History of Genetics in Evolution

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The Great Chain of Being

Going back as far as the Ancient Greeks, a linear hierarchy of life forms was assumed, with inanimate objects at the bottom and deities at the top:

Deity
Angels
Man
Mammals
Birds
Reptiles
Amphibians
Fish
Insects
Worms
Protists
Rocks

Issues: placement of birds, insects not obvious. A scale of complexity? Or what?

Carl Linnæus (Carl von Linné) (1707-1778)

Monophyly

Monophyletic: having a common ancestor which is not the ancestor of any of the other species being discussed.

(This definition works for cases where there are fossil forms being included, and those where they are not, and works whether we are discussing only a fixed set of species or all species descended from some ancestor.)

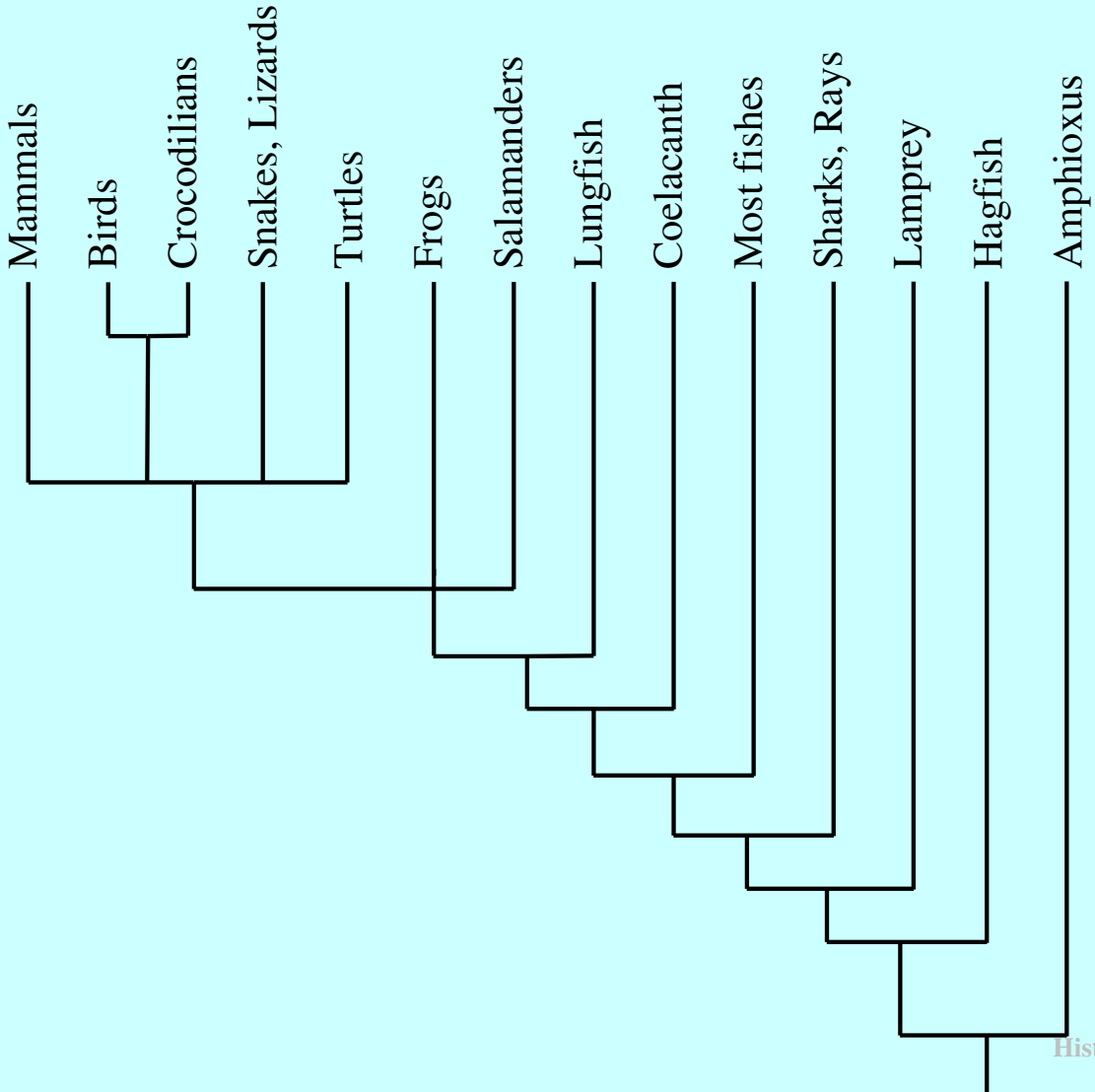
Linnæus's classification of vertebrates

In the 10th edition of *Systema Naturae:*

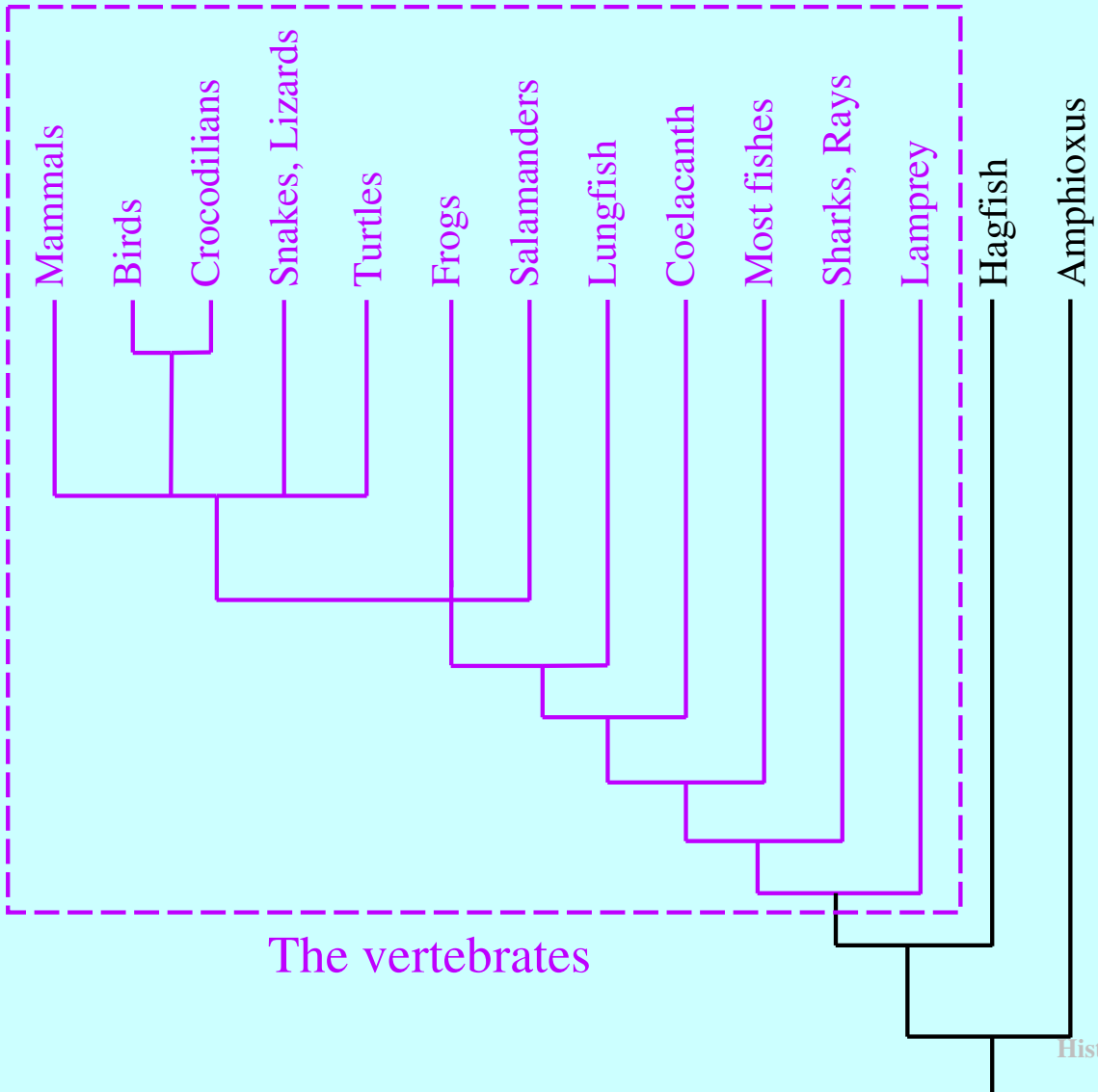
- Class Mammalia (mammals)
- Class Aves (birds)
- Class Amphibia (amphibians and reptiles)
  - Order Reptiles
    - Genus Testudo (turtles)
    - Genus Draco (gliding lizards)
    - Genus Lacerta (lizards, salamanders, crocodiles)
    - Genus Rana (frogs and toads)
  - Order Serpentes (snakes, slowworms, caecilians)
- Class Pisces (most fishes)
  - Order Nantes (lampreys, rays, sharks, anglerfishes, sturgeons)

Not exactly our current scheme!

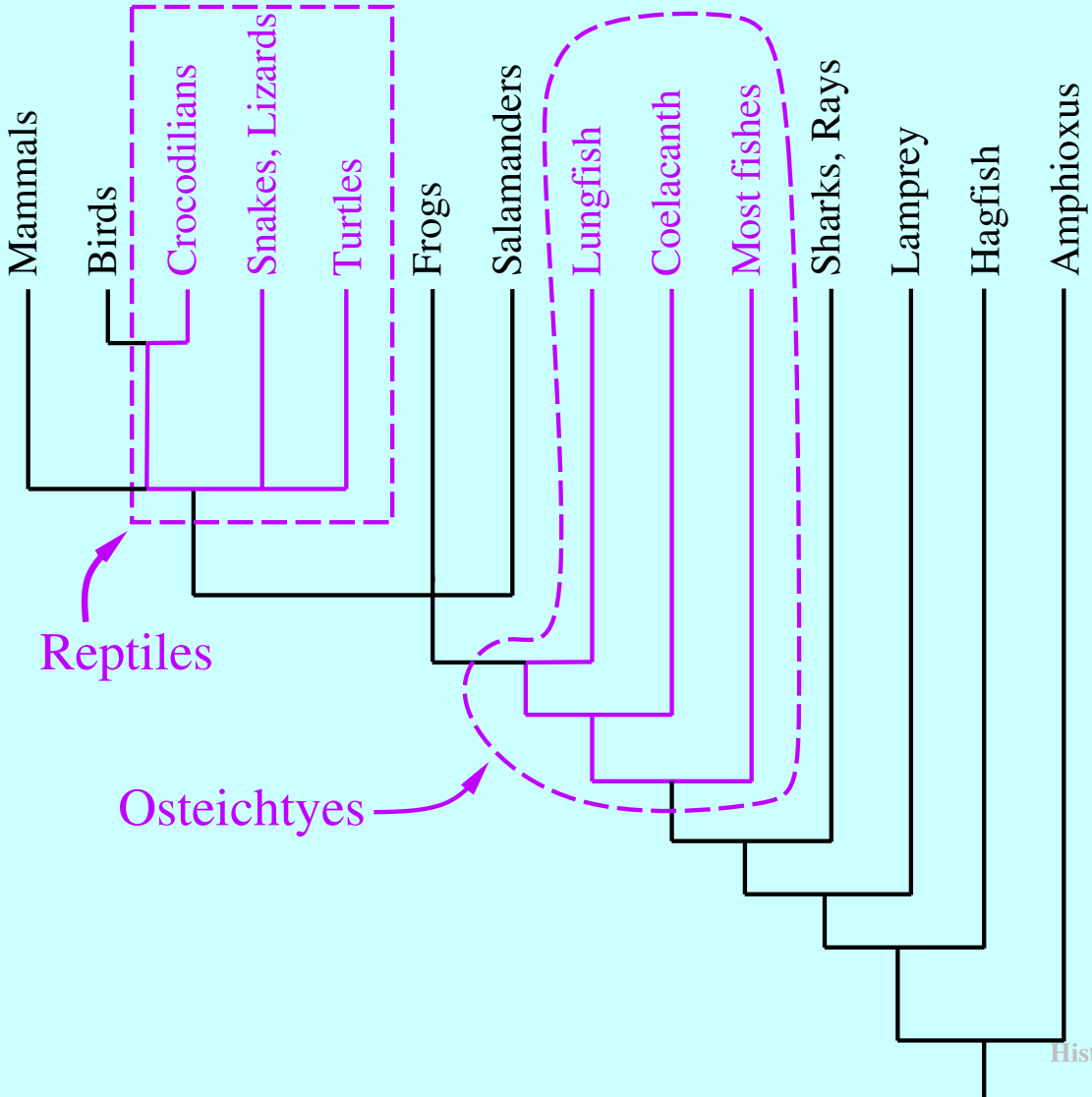
Example: A phylogeny of the living Craniata



Vertebrates are a monophyletic group



Reptiles and fishes are paraphyletic groups



An American in Paris (2005)

Wandering east of the Panthéon on the Left Bank of Paris, you begin to notice unusual street names:

A street named for Linnaeus? This only hints at a little-known story.

Buffon

George-Louis Leclerc, Comte de Buffon (1707-1788)

Statue of Buffon at the Jardin des Plantes

Buffon, honored

Rue Buffon, next to the Jardin des Plantes
(with plastic mastodon, Golden Arches, traffic ticket)

Lamarck

Jean Baptiste Pierre Antoine de Monet, Chevalier de Lamarck (1744-1829)

Lamarck's tree

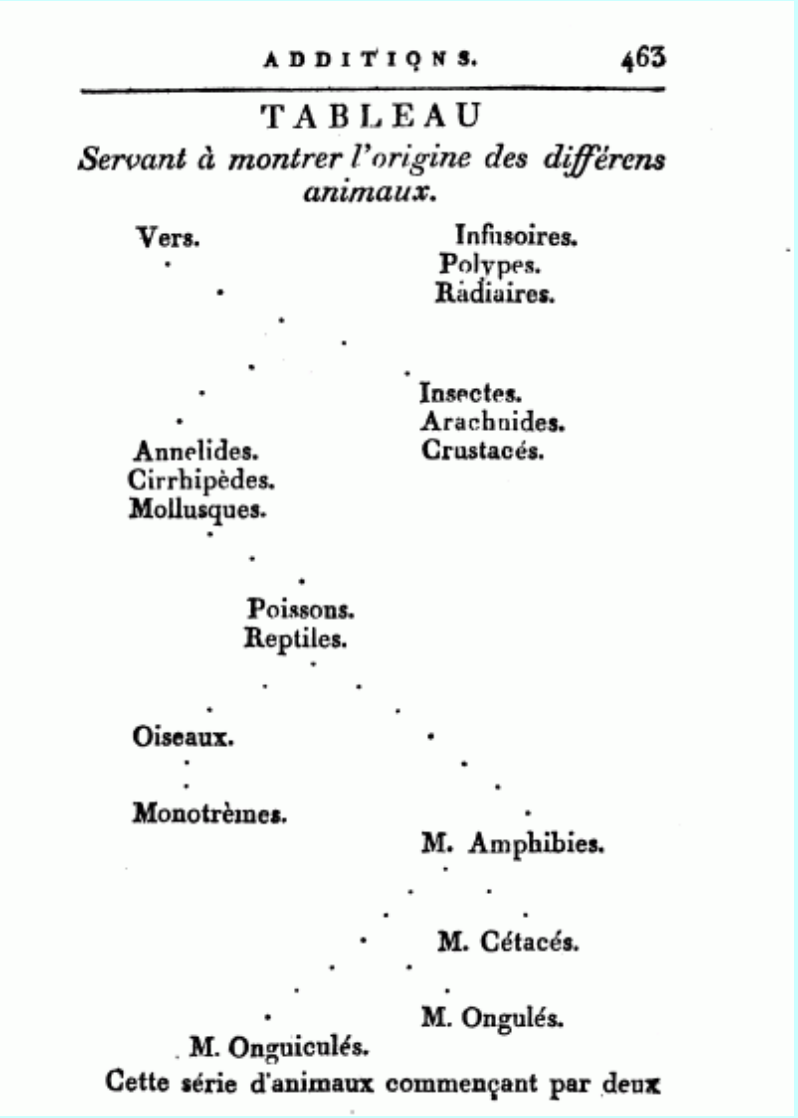


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TABLEAU

Servant à montrer l'origine des différens animaux.

Vers.

Infusoires.
Polypes.
Radiaires.

Insectes.
Arachnides.
Crustacés.

Annelides.
Cirrhipèdes.
Mollusques.

Poissons.
Reptiles.

Oiseaux.

Monotrèmes.

M. Amphibies.

M. Cétacés.

M. Ongulés.

M. Onguiculés.

Cette série d'animaux commençant par deux

As published in *Philosophie Zoologique*, 1809

Can you identify some of the groups? "M." means mammals

Lamarck's mechanism for evolution

In *Philosophie Zoologique*, 1809.

- Organisms' characters are altered by the effects of use and disuse.
- These changes are passed on to descendants by inheritance of acquired characters.

Note that Lamarck did not originate "Lamarckian inheritance": it was something everyone believed in at that time.

Old displays in the Museum of Natural History, Paris

Statue of Lamarck in the Jardin des Plantes, Paris

Lamarck's works listed

“My father, you will be vindicated”

Buffon's (and Lamarck's) house next to the Museum

Plaque on house commemorating Buffon

“George Louis Leclerc, Count of Buffon, born in Montbard, 7 September 1707, director of the Royal Botanical Garden from 1739 on, died in this house, 16 April 1788”

Plaque on house commemorating Lamarck

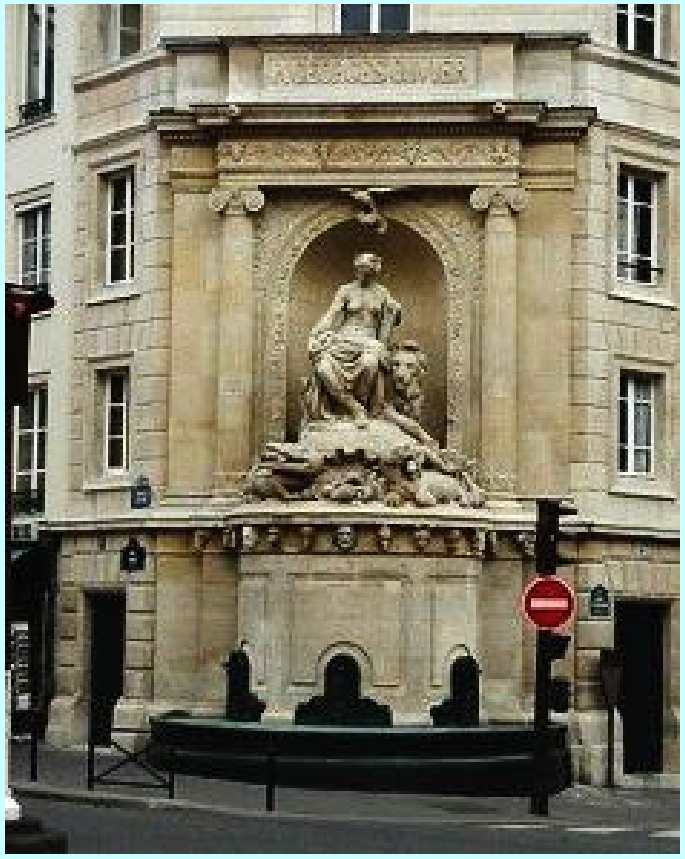
"Jean Baptiste Lamarck, born in Bazentin Le Petit, 1 August 1744, Professor at the Museum, Author of the first theory of evolution, lived in this house from 1795 on, died on the 18th of December 1829"

Geoffroy versus Cuvier

Etienne Geoffroy St. Hilaire
(1772-1844)

Georges Lèopole Chrètien Frèdèric Dagobert, Baron Cuvier
(1769-1832)

Memorials in Paris



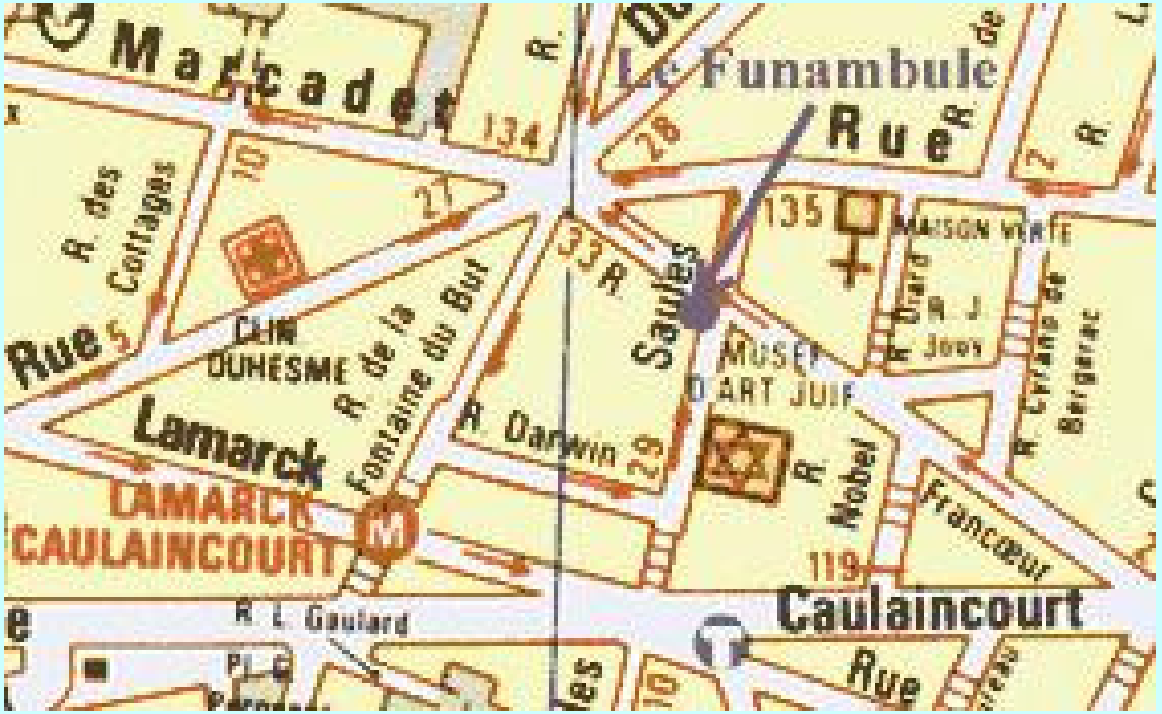
Fountain on corner of
Rue Linné and Rue Cuvier
(“Á GEORGES CUVIER”)

Rue Cuvier,
along side of fountain
and side of Jardin des Plantes

Allee Cuvier, within the Jardin

Rue Geoffroy St. Hilaire

Paris: Rue Lamarck and Rue Darwin



Johann Wolfgang von Goethe (1749-1832)

Goethe (1790) on the origin of parts of flowers

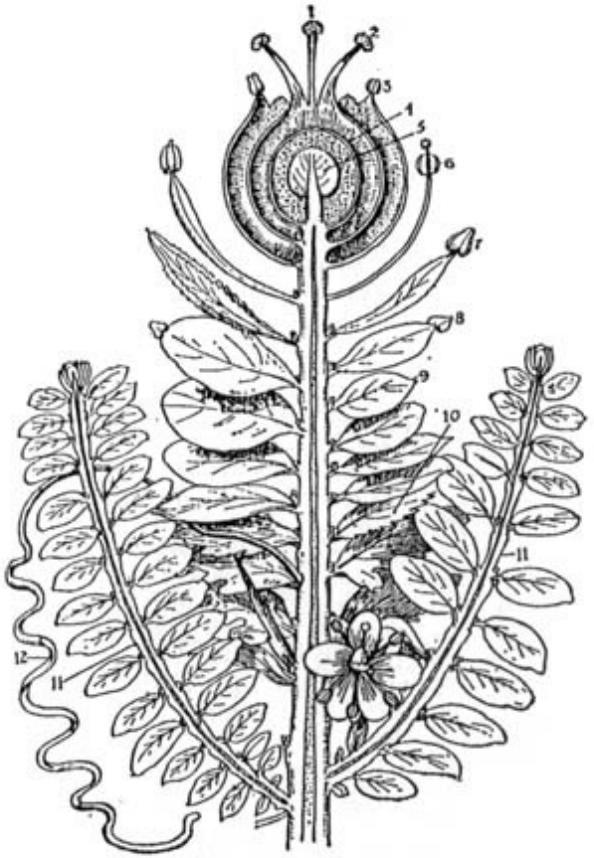
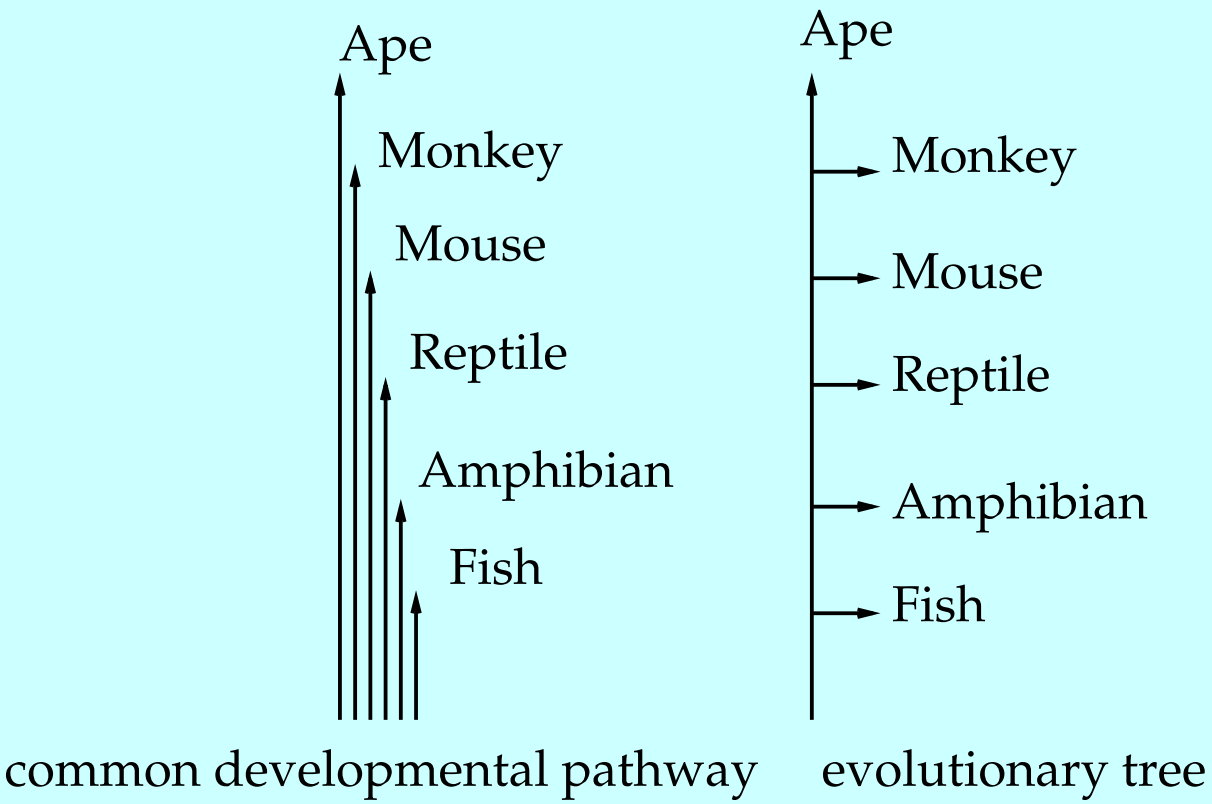


Figure 1. Part of Goethe's figure of the variations of leaf form according to which he interpreted the parts of the flower: 1 and 2 the stigmas of carpels; 3 and 4 walls of the seed-box; 5 the seed leaves or cotyledons; 6 typical stamen; 7 slightly petaloid stamen; 8 intermediate between stamen and petal; 9 petal; 10 sepal; 11 compound leaf with pinnules; 12 a leaf transformed into a tendril.

The Naturphilosophen

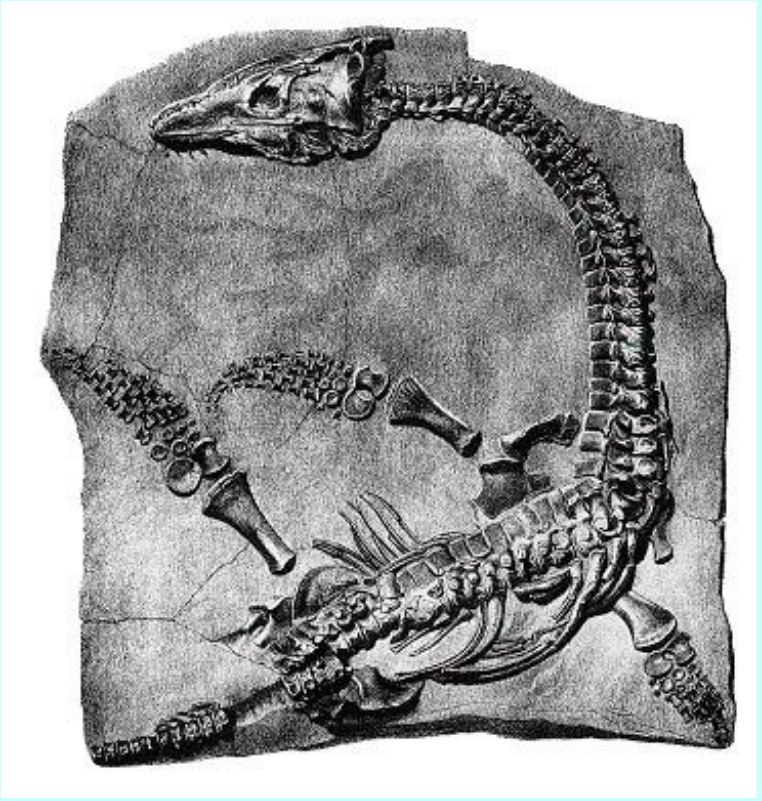
The *Naturphilosophen* and Evolutionary views



Note – The picture here is very much a Great Chain of Being

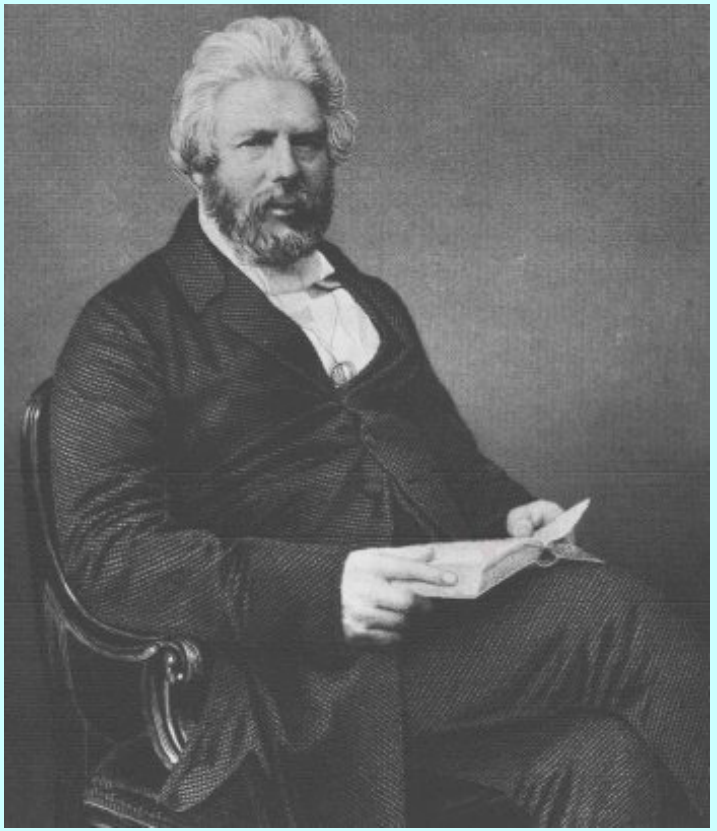
Fossil forms becoming known in 1700s, 1800s

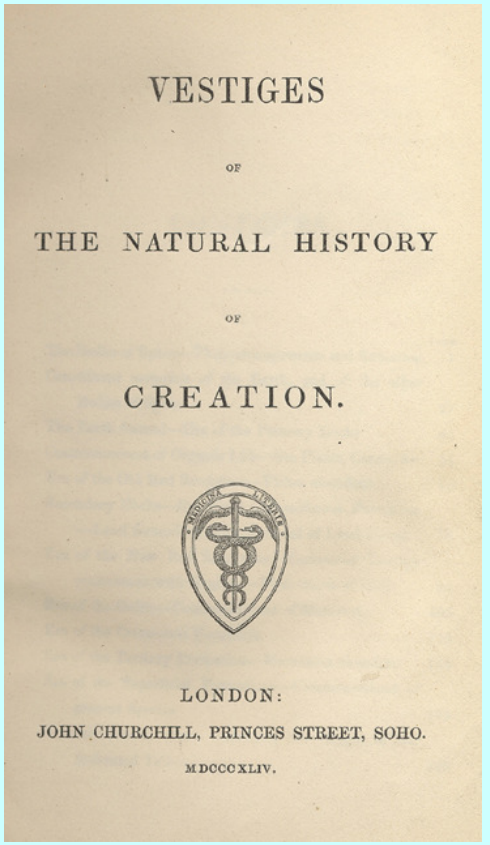
Charles Willson Peale
The Exhumation of the Mastodon
(in 1801, painted 1808)



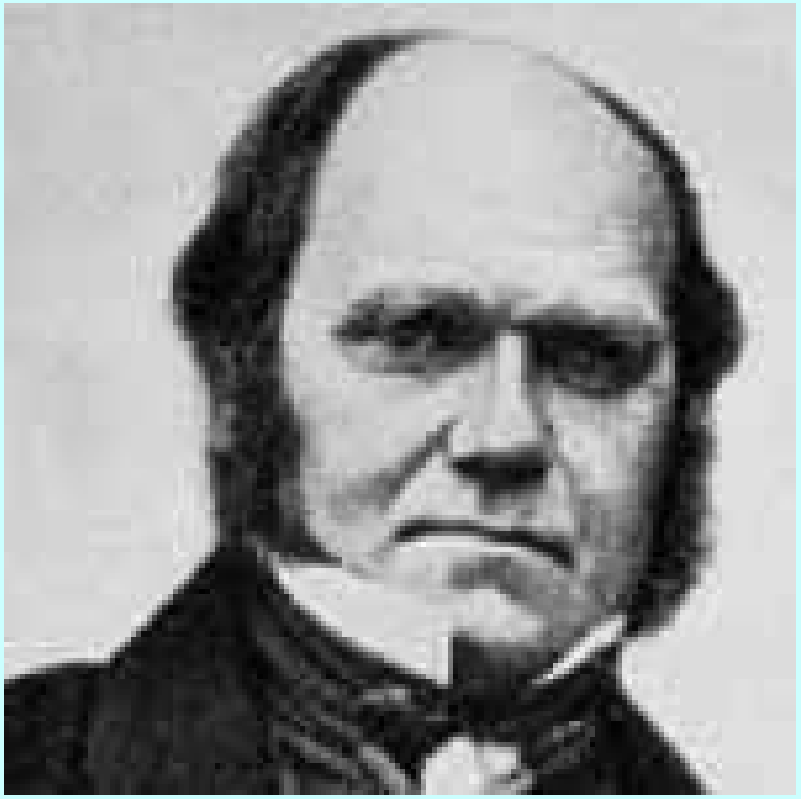
Mary Anning's Plesiosaur, 1821

Robert Chambers discusses evolution in 1844





Charles Darwin (1809-1882)



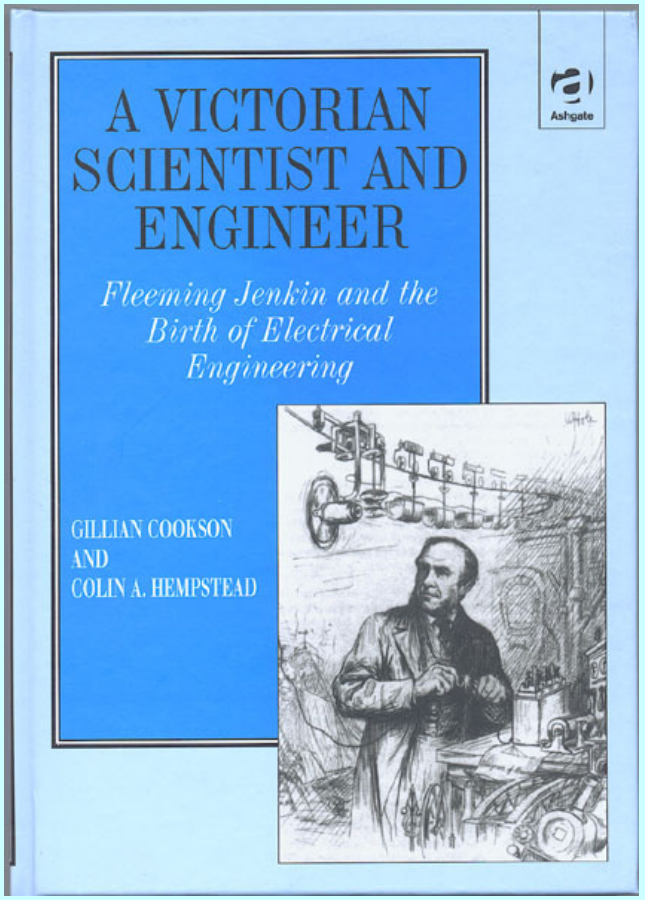
Wallace

Alfred Russel Wallace (1823-1913) in 1869

Lamarck's theory versus Darwin's

	Lamarck	Darwin/Wallace
Genetic variation important?	No	Yes
Differential survival or reproduction?	No	Yes
Mutations are in what direction?	adaptive	random
Phenotypic changes inherited?	Yes	maybe

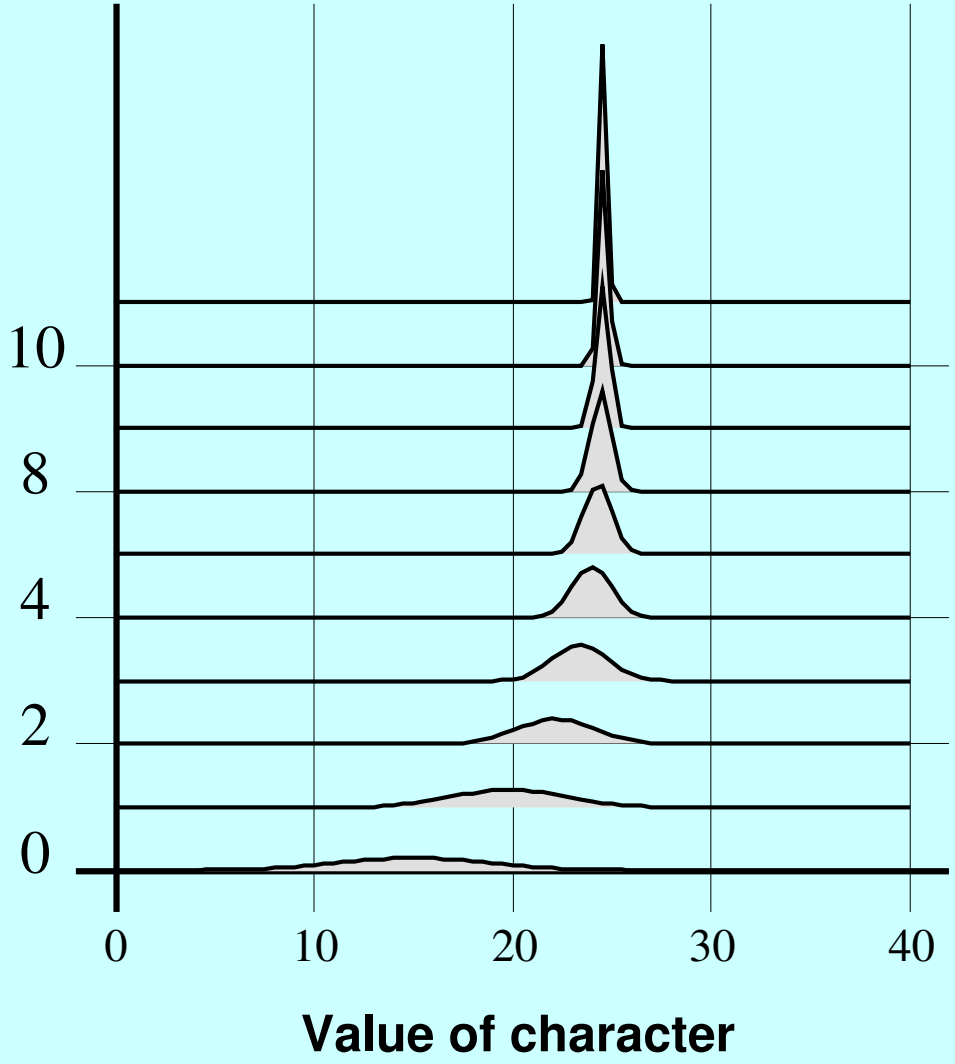
Fleeming Jenkin



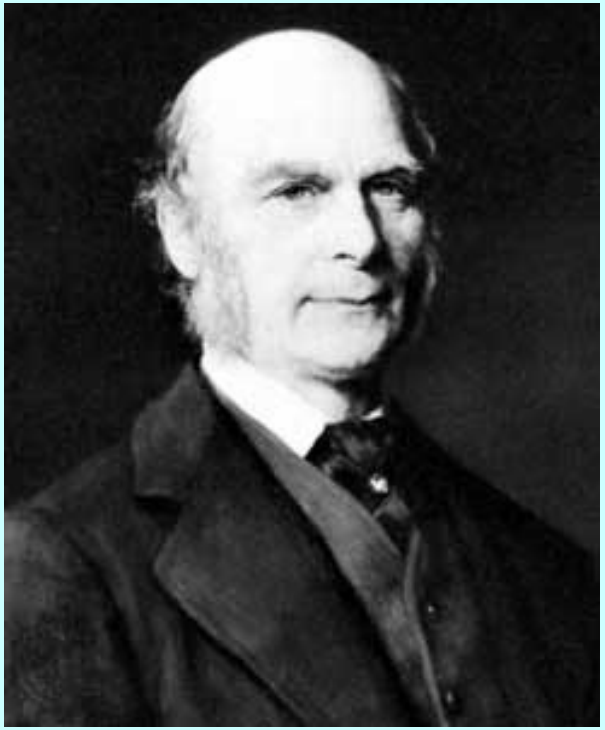
Fleeming Jenkin (1833-1885)

Fleeming Jenkin Building
University of Edinburgh

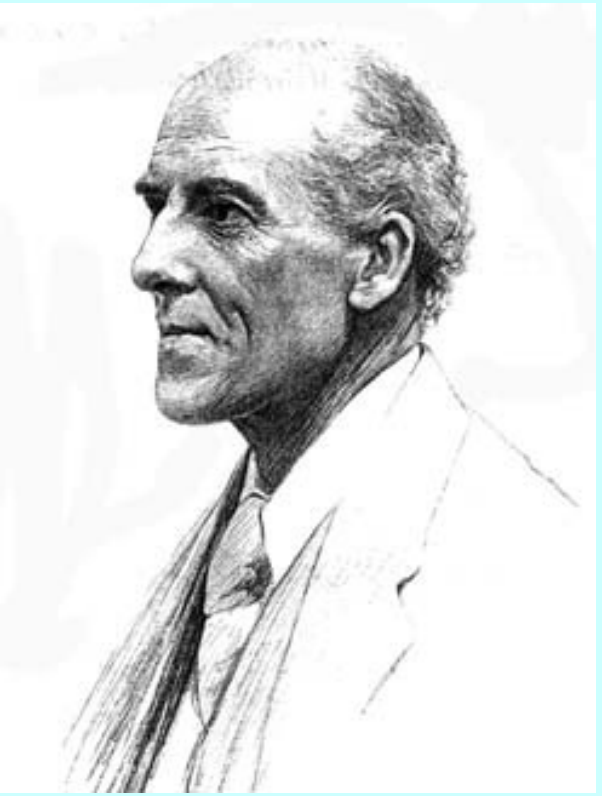
Blending inheritance and selection



The Biometricians



Francis Galton (1822-1911)



Karl Pearson (1857-1936)

Gregor Mendel (1822-1884)

Mendel in his school

The faculty of Mendel's monastery school
(Mendel is top center-right with flower)

Rediscoverers of Mendel

Carl Correns

Erich von Tschermak-Seysenegg

Hugo De Vries

Founders of theoretical population genetics

R. A. Fisher

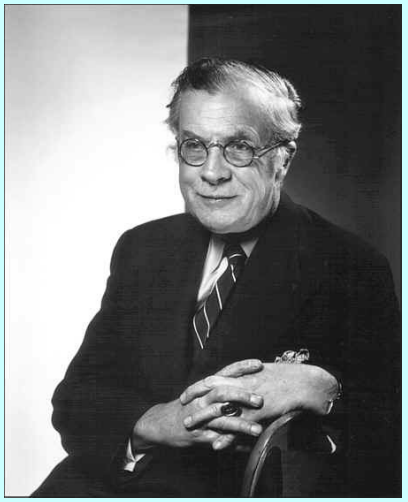
J. B. S. Haldane

Sewall Wright

Developers and popularizers of the Neodarwinian Synthes

Ernst Mayr

George Gaylord Simpson



Sir Julian Huxley

G. Ledyard Stebbins

Theodosius Dobzhansky