

Don't forget the quiz

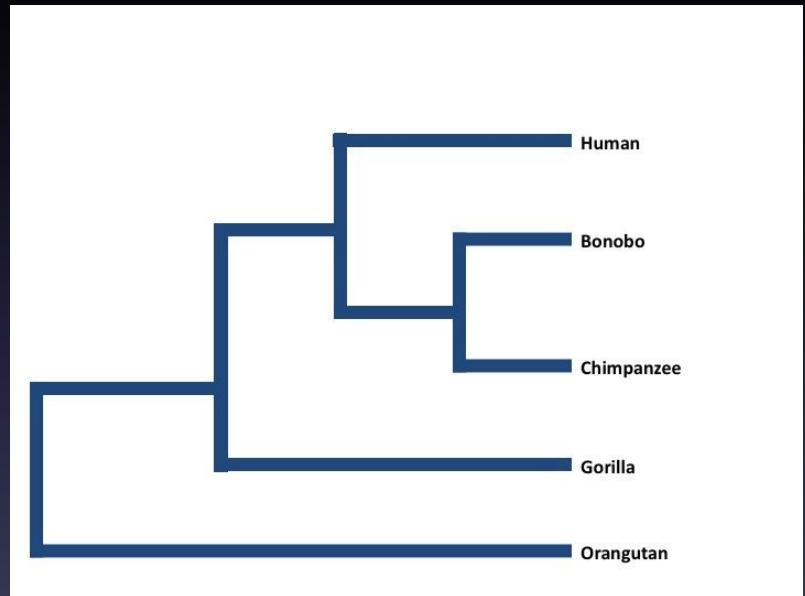
- Opens tonight, deadline is Monday at 9 am

What do we mean by evolutionary relationships?

- E.g. “Humans and chimpanzees are related”
- E.g. “chimpanzees are more closely related to humans than to gorillas”
- E.g. “chimpanzees are more closely related to bonobos than to humans”

What do we mean by evolutionary relationships?

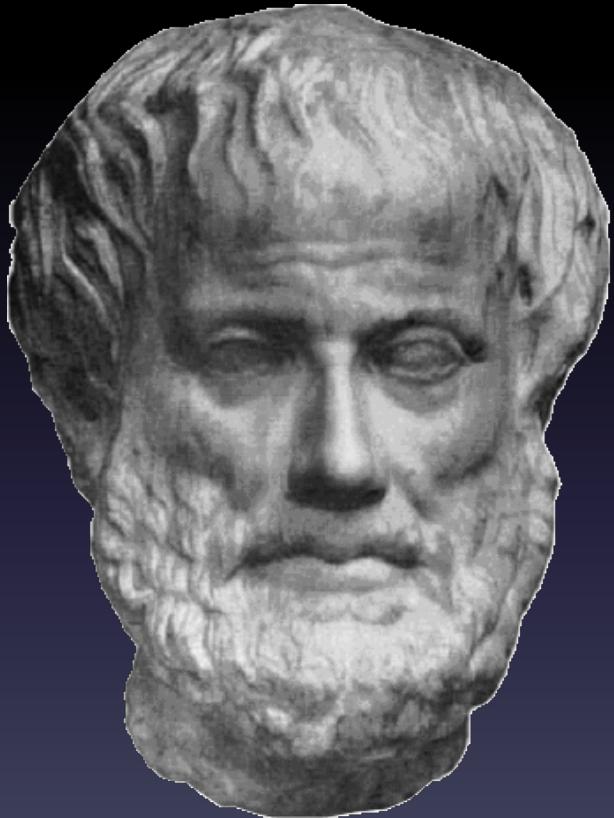
- E.g. “Humans and chimpanzees are related” (bit too vague)
- E.g. “chimpanzees are more closely related to humans than to gorillas”
- E.g. “chimpanzees are more closely related to bonobos than to humans”



History of systematics/evolution

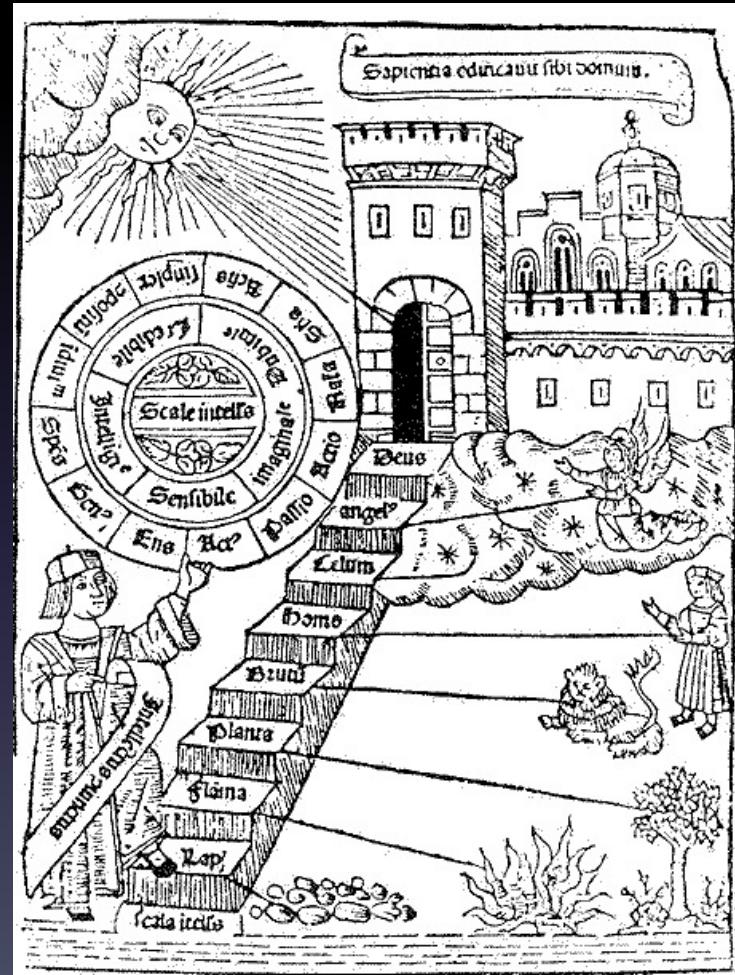
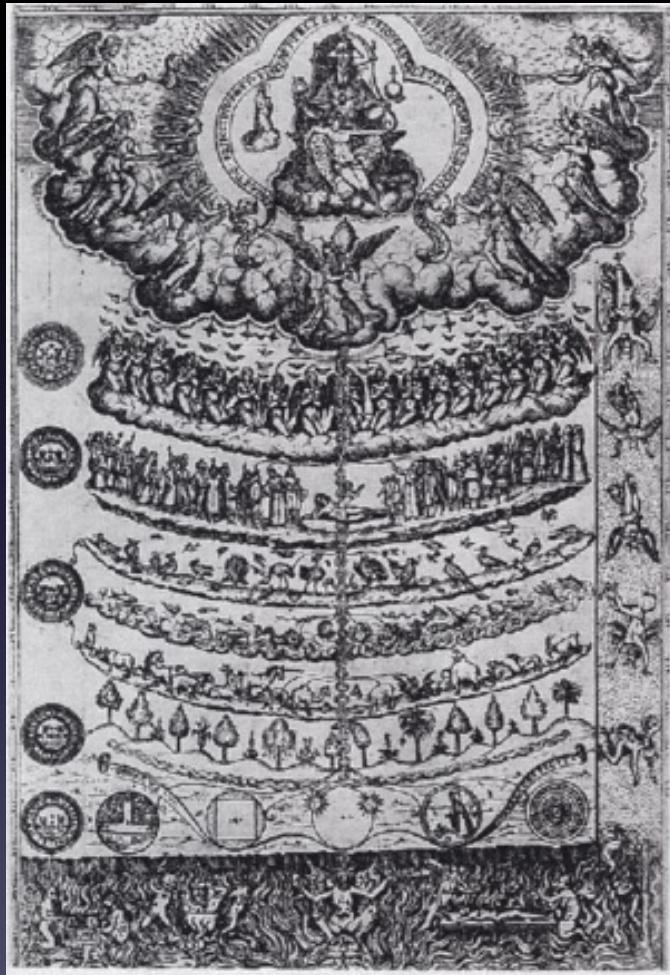
Aristotle – (384-322 BC)

- Founder of Western “Natural History”
- *Scala Naturae*
 - Great Chain of Being (humans on top)
- Species thought to be fixed
 - Similarities were pointed out but relatedness not implied



Medieval thinking continued the Great Chain of Being

Earth is the center of the universe, and a few thousand years old



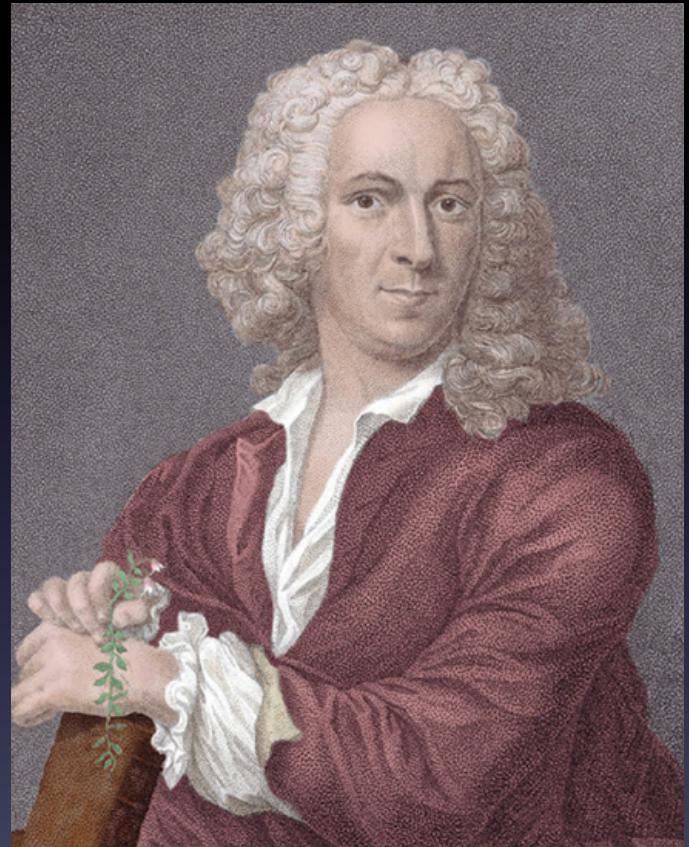
Renaissance (~15th-17th century)

- Astronomy / Physics – (Copernicus, Galileo)
 - Earth not the center of universe
- Natural History / Anatomy
 - Human anatomy and embryology; underlying similarity with animals



Carl Linnaeus (Carolus Linneaus, Carl Von Linne) 1707-1778

- Swedish botanist, VERY important in systematics (taxonomy)
 - Binomial nomenclature (genus and species)
- Human = *Homo sapiens*



Linneaus: groups within groups

Class Mammalia

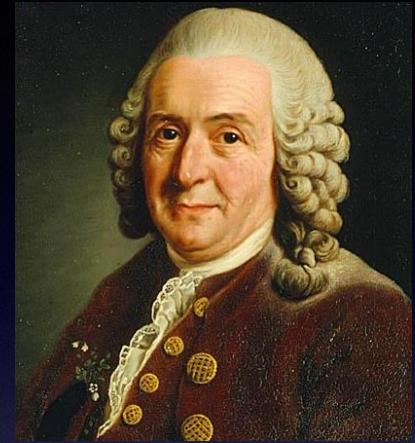
Order Primates

Family Hominidae

Genus *Homo*

Species: *Homo sapiens*

Carl Linnaeus: *Systema Naturae*



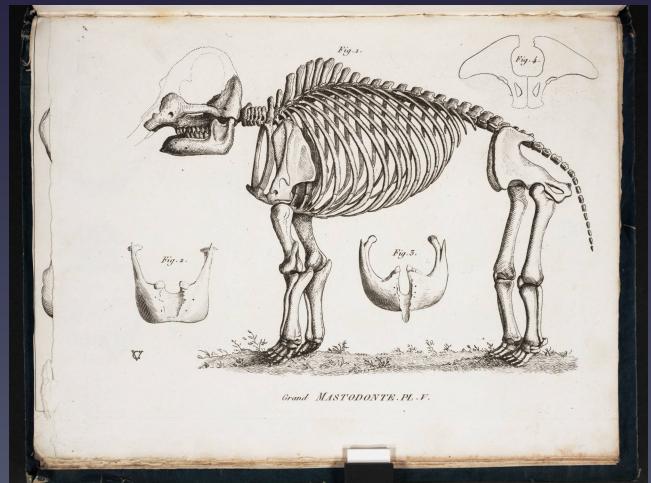
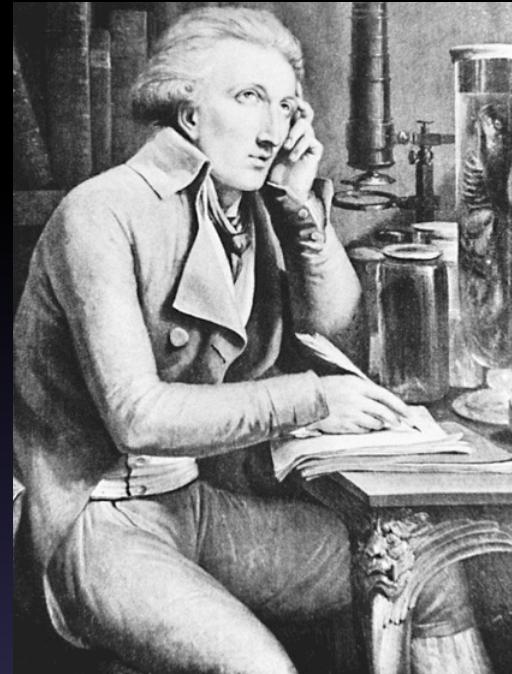
1707-1778

- *Systema Naturae* published 1735:
Classified life's diversity "for the
greater glory of God"
 - Developed a nested classification
system, grouping similar species into
increasingly general categories
 - Did not ascribe relationships among
species to evolution

Paleontology 1700s-early 1800s

Dominated by French naturalist and zoologist Georges Cuvier

- Fossils differ over time.
- Extinctions
- Different interpretations proposed, generally attempted to link to the biblical events.



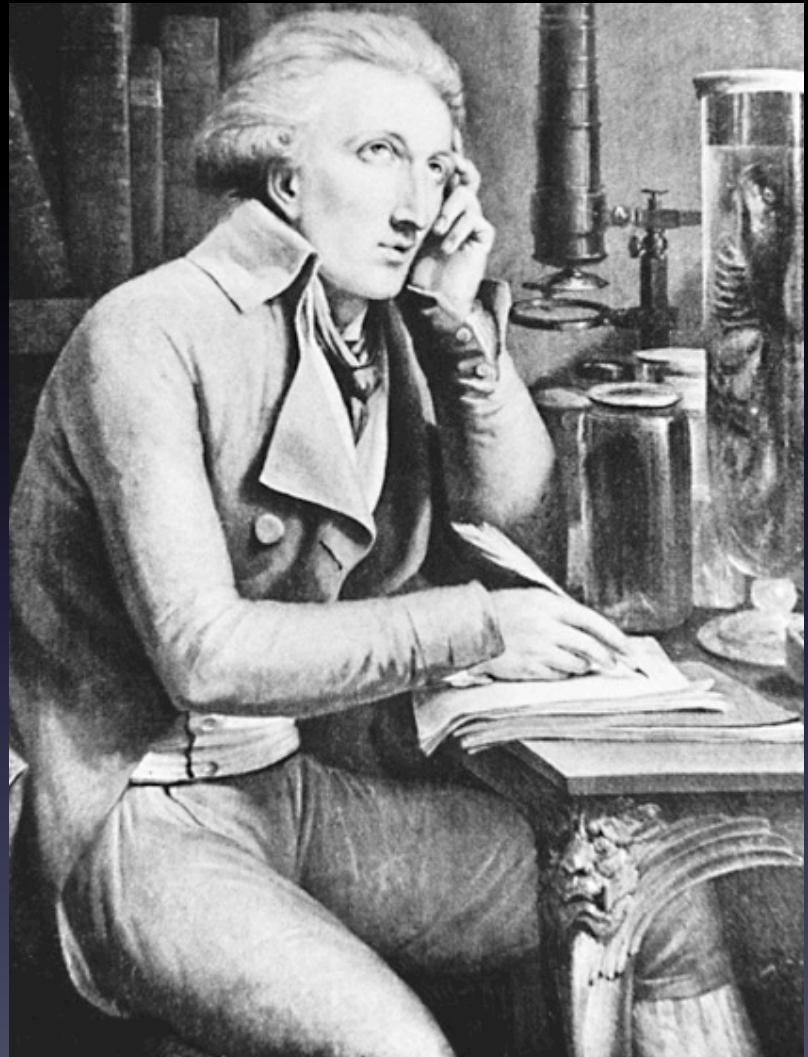
COUPE THÉORIQUE des divers TERRAINS ROCHES et MINÉRAUX

qui entrent dans la composition du SOL du RISSIX de PARIS. Par MM. CUVIER et Alexandre BRONGNIART. 1852.

Désignation des Terrains.			Indication de quelques localités.	Terrains et Roches éloignés du bassin de Paris, qu'on peut comparer avec quelques roches et terrains de ce Bassin.
A. CLAYEUX	1. Gypse. 2. Gypseux.		1. Gypse d'Orléans. 2. Gypse de Reims. 3. Gypse de Paris. 4. Gypse.	1. La Boulardie.
B. CALCAIERS	1. Limestone. 2. Bivalgues.		5. Platre de Rosières. 6. Gypse.	2. Gypse crevassier, calcaire et argileux de la Westphalie et du Danube.
	3. Calcaire lenticulaire.	Limestone de Hyères-Médiocre	7. Platre de Roquemaure.	3. Gypse calcaire ancien.
	4. Bivalve et Bivalve aggrégée		8. Kieselite à Bivalve longicorne.	
C. MÉTAMORPHIQUE	5. Calcaire Bivalve.		9. Kieselite lenticulaire.	
	6. Gypse crevassier et bivalve.		10. Roche Paléozoïque Kieselite-Bivalve.	
	7. Gypse crevassier et marne minéral		11. Marne des Andes connue au Sud de l'Amérique.	
	8. Bivalve marine		12. Kieselite.	
	9. Bivalve aggrégée		13. Kieselite, Kieselite-Kieselite.	
	10. Bivalve lytique		14. Platre.	
D. PLATANIQUES	11. Gypse et Bivalve.		15. Kieselite, Bivalve Kieselite-Kieselite.	1. Gypse d'Asie de l'Est.
	12. Bivalve lenticulaire		16. Platre.	de la Mandchourie, de l'Asie.
	13. Bivalve lytique			Liquides d'hydroxyde de calcium ; Régnante de Schivelbe.
E. PHYLLOTHÈMIQUES	14. Gypse et Bivalve.		17. Platre Champs-Élysées.	2. Gypse d'Asie de l'Est.
	15. Bivalve lenticulaire		18. Gypse d'Asie près Roche.	de la Mandchourie, de l'Asie.
	16. Gypse et Bivalve		19. Bivalve.	Liquides d'hydroxyde de calcium ; Régnante de Schivelbe.
	17. Gypse et Bivalve		20. Kieselite.	
	18. Gypse et Bivalve		21. Bivalve.	
			22. Bivalve, Bivalve, Gypse.	
F. TRINITAIRES	19. Gypse		23. Bivalve.	
	20. Gypse grossier et trinitaire		24. Bivalve, Gypse.	
	21. Gypse		25. Gypse et Bivalve.	
	22. Gypse grossier		26. Bivalve.	
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G. ANTO-CALCAIERS	24. Gypse grossier		29. Bivalve.	
	25. Argile fine et lenticulaire		30. Bivalve.	
	26. Gypse grossier		31. Bivalve.	
	27. Bivalve grossier		32. Bivalve.	
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	29. Argile plastique		34. Bivalve.	
H. PLAGIOTHÈMIQUES	30. Gypse blanche et siliceux		35. Bivalve.	
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Paleontology 1700s-early 1800s

- Catastrophism
 - Biblical catastrophes caused extinctions



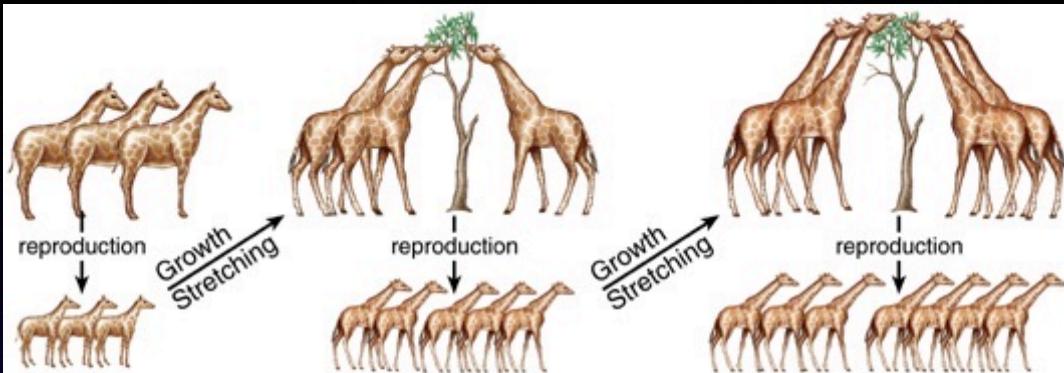
Jean-Baptiste Lamarck (1744-1829)

French biologist

- Importance of environmental effect on organisms
- Evolutionary change

Proposed mechanism of evolution

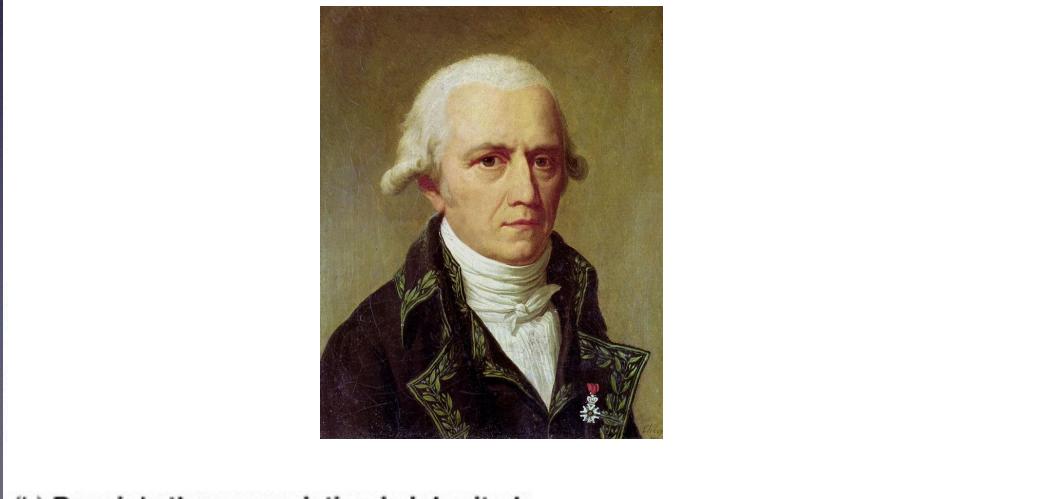




Proposed ancestor of giraffes has characteristics of modern-day okapi.

The giraffe ancestor lengthened its neck by stretching to reach tree leaves, then passed the change on to offspring.

(a) Lamarck's theory: variation is acquired.

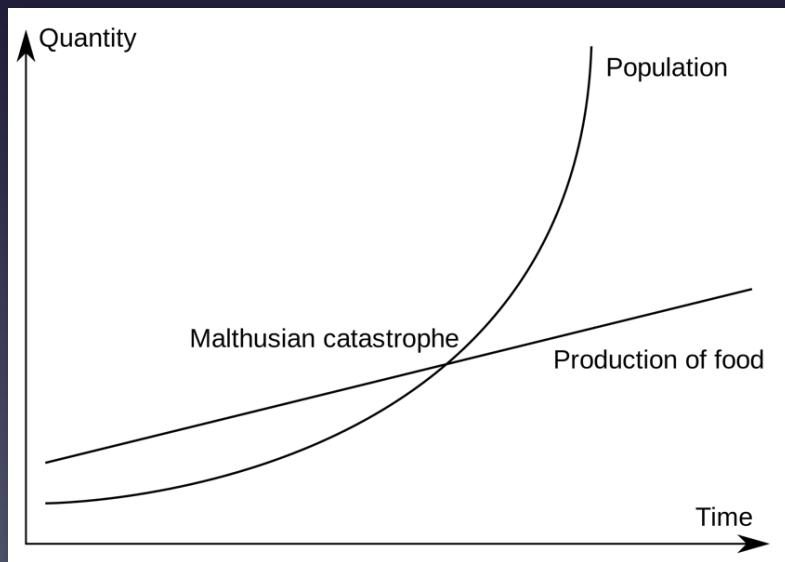


(b) Darwin's theory: variation is inherited.

Inheritance
of acquired
Characteristics
(turned out to be
incorrect)

Thomas Malthus (1766-1834)

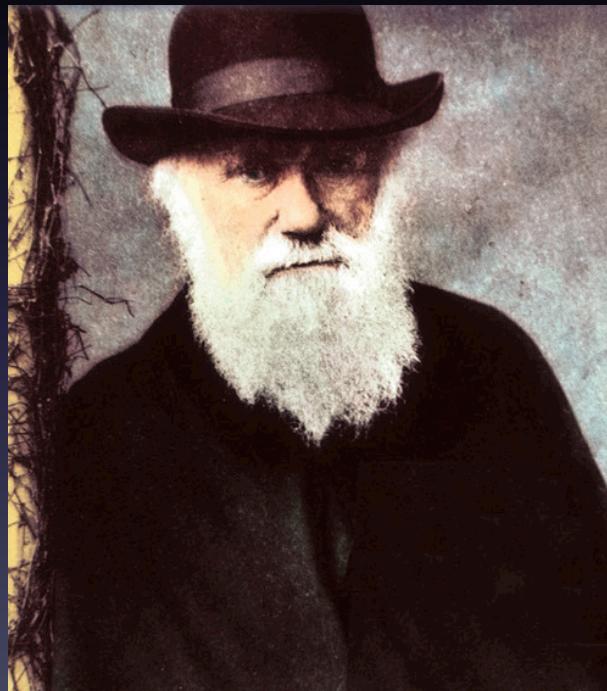
- Philosophizing about populations
- Population has potential for exponential growth
- Competition for resources



Evolution by Natural Selection

Darwin and Wallace

The theory of evolution by Natural Selection was proposed by Darwin and Wallace (1858)

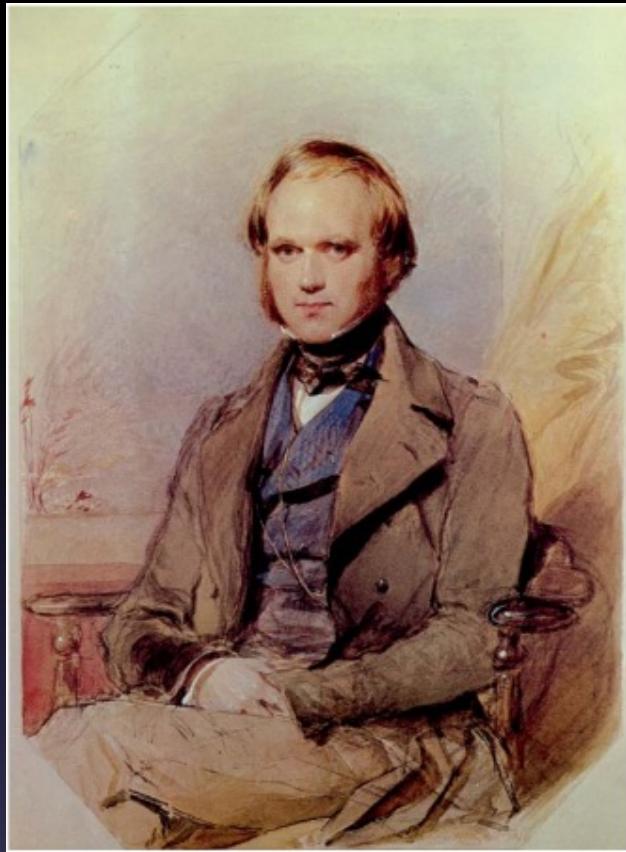


Charles Darwin (1809-1882)



Alfred Russel Wallace (1823-1913)

Darwin's background

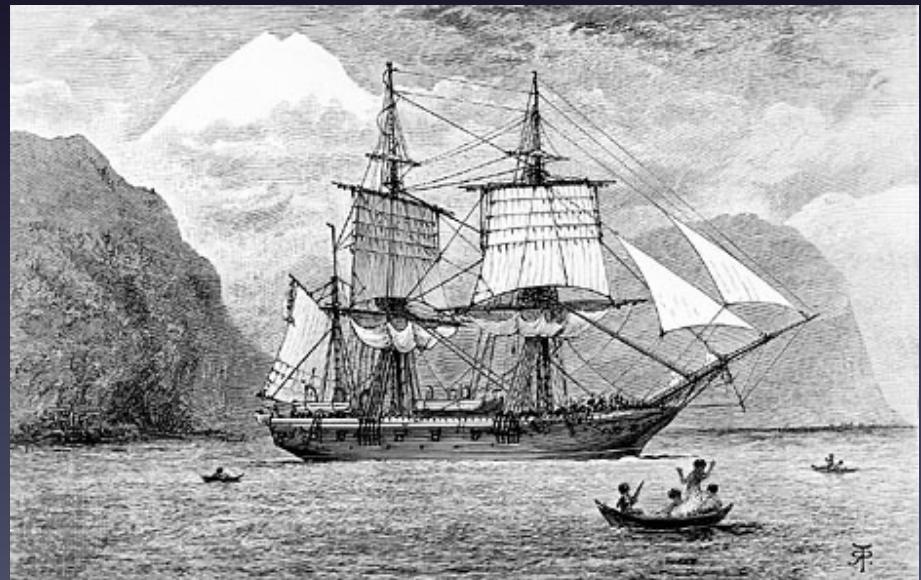


- From a small town in Western England (near Wales)
- Well-to-do family of physicians (Charles' Grandfather was also naturalist, philosopher, poet)
- Studied to become doctor, then priest
- Interested in natural history: met Captain of *HMS Beagle* through friends

Erasmus Darwin
(Charles' Grandfather)

Goals of Journey

- Map the Coast of S. America for trade routes
- Captain's (Fitzroy) secondary goals:
 - Make natural history collections
 - Start a mission(?)



From Darwin's 1890 *Journal of Researches...*

Darwin's travels

- HMS Beagle route (27 Dec. 1831- 2 Oct. 1836)



The Galapagos Islands

- Darwin collected numerous specimens, and noted a great variety among giant tortoises and birds (e.g. Darwin's finches)

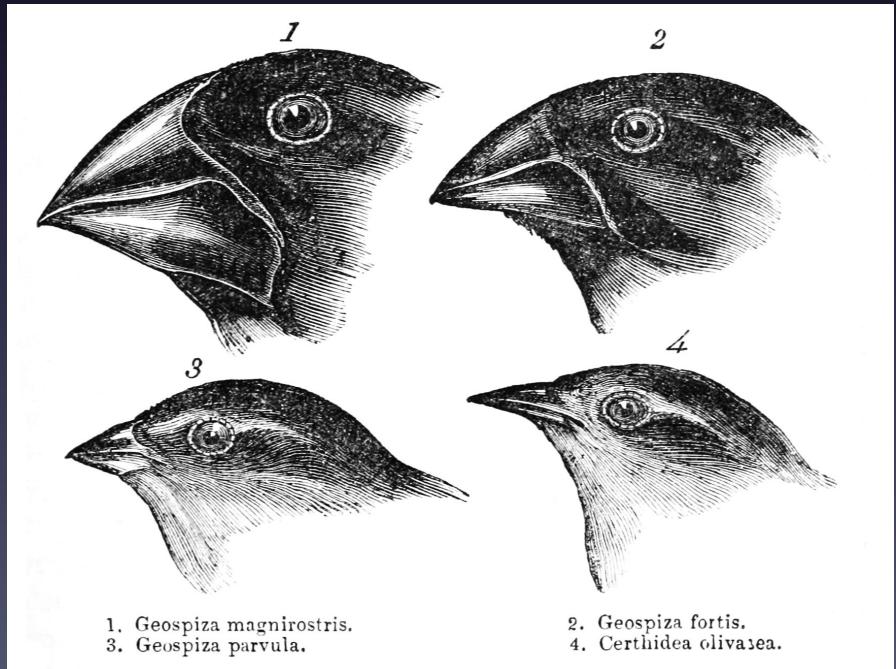


The Galapagos Islands

- Species resembled those of the mainland, but had various adaptations



- Later realization:
 - All species came from small number of mainland spp. that diversified on islands



1. *Geospiza magnirostris*.
3. *Geospiza parvula*.

2. *Geospiza fortis*.
4. *Certhidea olivacea*.

What About Wallace?



- [Video:](#)
- http://www.nytimes.com/2013/11/05/opinion/the-animated-life-of-alfred-wallace.html?_r=0