Charles Darwin’s Legacy

- Marshaled a large body of evidence in support of the fact of evolution (that all species living and extinct are descended from other species).
- Developed a materialistic (non-supernatural) explanation for the formation of new species and for the appearance of design in adaptation.
- Mechanism of natural selection is plausible and testable.
- Darwin argued that Humankind could not be excluded from his theory.

Darwin’s Publications after “The Origin of Species”

- 1862 Fertilisation of Orchids
- 1868 The Variation of Animals and Plants under Domestication
- 1871 The Descent of Man, and Selection in Relation to Sex
- 1872 The Expression of the Emotions in Man and Animals
- 1875 Insectivorous Plants
- 1876 The Effects of Cross and Self Fertilisation in the Vegetable Kingdom
- 1880 The Power of Movement in Plants
- 1882 The Formation of Vegetable Mould through the Action of Worms, with Observations on their Habits

The Descent of Man, and Selection in Relation to Sex

- From The Origin of Species: “light will be thrown on the origin of man and his history”
- Descent of Man provides the follow up to this mention of human evolution.
- Part 1 - evidence that humans are directly descended from the Great Apes.
- Part 2 - Sexual Selection
- The two are related in that Darwin argues that differences between human races are due primarily to sexual selection.
Sexual selection is a critical adjunct to natural selection – without it Darwin could not explain seemingly aesthetic or maladaptive features such as the peacock’s tail.

**The Expression of the Emotions in Man and Animals**

- Uses facial expressions to argue for a common ancestry of humans and animals.
- Same facial muscles and expressions communicate similar emotions in a wide variety of species, including humans.

Charles Darwin died at Downe on the 19th of April, 1882 at the age of 73.

He is buried in a tomb in Westminster Abbey in London, a few feet away from Sir Isaac Newton.
Darwin's Unknows

• Did not know where variations came from.
• Did not know how variations were passed on through generations.
• Genetics not invented until early 20th Century.
• Did not directly observe or measure natural selection.

Laws of Genetic Inheritance

• Gregor Mendel's experiments in the 1860s elucidated basic principles of genetics.
• Although published, his work was unknown to Darwin and most other biologists.

Mendel demonstrated that traits were discrete and did not blend.

The Eclipse of Darwinism

• Darwin's work convinced the scientific community of the reality of evolutionary descent.
• Darwin's mechanism of Natural Selection was less accepted due to the many uncertainties surrounding the mechanisms of inheritance.
• Other theories explaining evolution included "theistic evolution", orthogenesis, neo-Lamarckism, and saltational mutations ("hopeful monsters").
• Some evolutionists, including Alfred Russell Wallace, refused to accept that the human mind was not divinely created.
The Modern Synthesis (Neo-Darwinism)

• The rise of modern genetic theory in the early to middle 20th Century led to acceptance of natural selection as the driving mechanism of evolution.
• Mathematical models in population genetics showed that natural selection could have a very powerful effect on the propagation of traits from one generation to the next.
• Paleontologists show that examples of directed trends in the fossil record are more compatible with the branching model of evolution predicted by Darwin.

The Modern Synthesis

Marriage of natural selection and genetics

1. Variations caused by **genetic mutations** - changes in DNA.
2. Variations passed on to offspring as **genes**.
3. **Sexual reproduction** causes genes to be shuffled, creating new combinations of traits.
4. **Natural selection** eliminates unfavorable traits and therefore genes.
5. If a population of individuals changes enough so that it becomes **reproductively isolated** from the main population, a new species is born = **Speciation**
6. Most evolution probably happens in small, isolated populations, cut off from the main population (**Allopatric Speciation**).
Invasion of new habitat / ecological niche

Isolation of new population from old.

Variation: Individuals are born with different traits - members of a population are variable.

Population divergence
Natural selection favors different combinations of traits in different environments.

Variation combined with Natural selection alters the traits (genes) present in each generation.

Each generation changes from the previous one as some individuals survive and reproduce, while others die off.
Removal of physical barrier between populations.

Um, not tonight - I've got a headache…

What species are you?!

Red wine with fish?! I am so outta here.

Um, not tonight - I’ve got a headache…

Reproductive isolation
Intermixing of populations without breeding.

Full Speciation