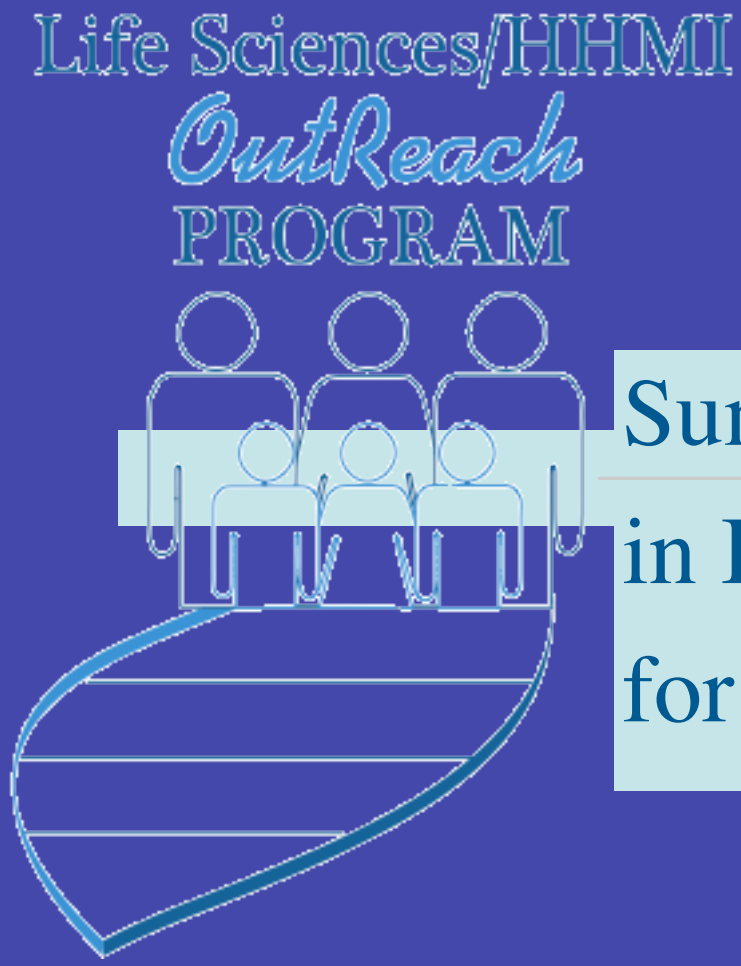

Summer 2006 Workshop in Biology and Multimedia for High School Teachers

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Evolution - An Introduction

Dr. Joel Gluck

Department of Science, NEL/CPS Construction Career Academy

Department of Biology, Community College of Rhode Island

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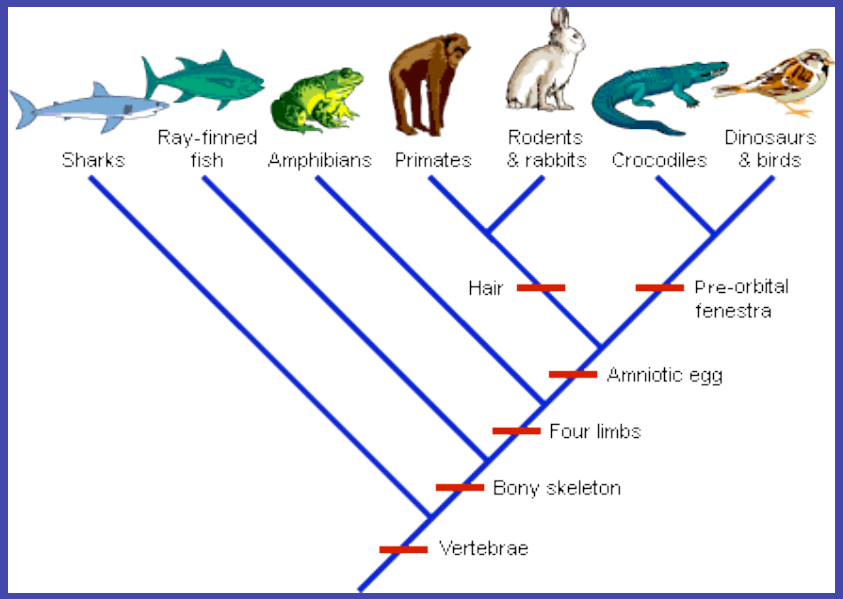
In a Nutshell…

- What is Evolution?
- What are some examples of Evolution?



CLADOGRAM

Image courtesy of http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_03

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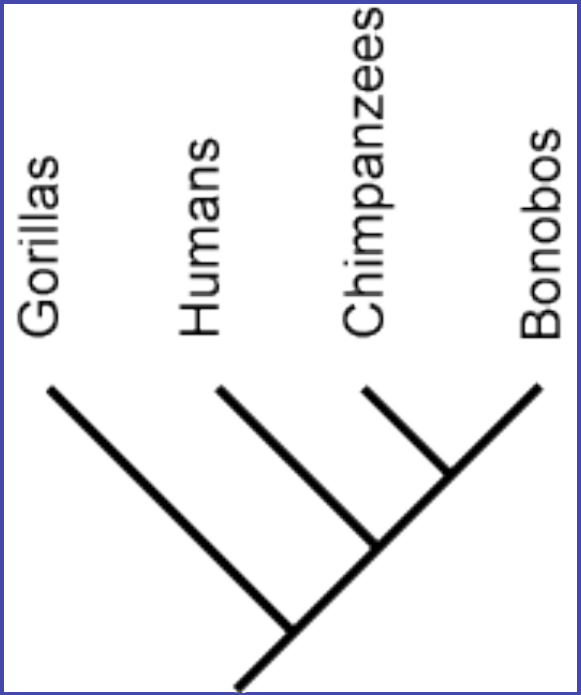
- Look at the cladogram at the right. What conclusions can be drawn about the relationship between humans and chimps?



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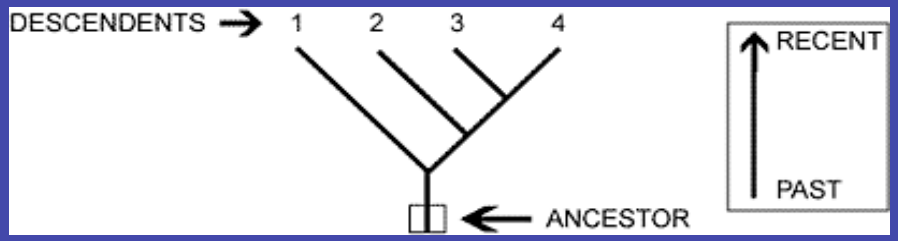
How to read a Cladogram

- This diagram shows a relationship between 4 relatives. These relatives share a common ancestor at the root of the tree.
- Note that this diagram is also a timeline. The older organism is at the bottom of the tree.
- The four descendents at the top of the tree are DIFFERENT species. This is called SPECIATION.



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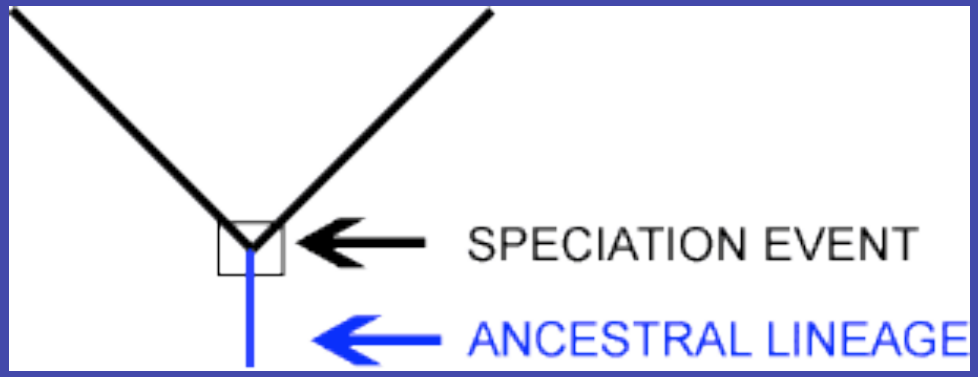
- Branches on the tree represent SPECIATION, the formation of a new species.
- The event that causes the speciation is shown as the fork of the "V".



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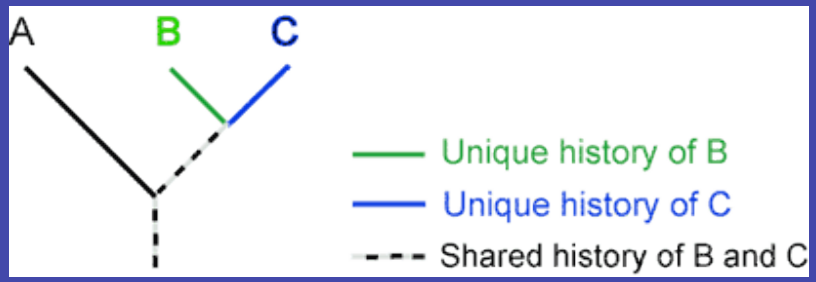

- Species B and C each have characteristics that are unique only to them.
- But they also share some part of their history with species A. This shared history is the common ancestor.

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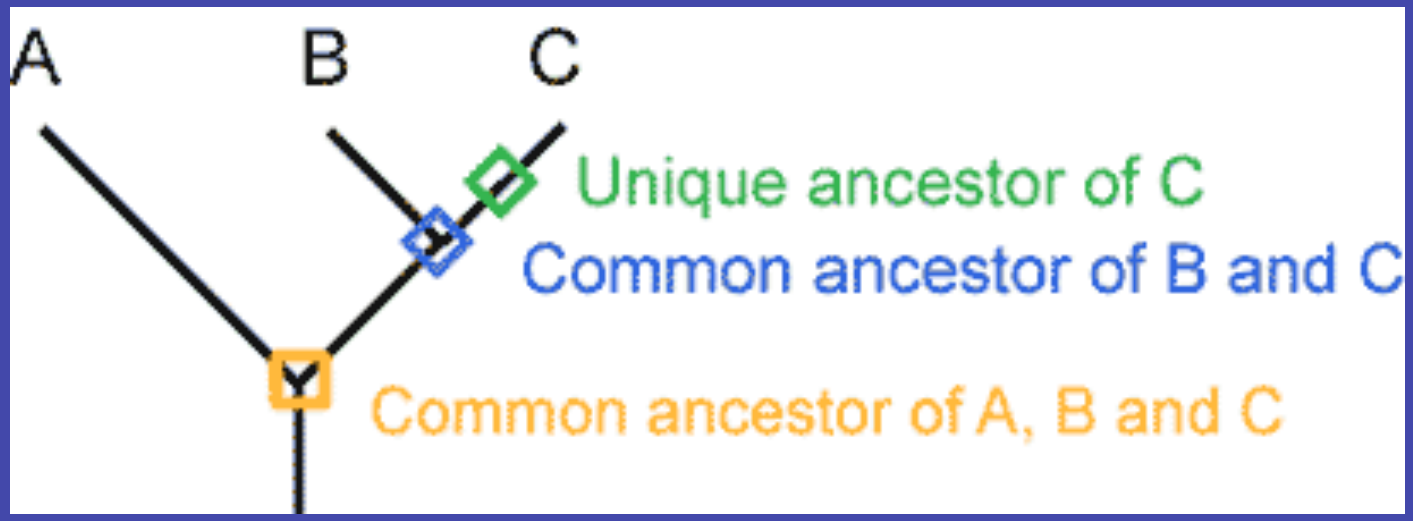

Write a sentence that summarizes the relationship between A and B. What is the only thing A and B have in common?

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- A CLADE is a group of organisms that come from a common ancestor.
- If you cut a branch of the tree, you could remove all the organisms that make up a CLADE.

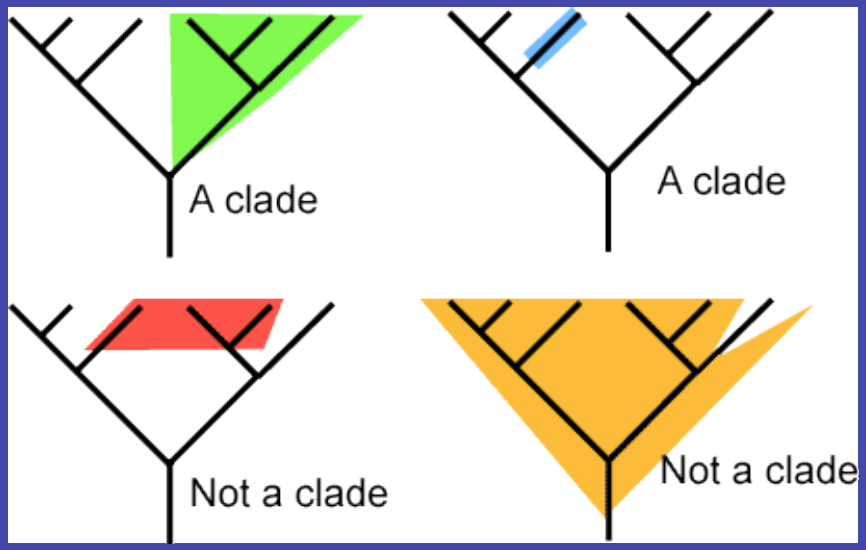

Image courtesy of http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_06

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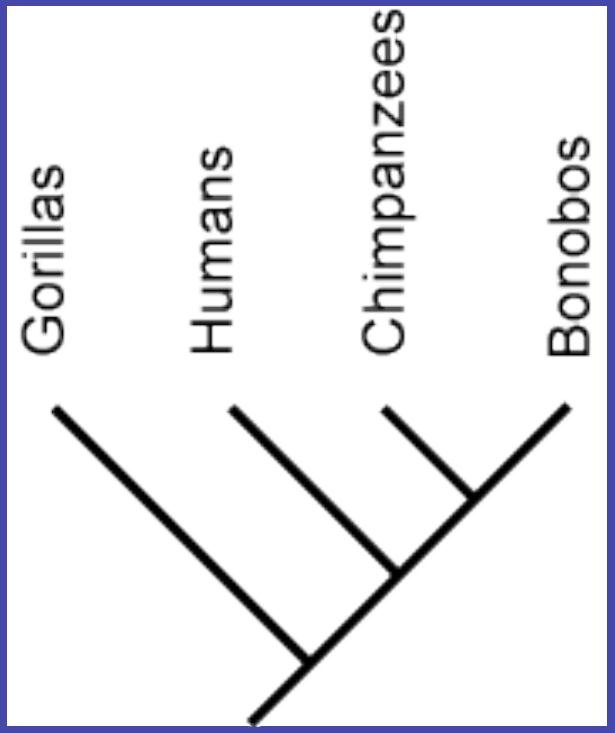
Let's go back to this diagram.



Look at your original description of this picture. Has your understanding of this diagram changed? How?

Something to Ponder…

Did humans evolve from chimps?

NO

What familial relationship is a good description of the relationship between chimps and humans?

DISTANT COUSINS

Are humans more highly evolved than chimps?

NO- since the lineage is split, each species has evolved unique traits.

Image courtesy of http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_07

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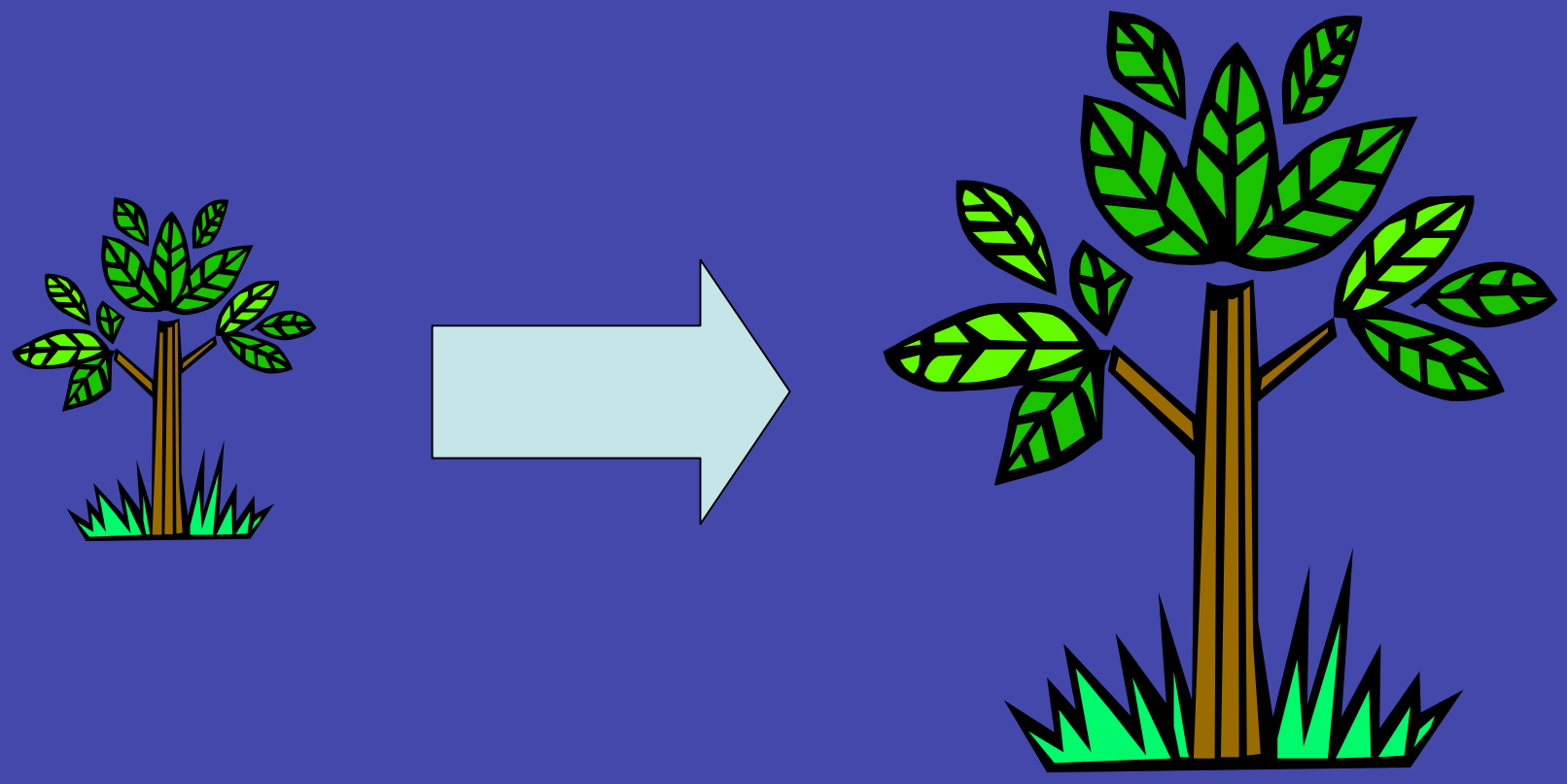
What is Going On?



The tree is getting larger.

Did the tree evolve?

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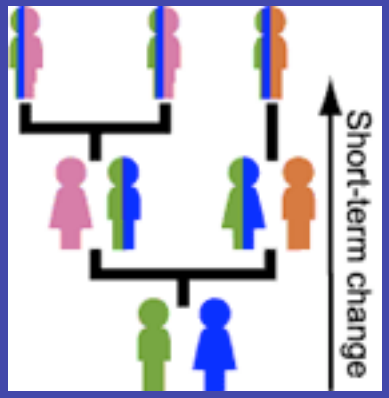
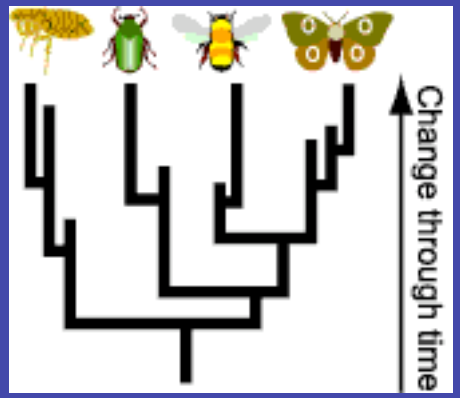
- Biological evolution is NOT just a change over time.
- The definition of evolution is

Descent with Modification

Some sort of change within a lineage.



Change with inheritance over a small period of time.



Change with inheritance over a long period of time.

Images courtesy of http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_02

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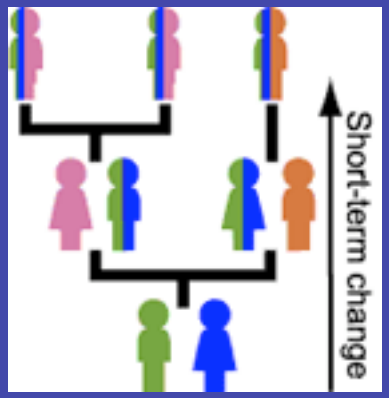
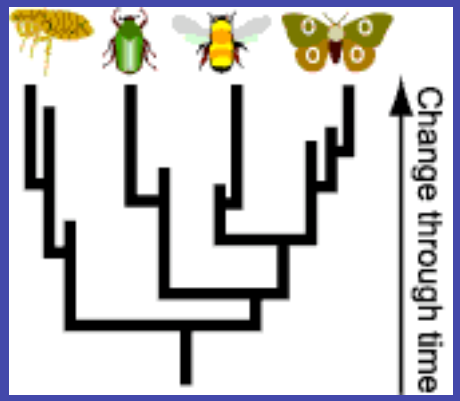


Change with inheritance over a small period of time.



Change with inheritance over a long period of time.

Image courtesy of http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_02

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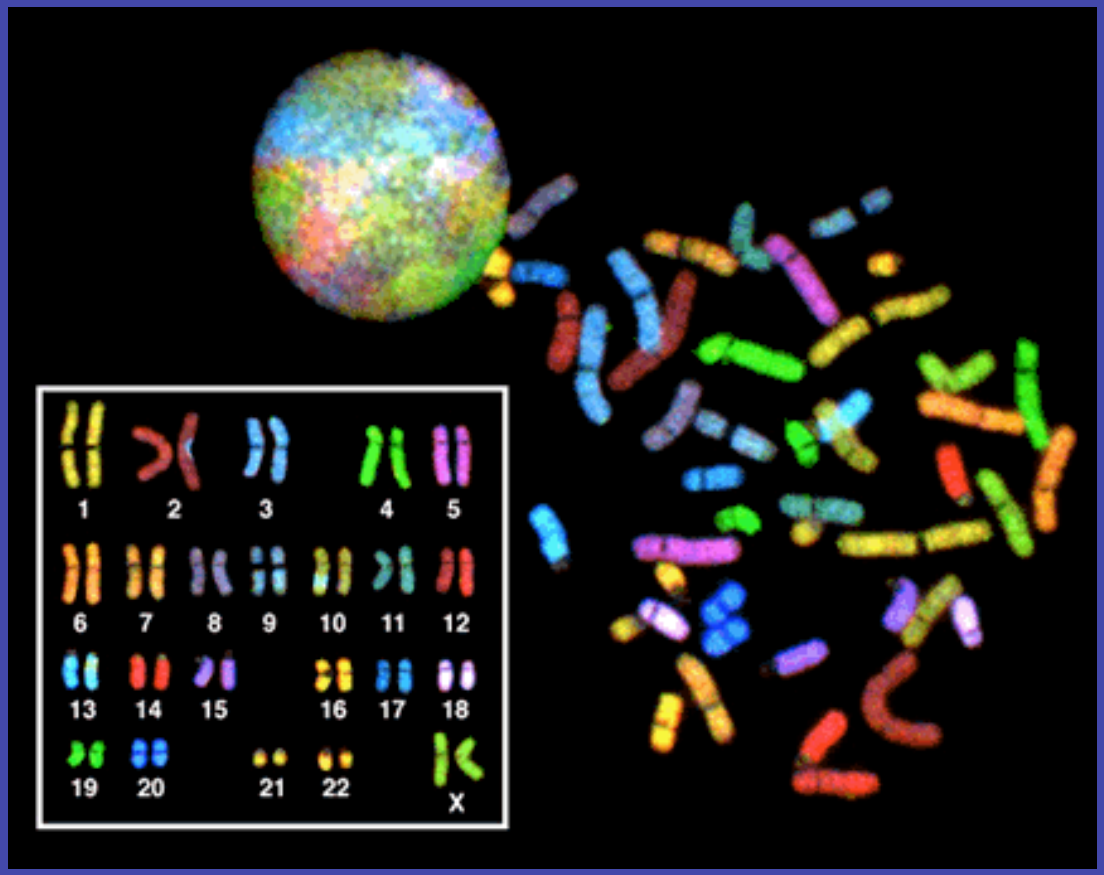
But what is this change?



GENETICS

Image courtesy of http://en.wikipedia.org/wiki/Image:Sky_spectral_karyotype.gif

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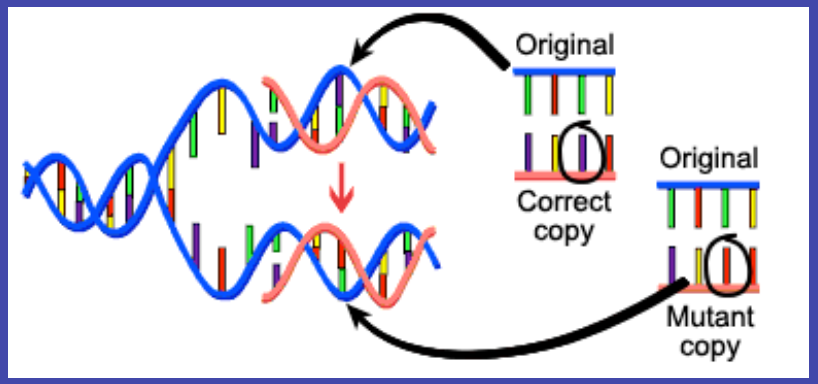

- So, we can change our definition of evolution from

  DESCENT WITH MODIFICATION

  to

  DESCENT THROUGH GENETIC INHERITANCE

Image courtesy of http://evolution.berkeley.edu/evolibrary/article/_0_0/evo_20

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Mechanisms of Evolution

- How does evolution work?
- What are the selective forces that cause evolution to occur?
- How can we get genetically DIFFERENT organisms that come from the SAME common ancestor?

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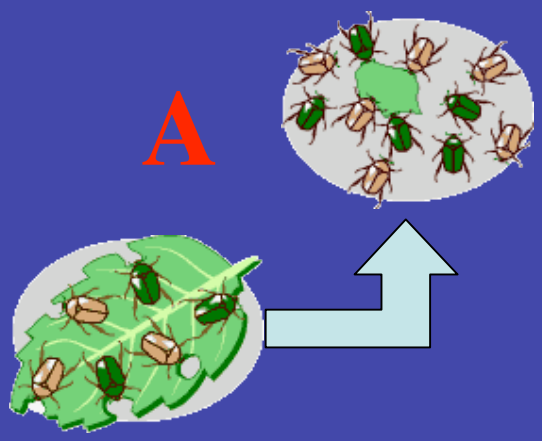
Descent with Modification

- Recall, there needs to be some long term change of the gene frequency over time.

A

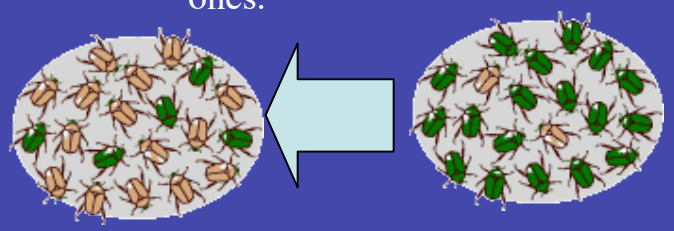


Drought causes a decrease in food. This causes a decrease in beetle size.

Which of these is evolution?

B

There are more beetles in the population that have genes for green color. Years later, there are more brown beetles than green ones.



B–These two generations are genetically different.

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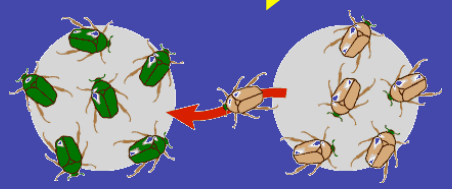
Genetic Variation

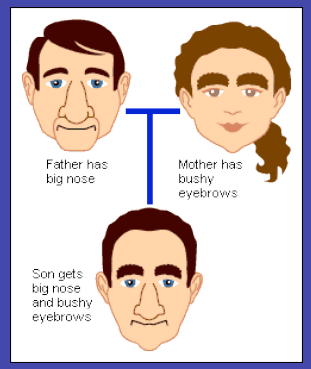
Gene Flow

Movement of genes from one population to another.



Sex

Sexual reproduction causes new combinations of genes.



Mutation

Changes in DNA

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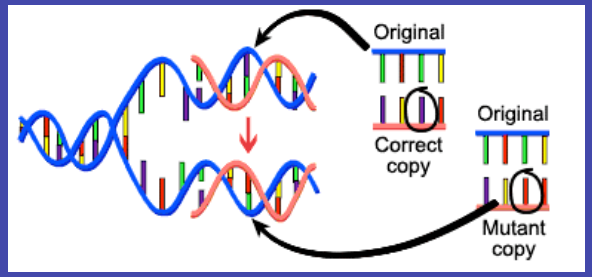
Mutations

Causes:

1. DNA copying error



2. Environment

Cause DNA breakdown

Imperfect repair

Mutations are RANDOM

2 Types:

Somatic-not in gametes so they <u>are not</u> heritable.

Germ-found in gametes so they <u>are</u> heritable.

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Genetic Drift

- Suppose that some organism left behind a few more offspring than other organisms.
- The ones that are left are the “lucky” ones. But their genes may be no more advantageous than anyone else’s.
- Entirely random.
- Doesn’t produce adaptations, only a mixing of the gene pool.

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Natural Selection

- **Natural selection** is the process by which individual organisms with favorable traits are more likely to survive and reproduce.

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Components of Natural Selection

- There is more than one representation of a trait.

Green and Brown Beetles

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Components of Natural Selection

- Not all individuals will be able to reproduce.
- Due to environmental issues, illness, etc…
- DIFFERENTIAL REPRODUCTION

Birds eat green beetles, not brown ones.

What's Left? → What's the end result?

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Components of Natural Selection

The brown trait has a genetic basis.

The brown beetles that are left will mate and have brown offspring.

This is called HEREDITY.

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- Finally, the brown trait (which is more advantageous) allows the beetle to survive in order to reproduce.

- Eventually, all beetles in this population will be brown.

- This PHENOTYPE has been SELECTED over the green phenotype.

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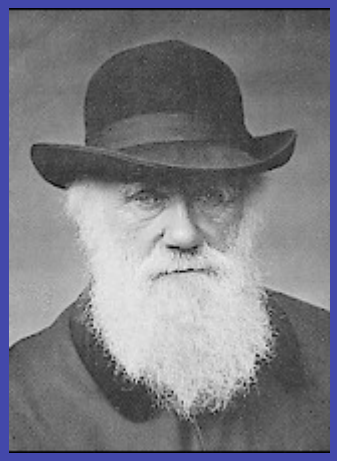
Natural Selection



Charles Darwin, 1880

*public domain

variation + differential reproduction + heredity = natural selection

- Populations are not perfect.
- It is not the result of wanting or needing something.
- There are no goals associated with the end result. Somewhat random.

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Examples of Natural Selection

Orchids fool wasps into "mating" with them.

Non-poisonous king snakes mimic poisonous coral snakes.

Katydids have camouflage to look like leaves

Images courtesy of http://evolution.berkeley.edu/evolibrary/article//evo_26

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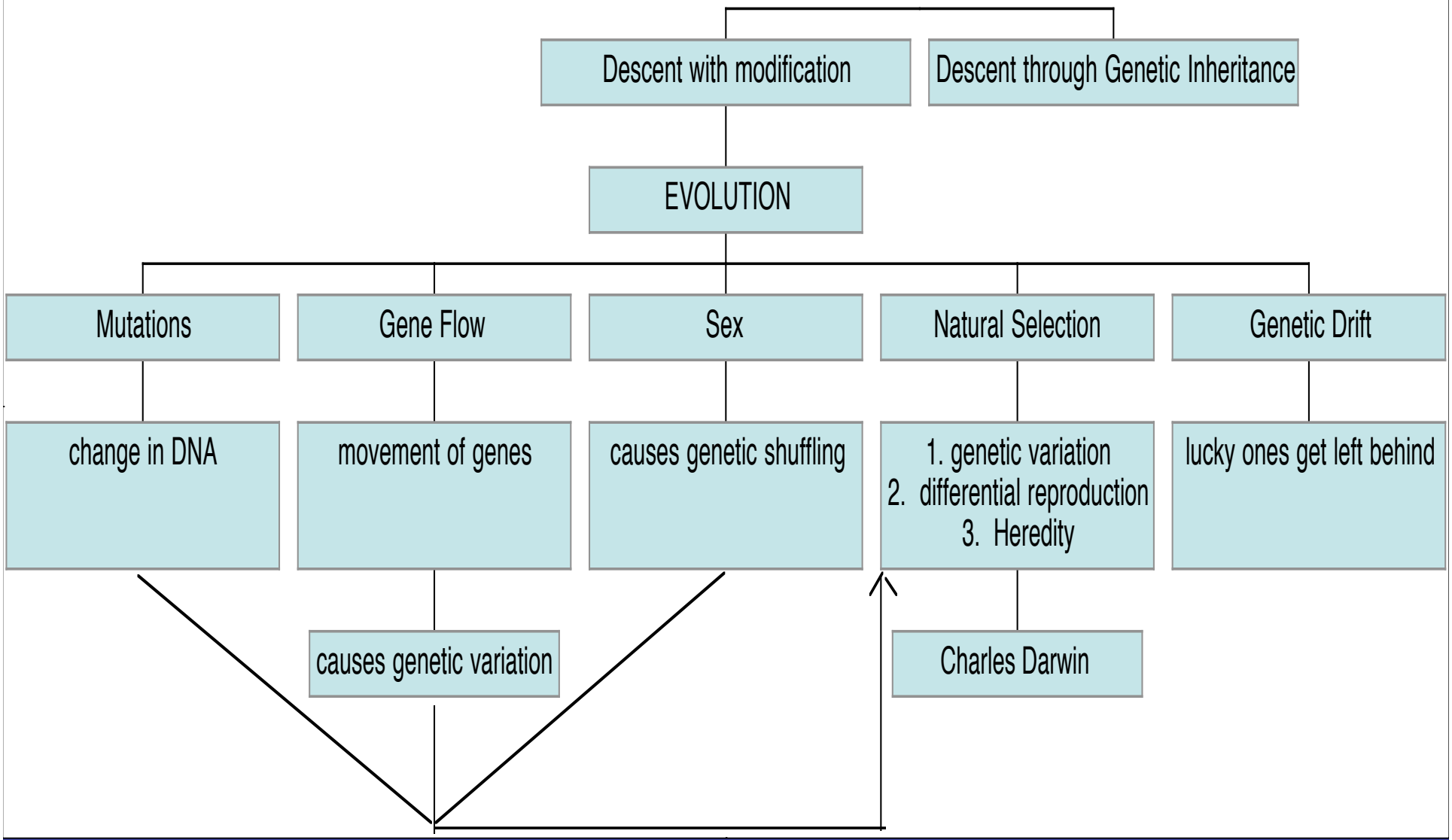
Summary



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