Notes: Pre-BIO "Population Genetics and Patterns of Evolution"
(17, 19.2 and 19.3)

How do we study Evolution? 17.1

- **Species**- ____

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- **population** - ____

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  - We study evolution as genetic change in a population.

Genes and Variation 17.1

Inheritable traits are coded for by genes, and the different forms of a gene are called alleles. There exists variation within a population for many of these alleles. We can figure out what the frequency of a particular allele is by calculating the number of times that allele appears in that population compared to others in the entire gene pool.

- **gene pool** - ____

  The relative frequency of an allele in a population is often expressed in a percentage.

Example:________________

- **Microevolution** - ____

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Sources of Genetic Variation 7.1 p.407

- **Mutations**- ____

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- **Gene shuffling**- ____

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  - There is not change in a frequency when genes are shuffled, but that is why there is so much variation

Selection on a Single-Gene trait p. 408

A **single-gene trait** with two alleles will show two phenotypes. A change in frequency is easy to see in a population. **Example: see pg. 409**

Selection on a Polygenic Trait p. 408

- **Polygenic trait** - ____

Things such as height in humans are polygenic traits. If you were to graph out the frequencies of the phenotypes, you would get a bell shaped curve.

Evolution as Genetic Change in Populations (17.2 p. 410)

Type of selection	Which part of the phenotype spectrum is selected for?	Example	Graphical Representation
Directional Selection		Food becomes scarce for a population of birds and large beaks are most efficient at eating the available food.	
Stabilizing selection		Birth weight in humans.	
Disruptive Selection		Larger and smaller seeds become more common and so larger or smaller beaks are both advantages.	

<u>Evolution vs Genetic Equilibrium p.412-413</u>

We study evolution as genetic change by comparing to a population that is not evolving. There are 5 criteria for a NON-evolving population (Hardy-Weinberg principle)

1. **<u>Random mating</u>**- ____
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2. **<u>No genetic drift</u>**- ____
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3. **<u>No immigration or emigration</u>**- ______________________________
4. **<u>No mutations</u>**- ____
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5. **<u>No natural selection</u>**- ______________________________________
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Does this happen in nature?

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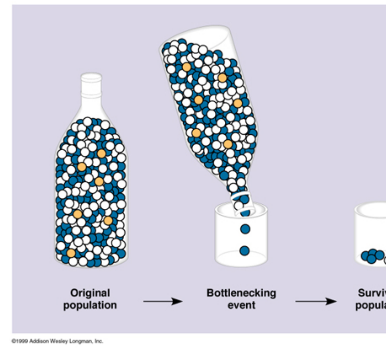
We can calculate genetic change using the **Hardy-Weinberg equation** comparing allelic frequencies. We will solve some tomorrow.

<u>**Genetic Drift p.411(17.2) slide 28.**</u>

- Genetic drift is the change in a population's allele frequencies due to chance.
- There are 2 situations in which a population is shrunk and genetic drift can take place.



1. <u>**The Bottleneck Effect p. 411**</u>
    - ____
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      ____
    - This can greatly reduce genetic variability.
2. <u>**The Founder Effect p. 411**</u>
    - ____
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    - There is very little genetic variety in the gene pool because not all genes from the original population are represented.

- How might the bottleneck effect and the founder effect negatively affect a forming population?

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<u>**Speciation (17.3 p. 414)**</u>

First of all what is a species?

- As defined by Ernst Mayr- the Biological Species Concept states: "____
  ____."
- When natural selection acts on a population, certain characteristics are favored and others are not. What causes new species to arise? They must be separated and no longer be able to produce fertile offspring, or become reproductively isolated, in order to become officially a different species. This is called speciation. Speciation may be phyletic (one species evolving into another) or divergent (one species splitting into two distinct species).

<u>**Types of Reproductive Isolating Mechanisms (RIMs): 17.3 pp. 414-416:**</u>

1. Geographic isolation- ________________________________
2. Temporal isolation- ________________________________

3. Behavioral isolation- ____
4. Mechanical isolation- ____

<u>How did Speciation occur in the Galapagos? p. 414-415:</u> Because the Galapagos are a group of islands, there are separate ecosystems on each. 2. Founder populations arrived on an island from the main island. 3. Reproductive isolation occurred (geographic). 4. Frequencies of different traits changed in that population over time because of natural selection, based on food source, soil types, predators, etc. 5. Eventually, over a long period of time, the original population and the founder population on the second island are very different and are considered different species.

<u>The Origin of Life: Earth's early History (19.3 pp. 462–469:</u>
We will never truly know for sure how life began on Earth but scientists have tested two different ideas:

- **<u>Biogenesis</u>** – _The hypothesis that living matter arises only from other living matter.
    a. For the first three quarters of evolutionary history, life on earth was microscopic and unicellular.
    b. **(19.3 - p. 462)** In 1953, two scientists, Miller and Urey, recreated what was believed to be the early conditions on Earth.
        - It is believed that the atmosphere consisted of hydrogen, methane, ammonia, and water.
        - In the early atmosphere, energy was provided by intense light and UV radiation.
        - The scientists were able to create organic (carbon containing) compounds present today with just those conditions.
        - These organic compounds gave rise to cyanobacteria, which evolved into bacteria.
        - **(p. 464)** Eukaryote cells are believed to have come from the process of endosymbiosis (one bacteria cell absorbed another bacteria cell and it thrived in the new environment). This absorbed bacteria eventually evolved into organelles found today in eukaryote cells like mitochondria and chloroplasts. DNA similarities provide evidence that this is how eukaryote cells were formed.**"THE ENDOSYMBIOTIC THEORY."**

<u>Patterns of Evolution (19.2)</u>

- **<u>Increasing complexity of cellular life P. 456-</u>** The evolution of Biological complexity is one of the outcomes of the process of evolution. "Macroevolution" is the term that refers to large-term evolutionary patterns and processes that occur over long periods of time and have resulted in the increasing complexity of cellular life. Although there has been an increase in the maximum level of complexity over the history of life, there has always been a large majority of small and simple organisms and the most common level of complexity (the mode) appears to have remained relatively constant. Five important topics in macroevolution are extinction, adaptive radiation, convergent evolution, coevolution, punctuated equilibrium, gradualism and changes in developmental genes.

- **Extinction P. 456-457**

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- **Adaptive Radiation P. 459**

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- **Convergent Evolution P. 460**-

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  Coevolution P. 460-461-

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  analgous structures (also on p. 393).

- **Punctuated equilibrium P. 458**-

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- **Gradualism P. 458**- ____

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