Two major contributions of Darwin

1) All organisms have evolved from a single common ancestor.

2) Natural selection

Five Separate Theories (according to Ernst Mayer)

1) evolution

2) common decent

3) gradualism

4) populational speciation

5) natural selection

Pre-Mendalian Genetics

- Blending Theory
- Darwin’s Hypothesis of Panggenesis
- Lamarkian Acquired Characteristics
- Weismann’s Germplasm Theory

Pangenesis - *On the Variation of Animals and Plants under Domestication* (1868).

- Every organ produced minute hereditary particles called gemmules.
- An enlarged organ produced more gemmules than a small one.
- Gemmules from all areas of the body circulated through the blood and were collected in the gametes.
August Weismann (1834-1914) Tested inheritance of acquired characteristics.

- Amputated tails from 22 successive generations of mice.
- Offspring still had normal tails.

Proposed Germplasm Theory.

- Two distinct components of organisms
  1) Somatoplasm, the bulk of the organism
  2) Germplasm, or germ cells which produced the germplasm and somatoplasm of the next generation.

Early 1900’s

- Natural Selection Not accepted.

- Environmental influence, heretability of environmentally induced variants.

- Mendel’s work discovered.

Johann Gregor Mendel
(1822-1884)

- Demonstrated particulate nature of inheritance (1865).

Mendelian genetics was the “Death Blow” to natural selection.

Hugo DeVries - Mutation Theory (1901).

- New mutations arise spontaneously and spread throughout a population.
- These mutations result in new species.
- Adaptation and natural selection have no role in speciation.
- Speciation is rapid rather than gradual.
Beliefs commonly held by Mendelian geneticists of the period circa 1900–1930 and by contemporaneous naturalists (with certain exceptions). Beliefs printed in CAPITAL LETTERS are still held to be largely correct.

**Mendelian geneticists**

Typological thinking natural populations are uniformly 'wild type."

VARIATION IS DISCRETE: changes are discrete and sudden; INHERITANCE IS PARTICULATE

VARIATION ARISES AT RANDOM

Geographic variation is a phenotypic response only, and is thus unimportant.

SPECIES ARE REAL, DISCREET.

New species arise suddenly, by saltation.

**Naturalists**

POPULATION THINKING; NATURAL POPULATIONS ARE EXTREMELY VARIABLE

VARIATION IS CONTINUOUS: CHANGES ARE SMALL AND GRADUAL: inheritance is by blending.

VARIATION IS ADAPTIVE, SHOWING INFLUENCE OF ENVIRONMENT. This influence is often by direct induction & inheritance of acquired characteristics.

GEOGRAPHIC VARIATION IS GENOTYPIC (AND IMPORTANT).

SPECIES ARE VARIABLE (ESPECIALLY GEOGRAPHICALLY); TRANSITIONAL FORMS CAN SOMETIME BE FOUND BETWEEN NAMED SPECIES*

NEW SPECIES ARISE GRADUALLY.

*In these cases, however, adoption of the polytypic species concept has resulted in the lumping together of taxa that had been described as separate species.

**The "Synthetic Theory" or "Modern Synthesis"**

Modifications that reconciled Darwin's theory with genetics. Compatibility of the claim that evolution is primarily driven by natural selection operating on random genetic variation with the findings of all the sciences dealing with evolution, particularly compatibility of microevolution (population genetics) with everything known about macroevolution (origin of species).

Contributing factors:

- acquired characteristics not inherited Mendelian basis of continuous variation
- variation among races has genetic basis
- development of biological species concept
- population genetics

**Major Tenets of Modern Synthesis:**

- populations contain genetic variation that arises by random (i.e. not adaptively directed) mutation and recombination.
- populations evolve by changes in gene frequency brought about by random genetic drift, gene flow, and especially natural selection.
- most adaptive genetic variants have individually slight phenotypic effects so that most phenotypic changes are gradual.
- diversification comes about by speciation, which ordinarily entails the gradual evolution of reproductive isolation among populations.
- these processes, continued long enough, give rise to changes of such great magnitude as to warrant the designation of higher taxonomic levels.