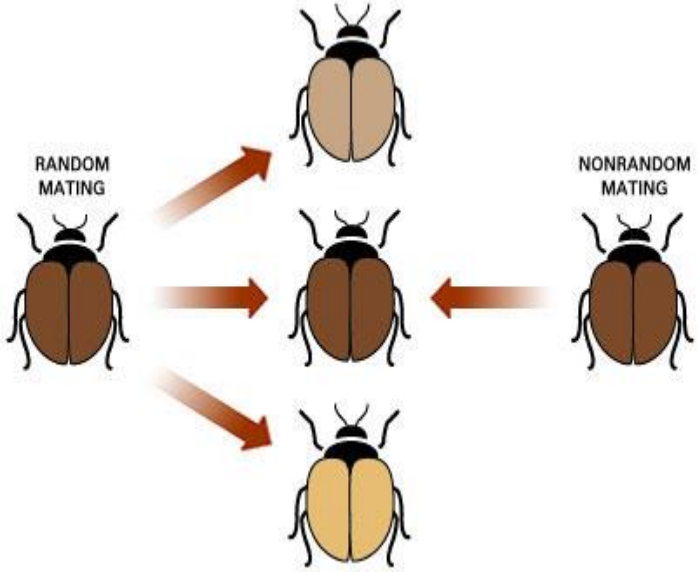
1. Large Population

2. Random Mating



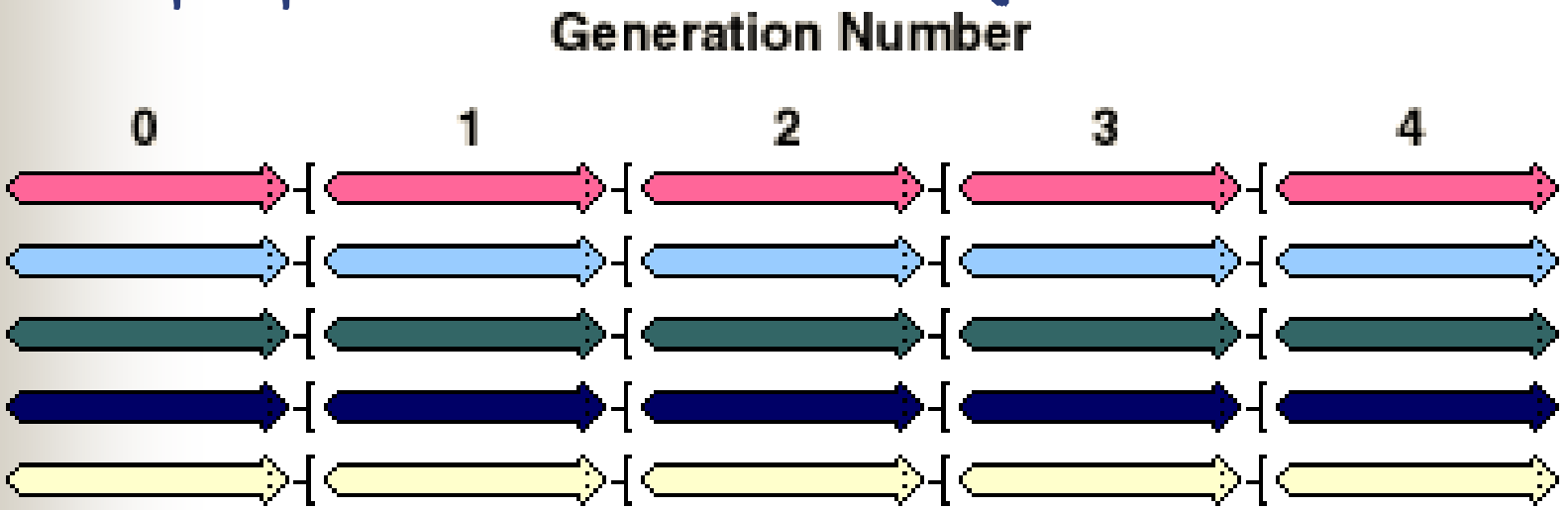
3. No New Mutations

4. No Differential Migration



5. Equal Viability

A population at equilibrium



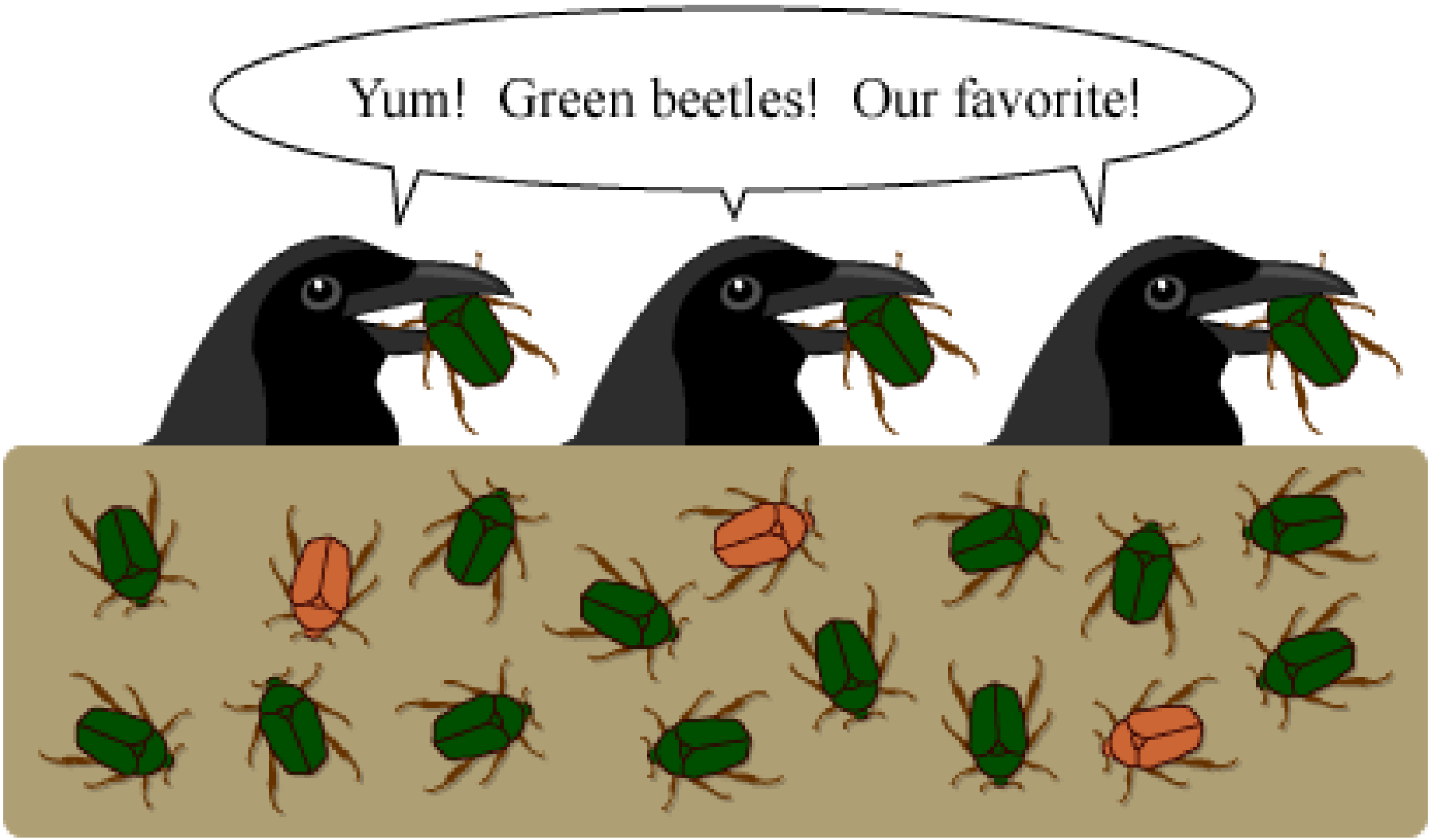
- In this population the number of different alleles remains the same generation after generation.
- It can be said that this population is at **equilibrium (balance) or the alleles in the gene pool are in a state of Genetic Equilibrium. The percentages (allelic frequencies) are not changing.**

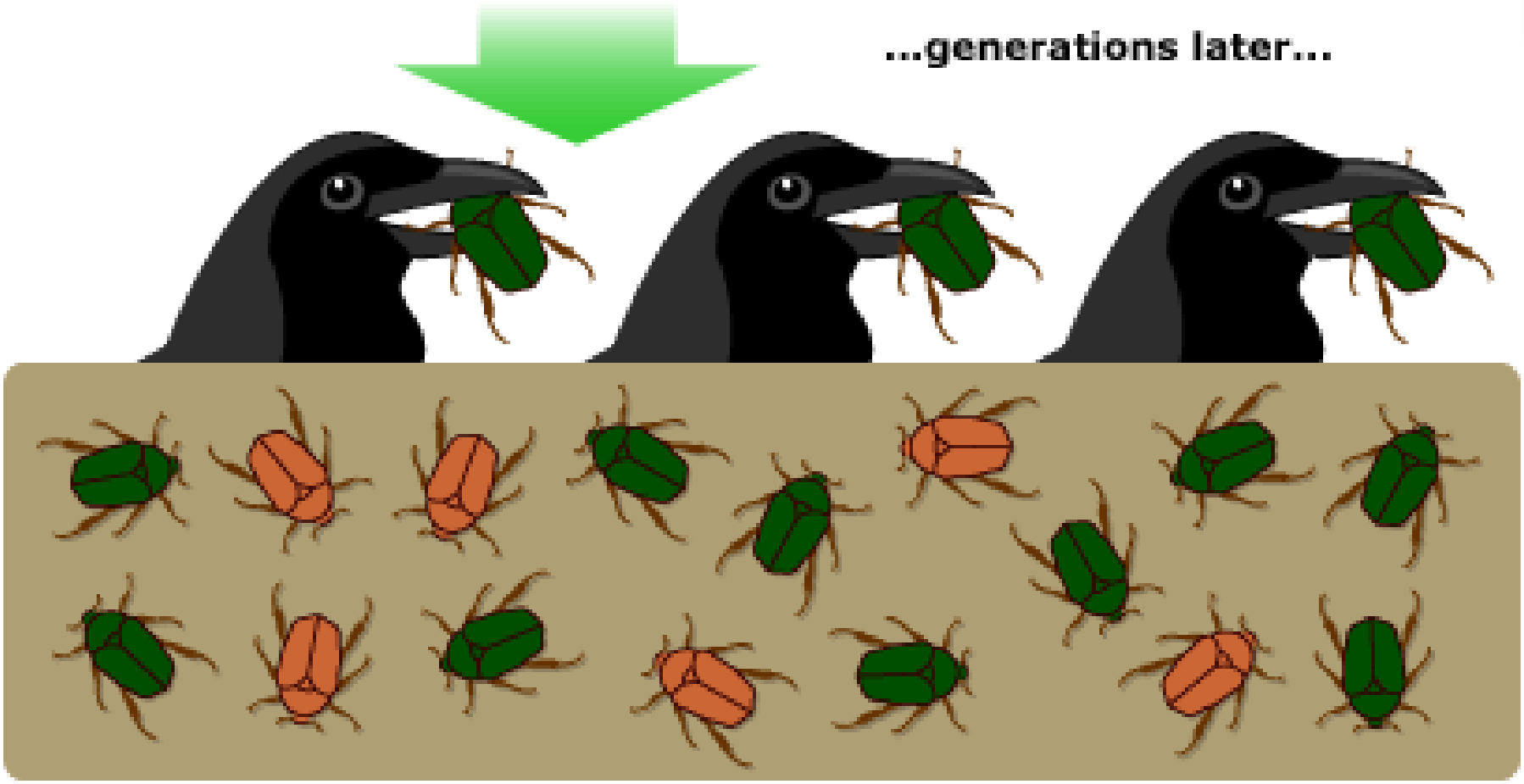
- There are three **main drivers** of evolution, as well as a couple of **minor drivers** of evolution

1. **Natural Selection**
2. **Mutation**
3. **Genetic Drift**
4. **Selective Mating**
5. **Differential Migration**
6. **Isolation – Founder Effect**

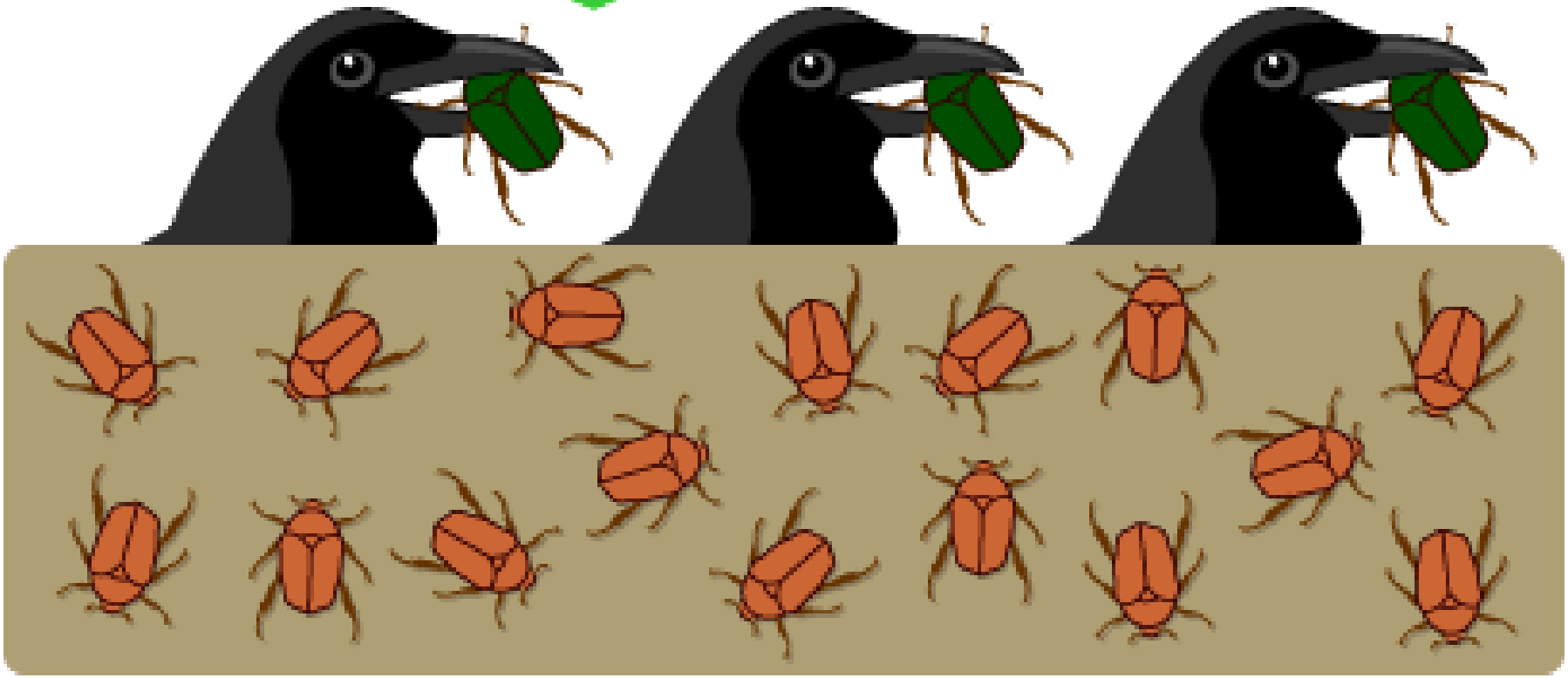
1. Natural Selection

Natural selection, in a nutshell:




...generations later...

...generations later...



Green beetles have been selected against, and brown beetles have flourished.

WHO WILL WIN

2. Mutations

- Any change in the DNA sequence of a species is a mutation.
- Mutations can be neutral, deleterious (harmful), or advantageous.
- **Mutations increase the variation in the gene pool of a species.**

Original DNA Strand

3' TACTGGGTGCTACCCACT 5'

5' AUGACCCACGAUGGGUGA 3'

Original Protein Produced

Change in 1 nucleotide

3' TACAGGGTGCTACCCACT 5'

5' AUGUCCCACGAUGGGUGA 3'

Result in Protein

Deletion of 1 nucleotide

3' TACGGGTGCTACCCACT 5'

5' AUGCCCACGAUGGGUGA 3'

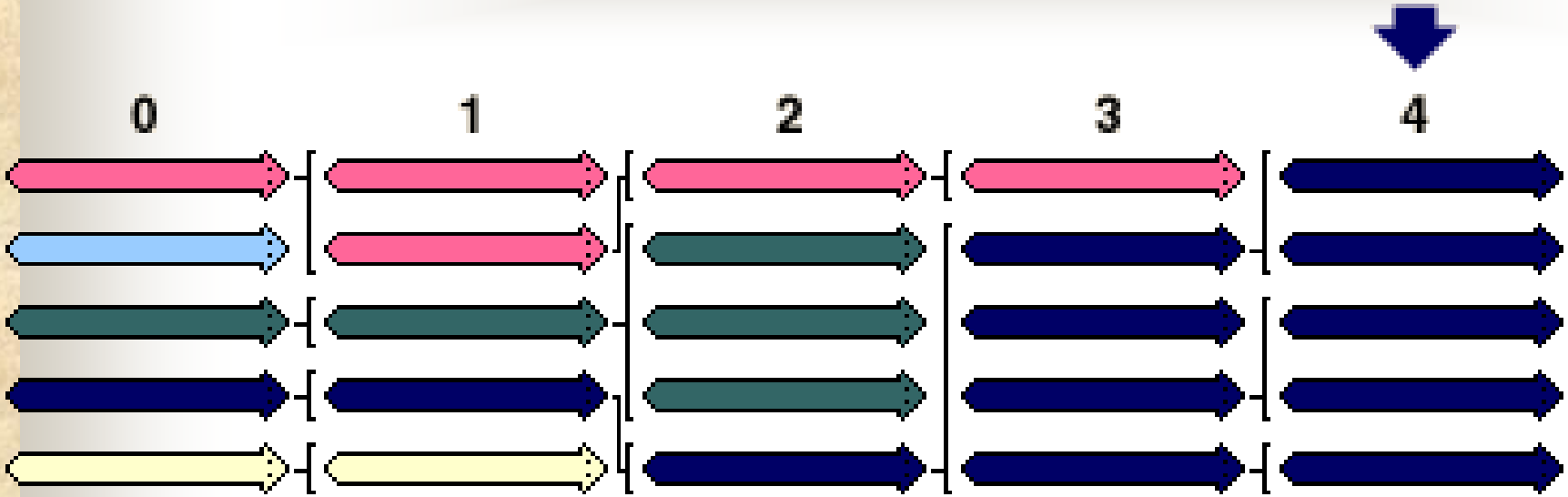
Result in Protein

3. Genetic Drift

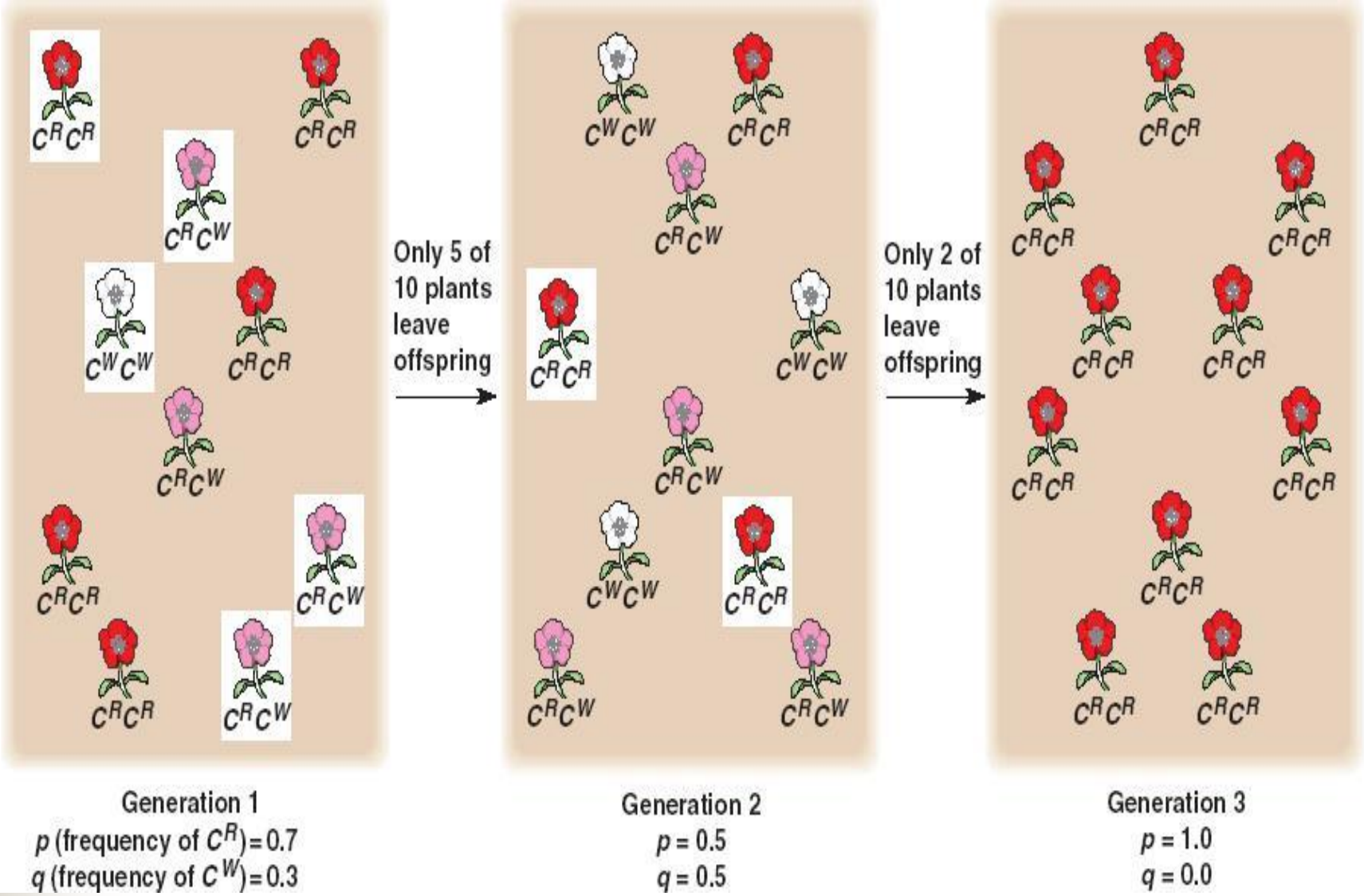
- Genetic drift a process that can increase the frequency of an allele, while decreasing the frequencies of other alleles, in a population.
- **This reduces the variation in a population** and can result in a uniform population (allele becomes fixed).
- **Genetic drift is a Random Process, the allele that becomes fixed may or may not be beneficial to the population.**

Flip a coin
ten times ??

HOW IS THIS DIFFERENT FROM NATURAL SELECTION???



- Recall the population that was in a state of Genetic Equilibrium, it may be affected by genetic drift.
- The allele for the blue worm is RANDOMLY chosen and its frequency increases as the other alleles decrease in numbers. Being BLUE was not an advantage!!
- At generation 4 the blue colour allele has become fixed in the population and the population has become uniform in colour.


C^RC^R
C^RC^R
C^RC^W
C^WC^W
C^RC^R
C^RC^W
C^RC^R
C^RC^W
C^RC^R
C^RC^W
Only 5 of 10 plants leave offspring
C^WC^W
C^RC^R
C^RC^W
C^RC^R
C^WC^W
C^RC^W
C^WC^W
C^RC^R
C^RC^W
C^RC^W
Only 2 of 10 plants leave offspring
C^RC^R
C^RC^R
C^RC^R
C^RC^R
C^RC^R
C^RC^R
C^RC^R
C^RC^R
C^RC^R
Generation 1
p (frequency of C^R) = 0.7
q (frequency of C^W) = 0.3
Generation 2
p = 0.5
q = 0.5
Generation 3
p = 1.0
q = 0.0

Other Ways Allelic Frequency Can Be Altered

4. Selective Mating
5. Differential Migration
6. Founder Effect – “Bottleneck”

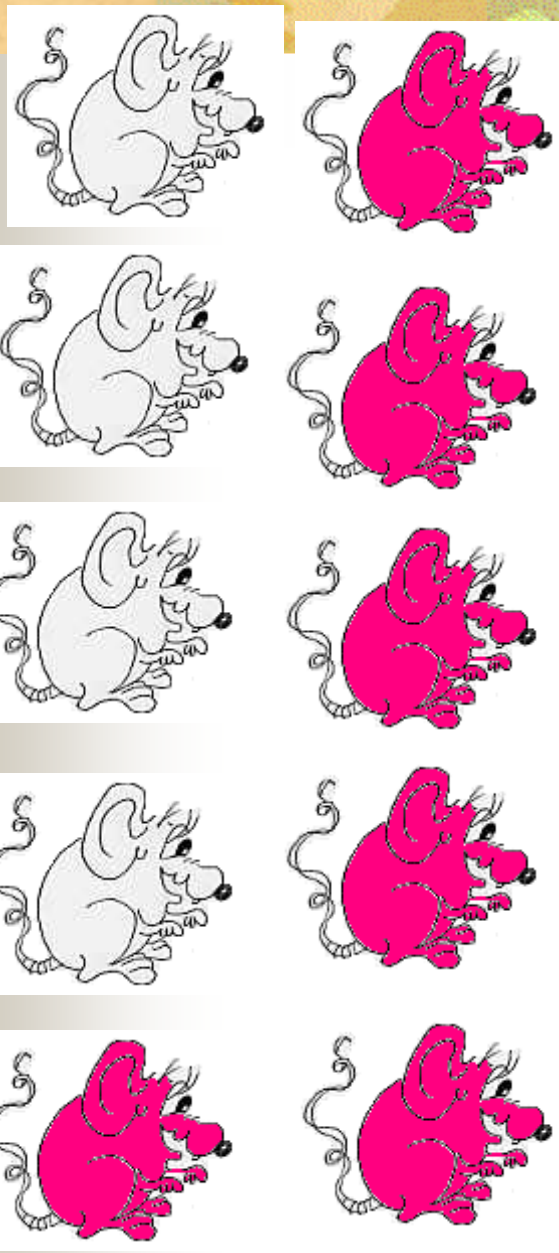
4. Selective Mating

- **With Selective Mating not all individuals have the same likeliness to reproduce and pass on their genes.** If one phenotype is desired the frequency for that allele will increase. This may have nothing to do with the fitness of that individual.

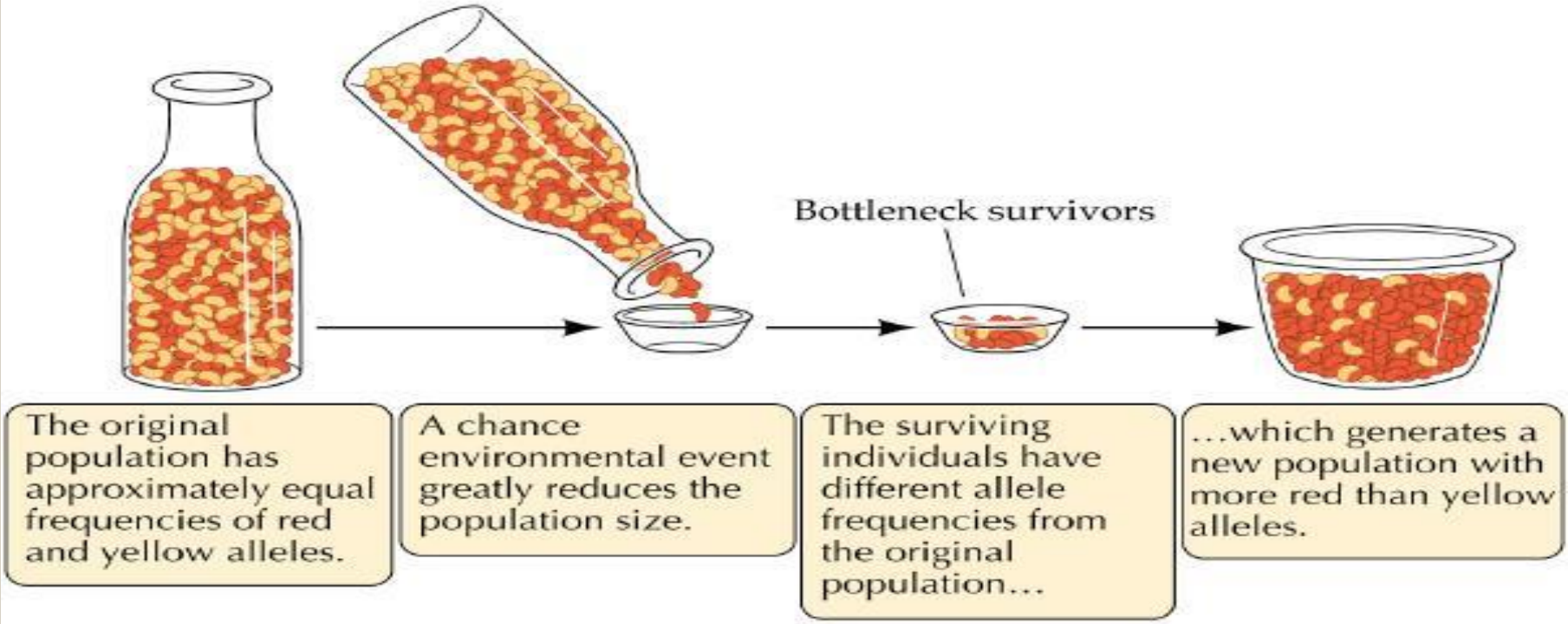
WHICH MAY BE THE BETTER CHOICE ???

5. Migration

- Emigration – The movement of individuals OUT of a habitat
- Immigration – The movement of individuals INTO a habitat
- Differential migration – **when the genetic frequency of the individuals entering, or leaving, the population differ from the genetic makeup of the population.**



8) The Bottleneck Effect



- **An extreme example of genetic drift**
- Can occur when something disturbs a population and causes one the new population to have a different allelic frequency than the original population.