Chapter 2

Evolution: Constructing a Fundamental Scientific Theory

The context for Darwin's Theory

- Since Aristotle, the predominant worldview was of *immutability.*
- hierarchy of plants and animals, - humans showed the greatest perfection and complexity

The Great Chain of Being

God
Angels
Kings/Queens
Archbishops
Dukes/Duchesses
Bishops
Marquises/Marchionesses
Earls/Countesses
Viscounts/Viscountesses
Barons/Baronesses
Abbots/Deacons
Knights/Local Officials
Ladies-in-Waiting
Priests/Monks
Squires
Pages
Messengers
Merchants/Shopkeepers

Tradesmen
Yeomen Farmers
Soldiers/Town Watch
Household Servants
Tennant Farmers
Shephards/Herders
Beggars
Actors
Thieves/Pirates
Gypsies
Animals
Birds
Worms
Plants
Rocks

The context for Darwin's Theory

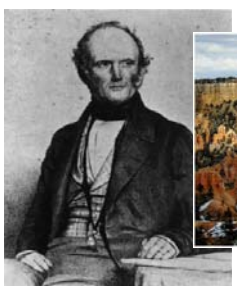
1) Deep time
2) Earth is different now than before
3) That goes for flora and fauna too

Darwin drew on 5 scientific disciplines to generate his theory:

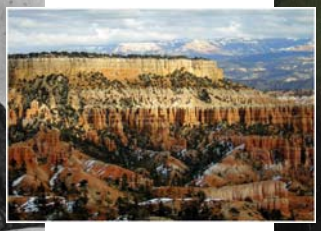
- Geology
- Paleontology (fossils)
- Taxonomy, Systematics
- Demography
- Evolutionary Biology

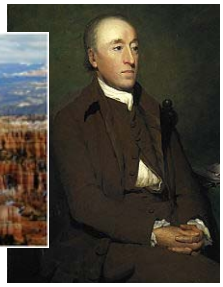
Geology: Reconstructing Earth's Dynamic History

Deep time uniformitarianism



Charles Lyell
(1797 - 1875)





James Hutton
(1726 - 1797)

Paleontology: Reconstructing the History of Life on Earth

Robert Hooke
(1605 – 1703)

Fossils

Georges Cuvier
(1769-1832)
catastrophism

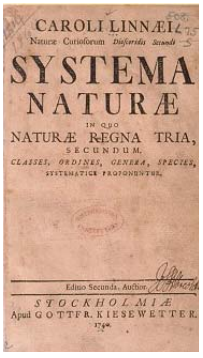
Taxonomy and Systematics: Classifying Living Organisms and identifying Their Biological Relationships

John Ray (1660**)** defined species, grouped organisms according to similarities

(1628-1705**)**

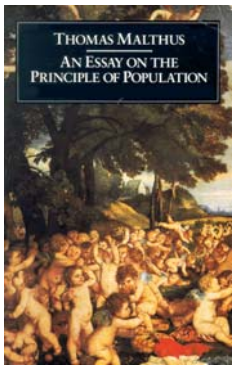
Taxonomy and Systematics: Classifying Living Organisms and identifying Their Biological Relationships

Carolus Linnaeus
(1707-1778)
Swedish naturalist
binomial nomenclature
genus



TAXONOMIC CATEGORY	TAXONOMIC LEVEL	COMMON CHARACTERISTICS
Kingdom	Animalia	Mobile multicellular organisms that consume other organisms for food and develop during an embryo stage.
Subkingdom	Eumetazoa	All major animals (except sponges) that contain true tissue layers, organized as germ layers, which develop into organs in humans.
Phylum	Chordata	Group of vertebrate and invertebrate animals that have a notochord, which becomes the vertebral column in humans and other primates.
Subphylum	Vertebrata	Animals with vertebral columns or backbones (including fish, amphibians, reptiles, birds, and mammals).
Superclass	Tetrapoda	Vertebrate animals with four feet or legs, including amphibians, birds, dinosaurs, and mammals.
Class	Mammalia	Group of warm-blooded vertebrate animals that produce milk for their young in mammary glands. They have hair or fur and specialized teeth.
Subclass	Theria	Group of mammals that produce live young without a shelled egg (including placental and marsupial mammals).
Order	Primates	Group of mammals specialized for life in the trees, with large brains, stereoscopic vision, opposable thumbs, and grasping hands and feet.
Suborder	Anthropoidea	Group of primates, including monkeys, apes, and humans, but not prosimians. They have long life cycles and are relatively large-bodied.
Family	Hominidae	Group of anthropoids, including the humans, great apes, and human ancestors. They have the largest bodies and brain sizes of all primates.
Genus	*Homo*	Group of hominids including modern humans, their direct ancestors, and extinct relatives (e.g., Neandertals). They are bipedal and have large brains.
Species	*sapiens*	Modern and ancestral modern humans. They have culture, use language, and inhabit every continent except Antarctica.
Subspecies	*sapiens*	Modern humans alone.

Demography: Influences on Population Size and Competition for Limited Resources



(1798)

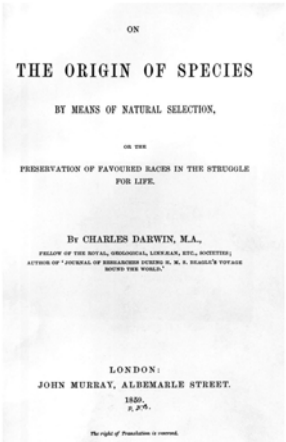
Evolutionary Biology: Explaining the Transformation of Earlier Life-Forms into Later Life-Forms

Erasmus Darwin

Lamarckism

1809

Darwin's Contribution to the Theory of Evolution: Natural selection



ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

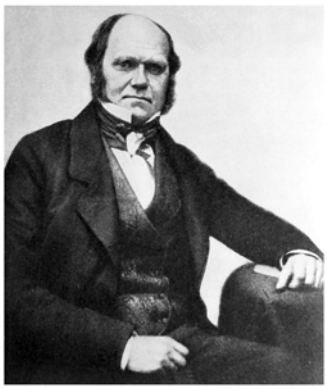
OR THE

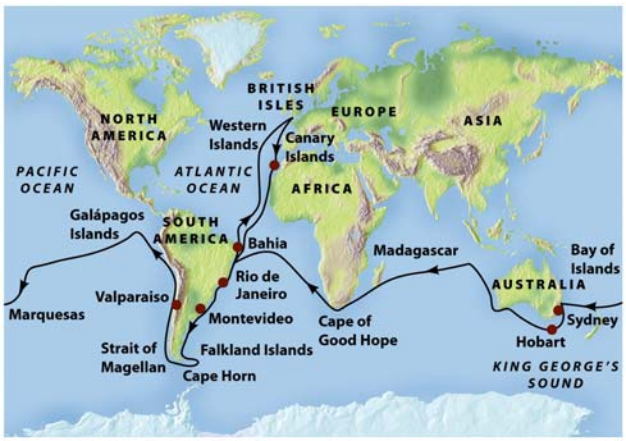
PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

By CHARLES DARWIN, M.A.,

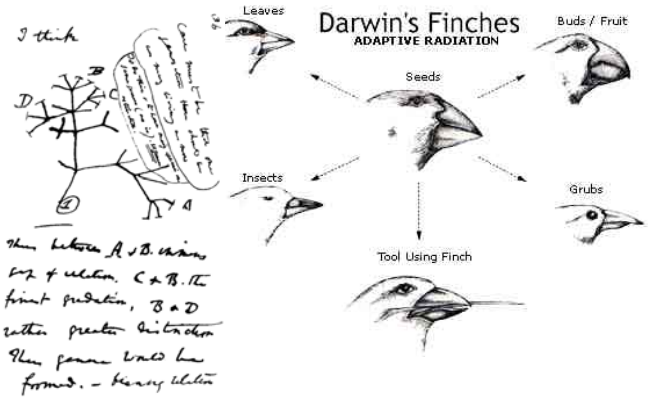
FELLOW OF THE ROYAL, GEOLOGICAL, LINNEAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.



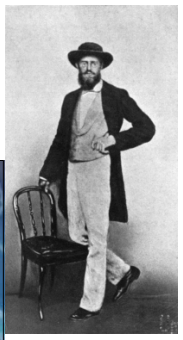


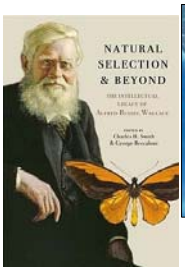
Adaptation
Adaptive radiation



Alfred Russel Wallace

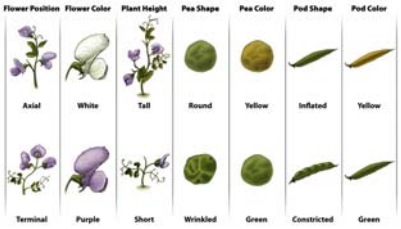
- Competition between species
- Warning coloration
- Biogeography “The Wallace Line”

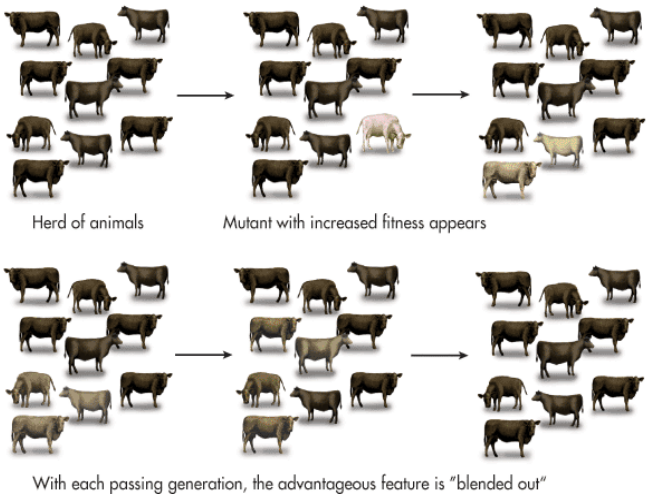


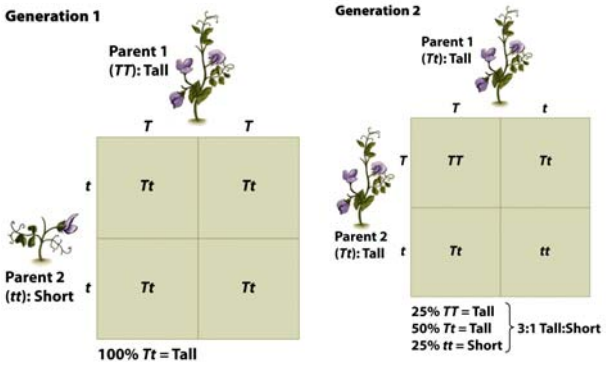


Since Darwin: Mechanisms of Inheritance

- Gregor Mendel (1856)
- Gemmules and blended inheritance
- Genes and alleles- particulate inheritance







Since Darwin: Mechanisms of Inheritance

- Mendelian inheritance

1. Dominance and recessive
2. Law of independent assortment
3. Law of segregation

Genotype, phenotype,

Since Darwin: the Modern Synthesis

- Mendel + Darwin- mechanism for evolution and how traits are passed on (variation)
- "Gene pool" – population genetics
- 4 causes of evolution:
  - Mutations, gene flow, genetic drift and natural selection

Since Darwin: the Discovery of DNA

- Watson and Crick (1953)
- chromosomes