# SUBJECT : MEDICAL BIOLOGY

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# TOPIC : BOTTLENECK EFFECT IN HUMAN POPULATION

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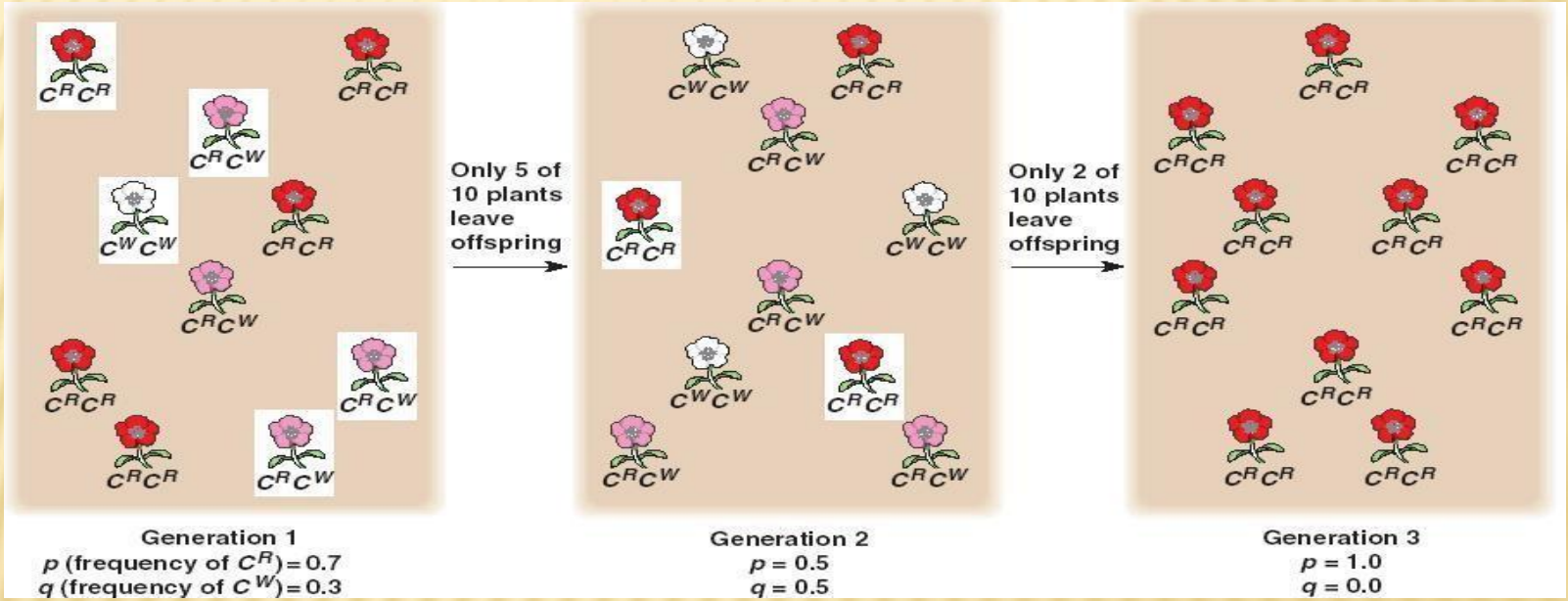
# INTRODUCTIO N

Introduction

- Basic mechanisms of evolution (along with natural selection and mutation).
- Random, stochastic process.
- Independent of selection
- "Random Drift" or "Random Genetic Drift" (allele frequencies do not change in any predetermined direction in this process)

**"The change in the frequency of an allele in a population due to random sampling of organisms."**

- Common in small population, no significance in large population.
- Some alleles become more common while others become less common over time (or lost).
- When there is only one allele is left for a particular gene pool, that allele is said to be fixed.




Source: http://bio1151.nicerweb.com/Locked/media/ch23/drift.html

# GENETIC DRIFT V/S NATURAL SELECTION

Genetic Drift v/s Natural Selection

Genetic Drift

- Random process
- Doesn't occur due to environment challenges
- Non directional
- Non adaptive evolution
- Important allele may

Natural Selection

- Non random process
- Occur due to environment challenges
- Directional
- Generation of adaptive trait
- Ends up with survival of fittest
- Operate on any allele
- Increase genetic variation

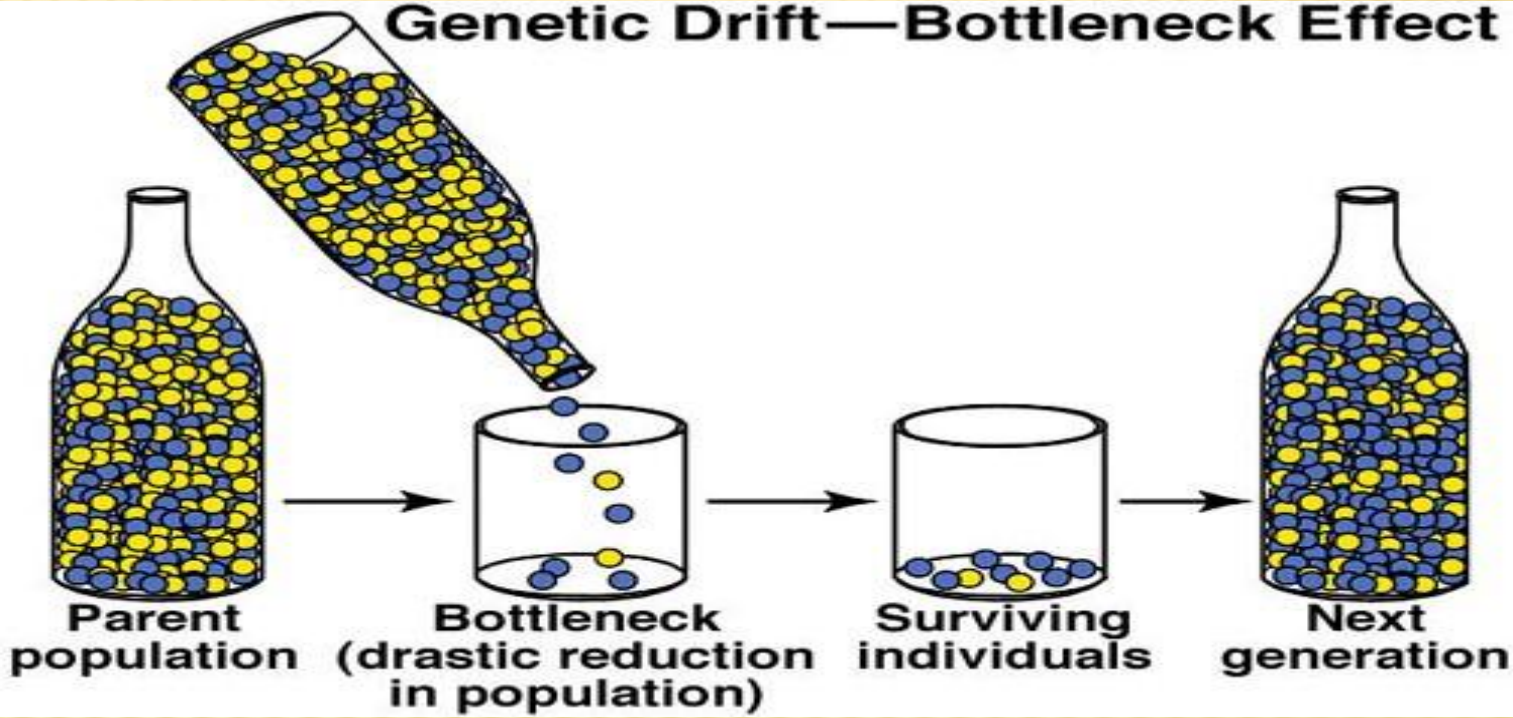
# KINDS OF GENETIC DRIFT

Kinds of genetic drift

- Factors that cause genetic drift are:
  - Bottleneck Effect
    - Reduction in population size
  - Founder Effect
    - Subset of population founds new population

# BOTTLENECK EFFECT

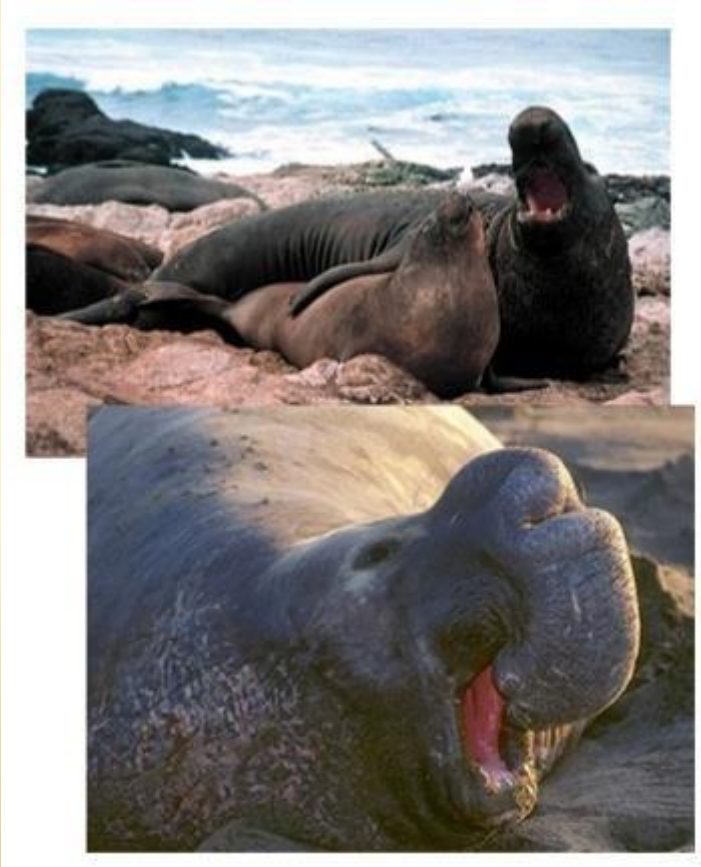
- The bottleneck effect occurs when a natural disaster or similar event randomly kills a large portion (i.e. random sample) of the population, leaving survivors that have allele frequencies that were very different from the previous population.




Source: http://evolgen.wikispaces.com/Group+19?responseToken=ff19f377988e5706840fce1e021e0034

# EXAMPLE OF A BOTTLENECK

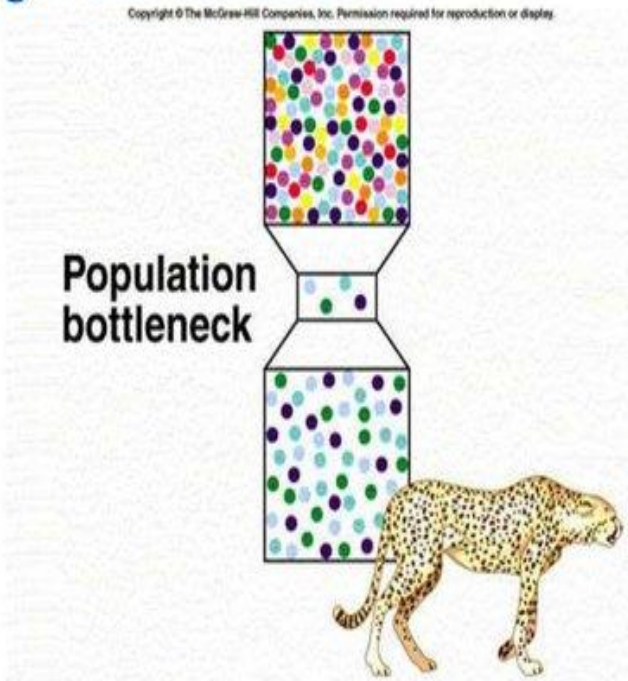
- Northern elephant seals
- Bottleneck event
  - Humans hunting (1890s)
- Population size 20 individuals (at the end of the 19th century)
- Now Population 30,000
  - — but their genes still carry the marks of this bottleneck:
- Much less genetic variation

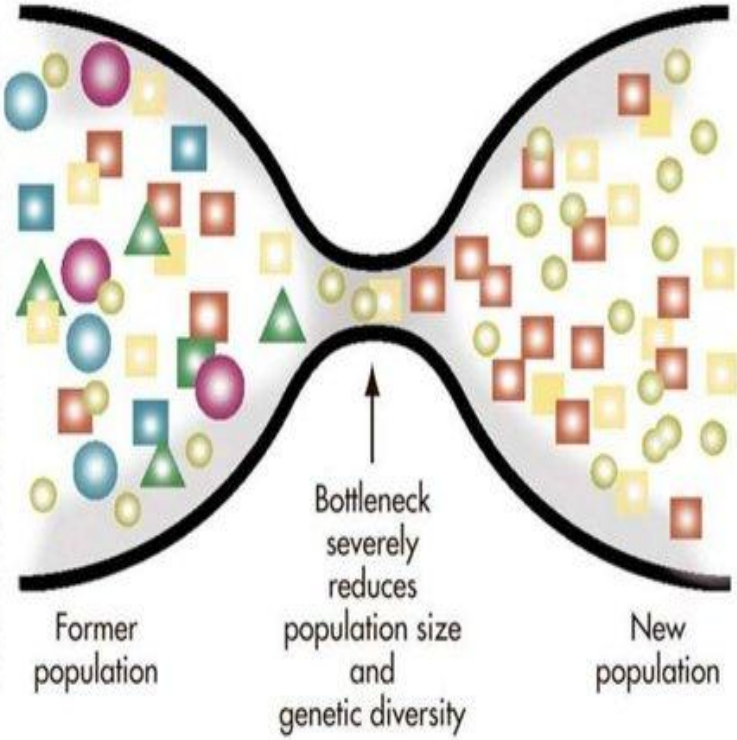


Source: http://science.opposingviews.com/comparison-bottleneck-effect-founder-effect-5188.html

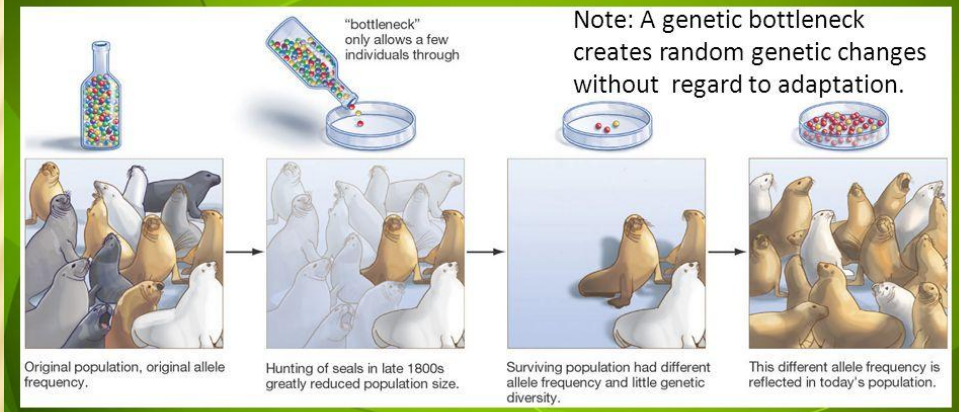
# Bottleneck effect

- Genetic drift can cause **big losses** of **genetic variation for small populations.**
- **reduces genetic variation**



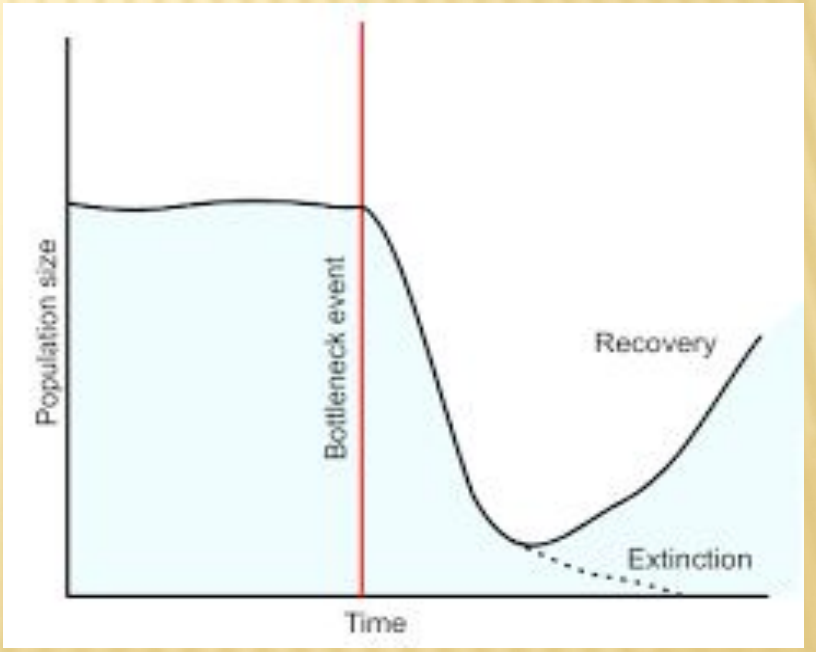



## Genetic Bottleneck – A Historical Case




A severe genetic bottleneck occurred in northern elephant seals.

Other animals known to be affected by genetic bottlenecks include the cheetah and both ancient and modern human populations.



# ROLE OF BOTTLENECK EFFECT IN EVOLUTION

- Affects the genetic makeup of the population.
- Mechanism of evolution, doesn't work to produce adaptations.
  - Cause non-adaptive evolution
- Allele fixing
- Decreases gene diversity
- New population genetically distinct from its original population
- Plays a role in the evolution of new species

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# THANK YOU