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Charles Darwin and the Evolution of Beauty
M-W 4-6:45

Fall 2020
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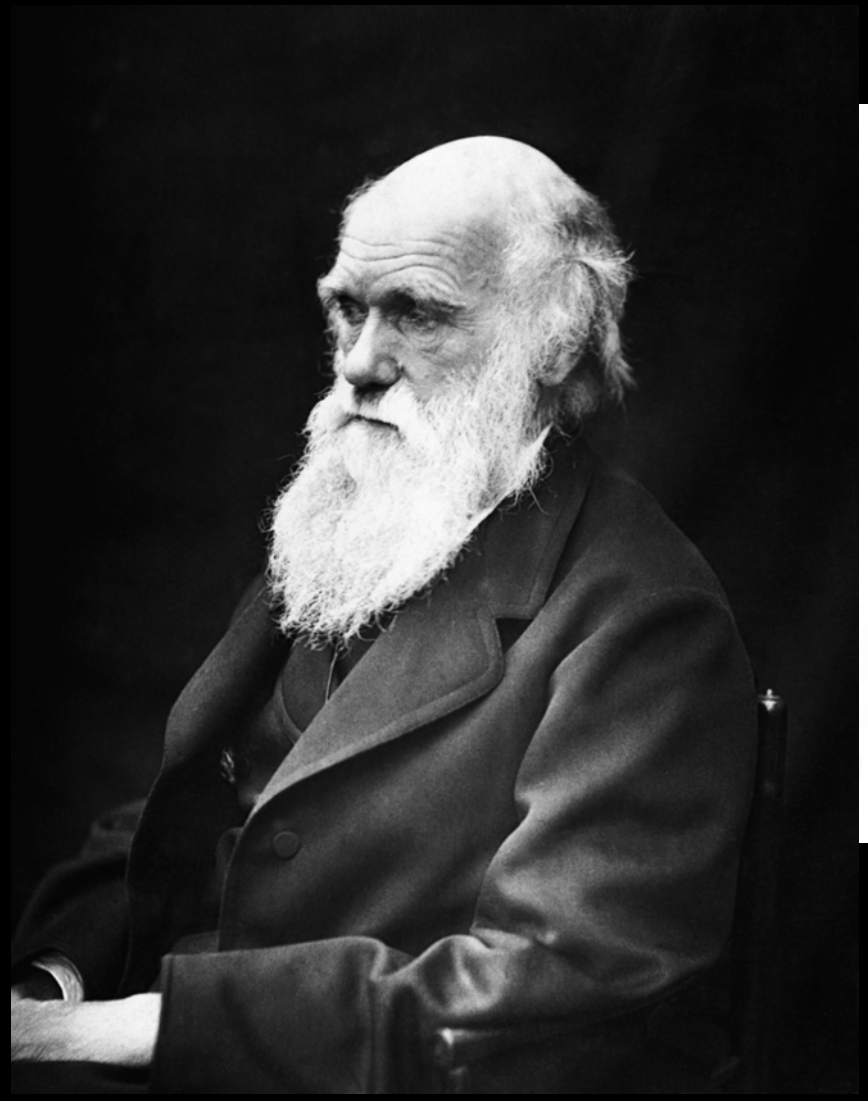
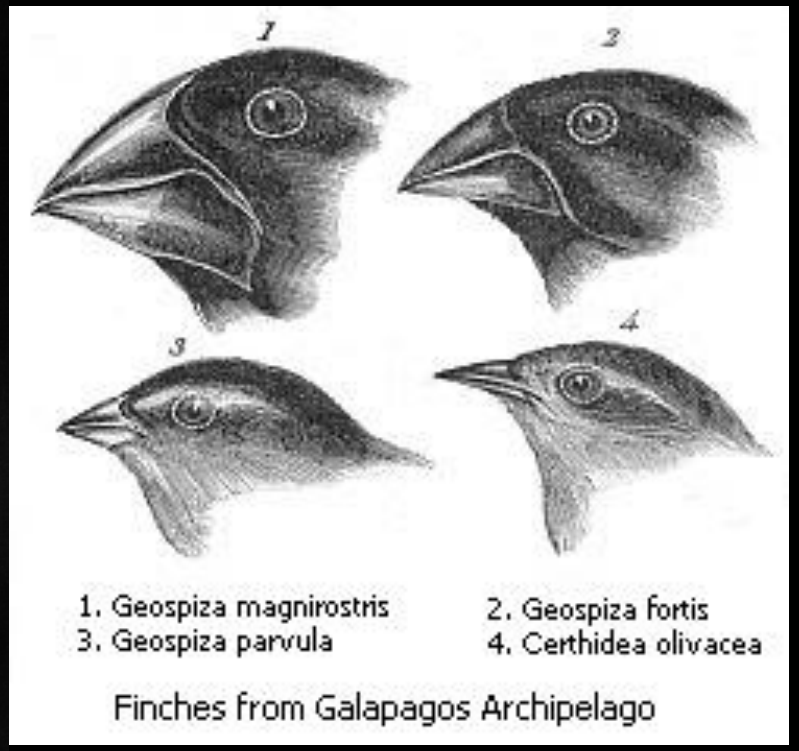
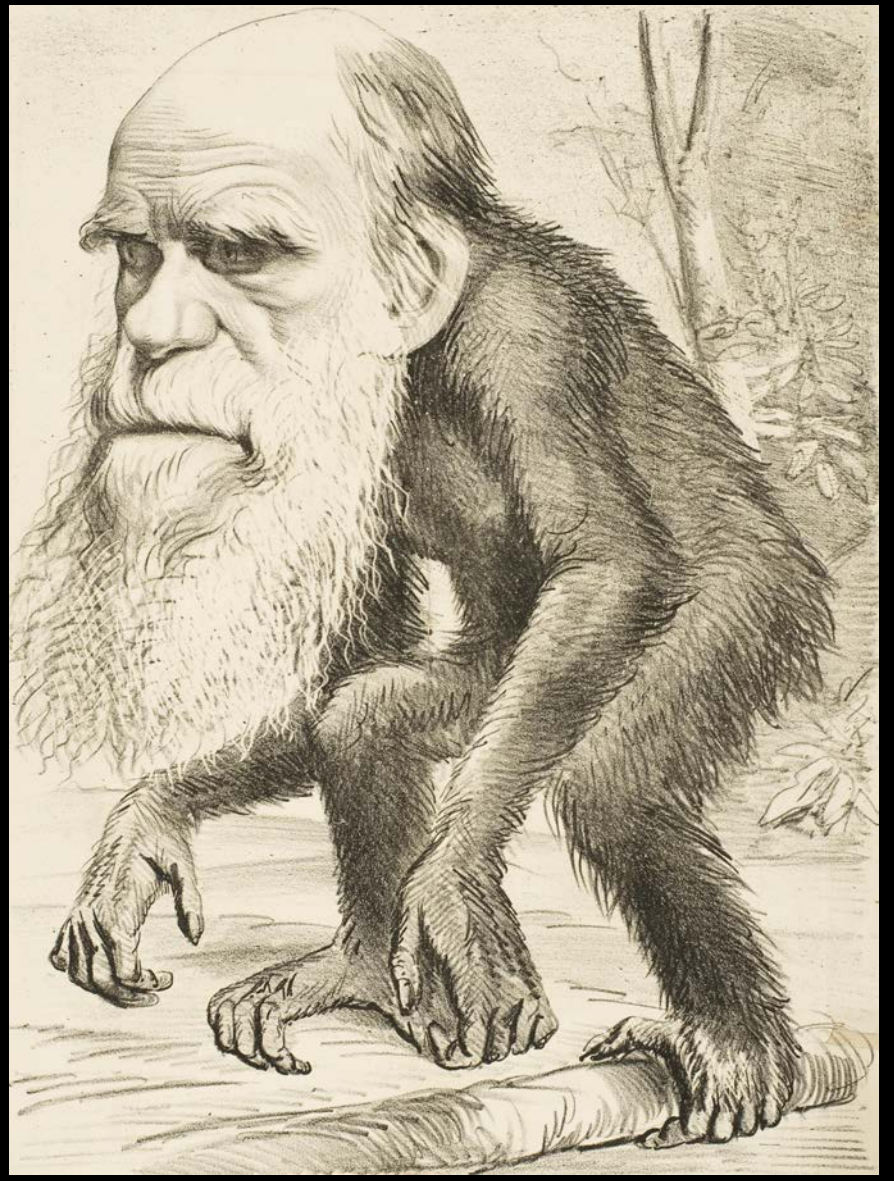
Monday 08/31/20
Charles Darwin and Natural Selection

Charles Darwin [1809-1882]

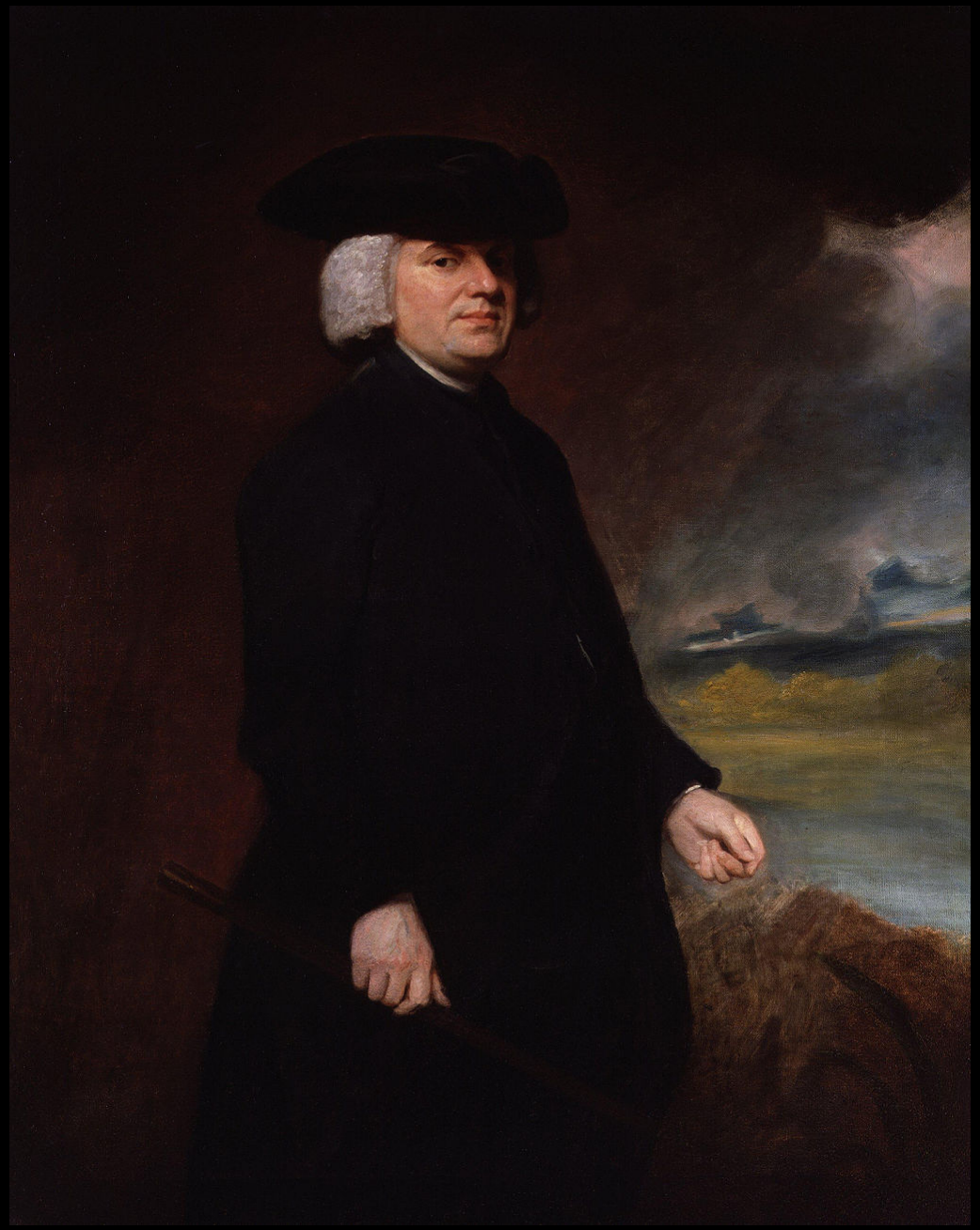




Finches from Galapagos Archipelago



- Born 02/12/1809 in Shrewsbury, Shropshire, England into wealthy family
- Planned to pursue career in medicine but switched to divinity
- 1831 joined a 5-year survey aboard the HMS Beagle
- On the voyage, Darwin read Lyell's 'Principles of Geology' which suggested that the fossils found in rocks were actually evidence of animals that had lived many thousands or millions of years ago.
- Lyell's argument was reinforced in Darwin's own mind by the rich variety of animal life and the geological features he saw during his voyage.
- The breakthrough in his ideas came in the Galapagos Islands, 500 miles west of South America. Darwin noticed that each island supported its own form of finch which were closely related but differed in important ways.
- On his return to England in 1836, Darwin tried to solve the riddles of these observations and the puzzle of how species evolve. Influenced by the ideas of Malthus, he proposed a theory of evolution occurring by the process of natural selection. The animals (or plants) best suited to their environment are more likely to survive and reproduce, passing on the characteristics which helped them survive to their offspring. Gradually, the species changes over time.
- Georg Wilhelm Friedrich Hegel [1770-1831]
- Queen Victoria in England reigns 1837-1901
- Great Exhibition London, Joseph Paxton’s Crystal Palace 1851
- Karl Marx [1818-1883]
- Sigmund Freud [1856-1939]
- American Civil War 1861-1865
- Darwin worked on his theory for 20 years. After learning that another naturalist, Alfred Russel Wallace, had developed similar ideas, the two made a joint announcement of their discovery in 1858. In 1859 Darwin published 'On the Origin of Species by Means of Natural Selection'.
- The book was extremely controversial, because the logical extension of Darwin's theory was that *homo sapiens* was simply another form of animal. It made it seem possible that even people might just have evolved - quite possibly from apes - and destroyed the prevailing orthodoxy on how the world was created. Darwin was vehemently attacked, particularly by the Church. However, his ideas soon gained currency and have become the new orthodoxy.
- Died 04/15/1882 in Down House, Downe, UK



William Paley [1743-1805]

- English clergyman, Christian apologist, utilitarian
- Natural Theology
- *Natural Theology or Evidences of the Existence and Attributes of the Deity* (1802)
- watchmaker analogy
- teleological argument/argument from design stating that design implies a designer

The Watchmaker Argument

From William Paley, *Natural Theology*, chs. 1-3

In crossing a heath, suppose I pitched my foot against a stone, and were asked how the stone came to be there: I might possibly answer, that, for any thing I knew to the contrary, it had lain there for ever; nor would it perhaps be very easy to show the absurdity of this answer. But suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place; I should hardly think of the answer which I had before given,—that, for any thing I knew, the watch might have always been there. Yet why should not this answer serve for the watch as well as for the stone? why is it not as admissible in the second case, as in the first? For this reason, and for no other, *viz*. that, when we come to inspect the watch, we perceive (what we could not discover in the stone) that its several parts are framed and put together for a purpose, e. g. that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; that, if the

different parts had been differently shaped from what they are, of a different size from what they are, or placed after any other manner, or in any other order, than that in which they are placed, either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it.

To reckon up a few of the plainest of these parts, and of their offices, all tending to one result:—We see a cylindrical box containing a coiled elastic spring, which by its endeavour to relax itself, turns round the box. We next observe a flexible chain (artificially wrought for the sake of flexure) communicating the action of the spring from the box to the fusee. We then find a series of wheels, the teeth of which catch in, and apply to, each other, conducting the motion from the fusee to the balance, and from the balance to the pointer: and at the same time, by the size and shape of those wheels, so regulating that motion, as to terminate in causing an index, by an equable and measured progression, to pass over a given space in a given time. We take notice that the wheels are made of brass in order to keep them from rust;

the springs of steel, no other metal being so elastic; that over the face of the watch there is placed a glass, a material employed in no other part of the work, but in the room of which, if there had been any other than a transparent substance, the hour could not be seen without opening the case. This mechanism being observed (it requires indeed an examination of the instrument, and perhaps some previous knowledge of the subject, to perceive and understand it; but being once, as we have said, observed and understood), the inference we think is inevitable, that the watch must have had a maker: that there must have existed, at some time, and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer: who comprehended its construction, and designed its use.

CHAPTER I.
STATE OF THE ARGUMENT.

I. Nor would it, I apprehend, weaken the conclusion, that we had never seen a watch made; that we had never known an artist capable of

making one; that we were altogether incapable of executing such a piece of workmanship ourselves, or of understanding in what manner it was performed; all this being no more than what is true of some exquisite remains of ancient art, of some lost arts, and, to the generality of mankind, of the more curious productions of modern manufacture. Does one man in a million know how oval frames are turned? Ignorance of this kind exalts our opinion of the unseen and unknown artist's skill, if he be unseen and unknown, but raises no doubt in our minds of the existence and agency of such an artist, at some former time, and in some place or other. Nor can I perceive that it varies at all the inference, whether the question arise concerning a human agent, or concerning an agent of a different species, or an agent possessing, in some respects, a different nature.

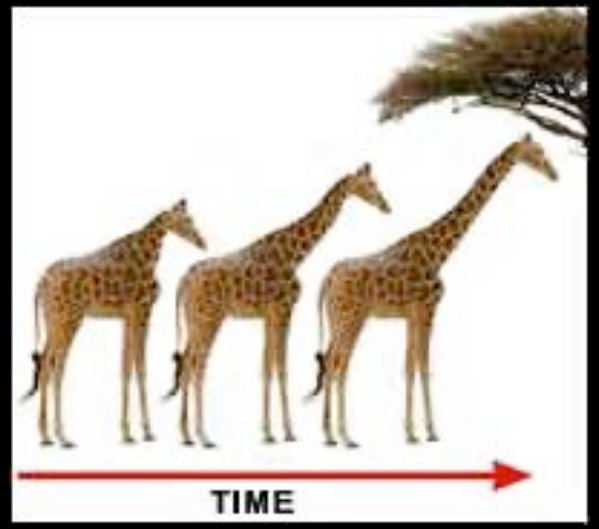
II. Neither, secondly, would it invalidate our conclusion, that the watch sometimes went wrong, or that it seldom went exactly right. The purpose of the machinery, the design, and the designer, might be evident, and in the case supposed would be evident, in whatever way we accounted for the irregularity of the move-

Something as complex as a mechanical watch clearly would not exist without a creator. Thus we can infer that the intricacy of our bodies — and those of all creatures — is the work of God.

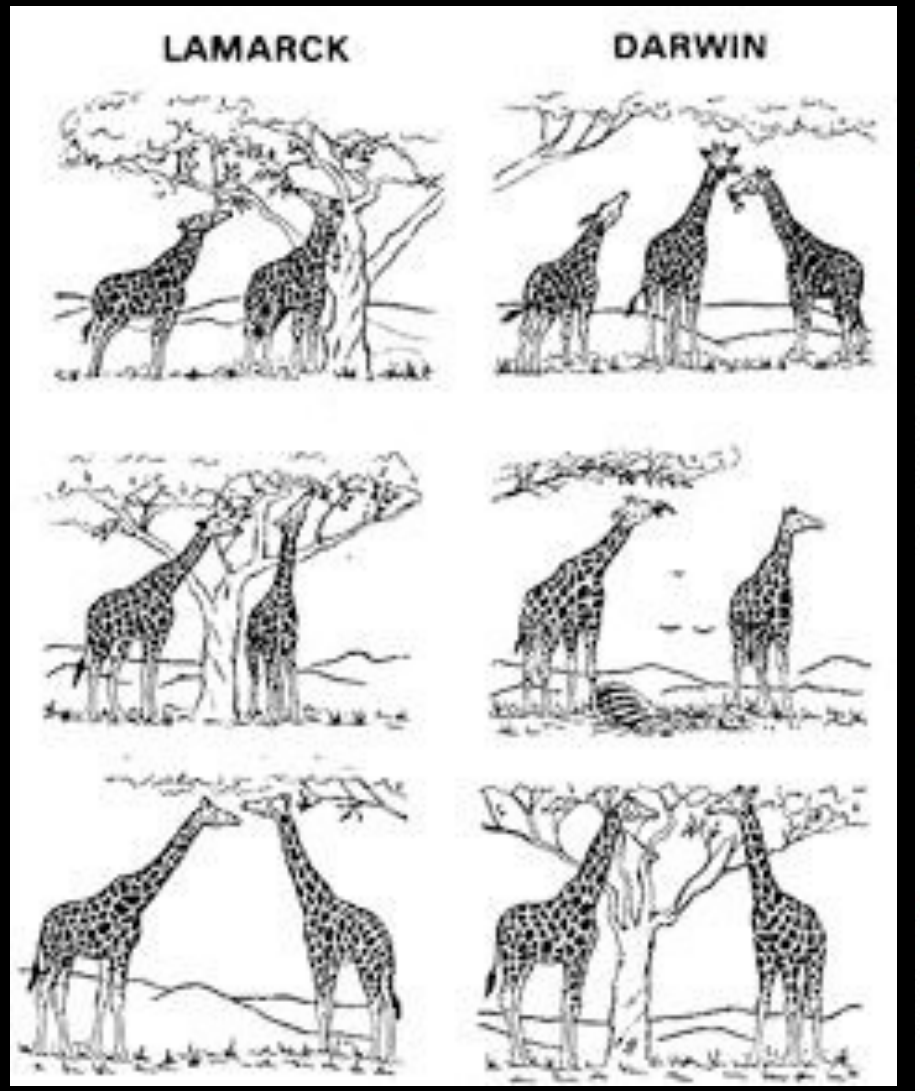
George Johnson, "A Creationist's Influence on Darwin," *NY Times* 05/23/14

Jean-Baptiste Lamarck [1744-1829]

- French naturalist
- Biologist
- The first to develop a truly coherent evolutionary theory
- The environment gives rise to changes in animals.
- Inheritance of acquired characteristics
  - aka soft inheritance
  - aka Lamarckism use/disuse theory
  - The force that perpetually tends to make order.
  - The adaptation of organisms to their environment.



Lamarck believed that the long necks of giraffes evolved as generations of giraffes reached for ever higher leaves.



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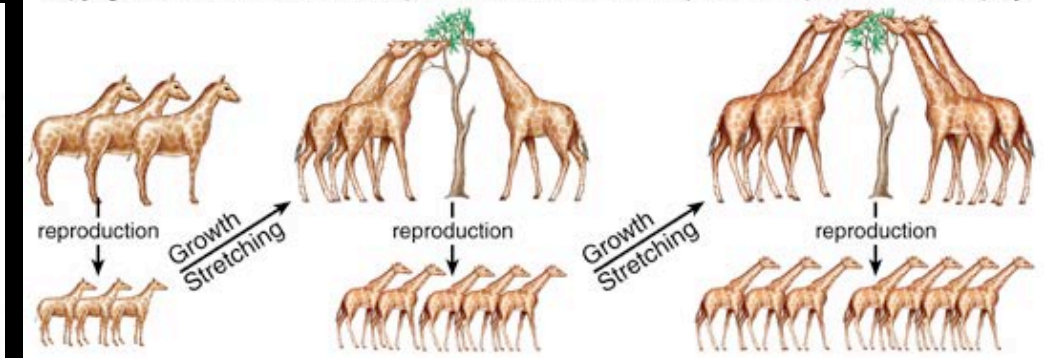
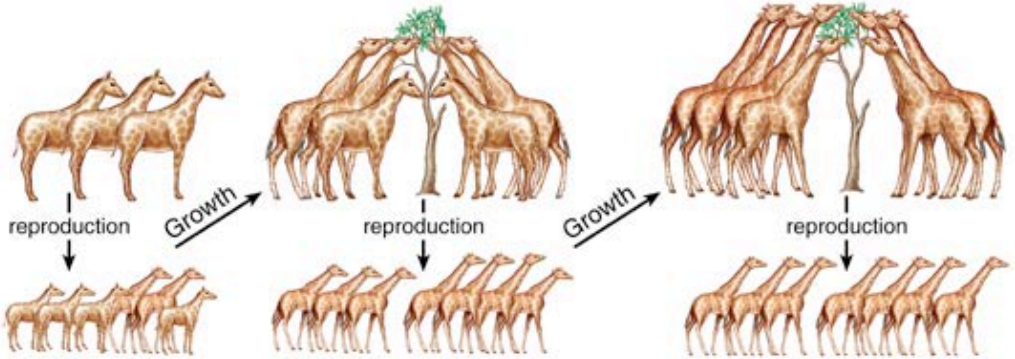


Proposed ancestor of giraffes has characteristics of modern-day okapi.

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.**



Some individuals born happen to have longer necks.

Over many generations, longer-necked individuals are more successful, perhaps because they can feed on taller trees. These successful individuals have more offspring and pass the long-neck trait on to them.

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

COMPARISON OF EVOLUTION MECHANISMS: SUMMARY

Lamarck's Hypothesis: The Inheritance of Acquired Characteristics

1. A **changing environment** creates a need for certain features to be developed in order to survive.*
2. **"Acquired Characteristics"**: Through use and/or non-use, those features needed for survival are developed in each individual.
3. **Inheritance**: Those characteristics developed ("acquired") by individuals are somehow passed on to their offspring, who can continue that development...
4. **New Species**: Eventually, over many generations, enough differences have developed that we can say we have a new species.

Darwin's Hypothesis: Natural Selection

1. **Overproduction**: More offspring produced than will ultimately survive and reproduce
2. **Variation**: Inheritable features vary from individual to individual.
3. **Change in environment**: Changes in climate, topography, food supply, predators, etc.
4. **"Struggle for existence":** Mainly competition within the species, for food, habitat, survival from being eaten
5. **"Survival of the fit"** (not necessarily the strongest): Those with more adaptive traits tend to survive longer and/or produce the most offspring; these are the "naturally selected".
6. **Inheritance of "selected" features**: Traits involved are already inheritable, but may involve new combinations.
7. **New Species,** better adapted to the new environment: When the collective traits of the population differ significantly from the earlier population, and can no longer reproduce with the earlier population.

QUICK COMPARISON

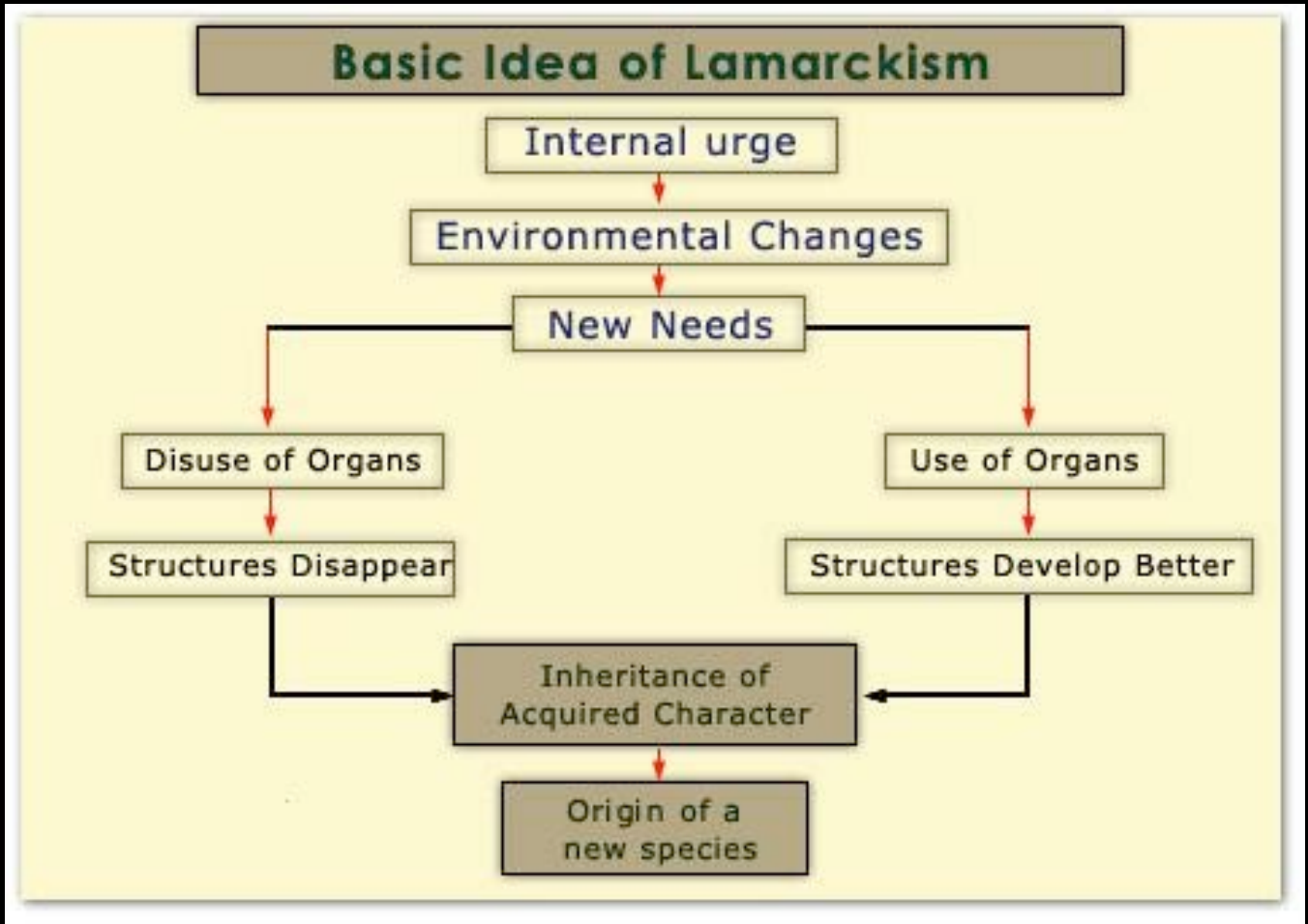
LAMARCK	DARWIN
1. Environment changes, creating a "need" to change	1. Variations of inheritable features which already normally are present
2. New features develop, "in order to survive" or "so that it can survive"	2. The environment selects features that will help the organism survive and others get eliminated
3. Traits gotten from parents are somehow passes down to the offspring	3. traits which help an organism to survive get passed on to offspring who inherit those traits

* Note the Anthropomorphic wording here ("something non-human having human motivations or attributes"). This could also be referred to as the "Mickey Mouse" syndrome. Be sure to avoid this kind of wording or implication in any explanations of Natural Selection.

========== COMMON MISCONCEPTIONS TO AVOID

1. Only groups of organisms can evolve (populations or species); individuals never evolve.
2. Adaptations, in the evolutionary sense, as properly used in class and text, can only "develop" as characteristics of a species, generally over a long period of time, involving many generations; these must not be confused with the "adjustments" an individual might make, consciously or otherwise, enabling it to survive better (such as "developing resistance to a disease" or "adapting to higher altitudes", etc.).

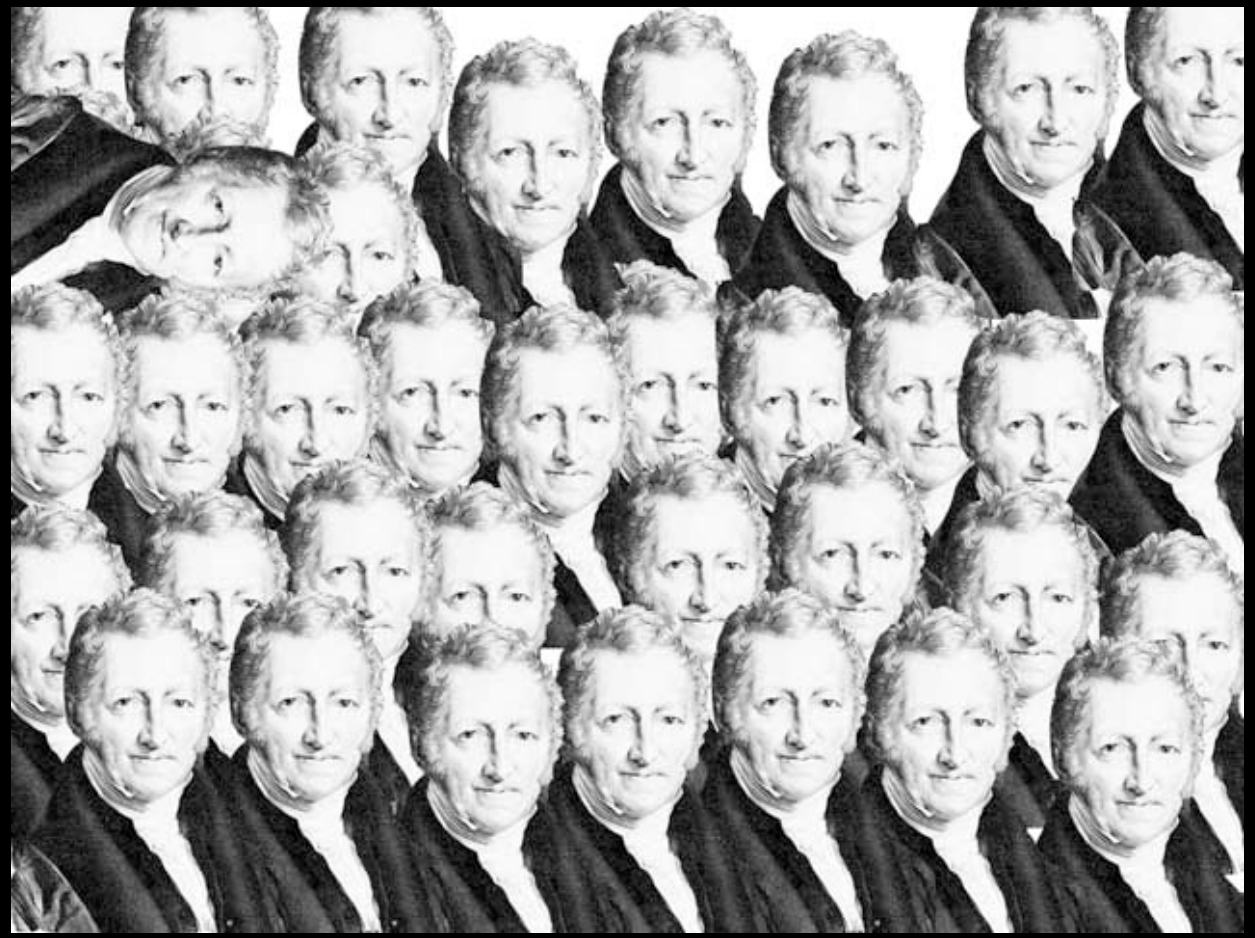
Lamarckism or Neo-Lamarckianism

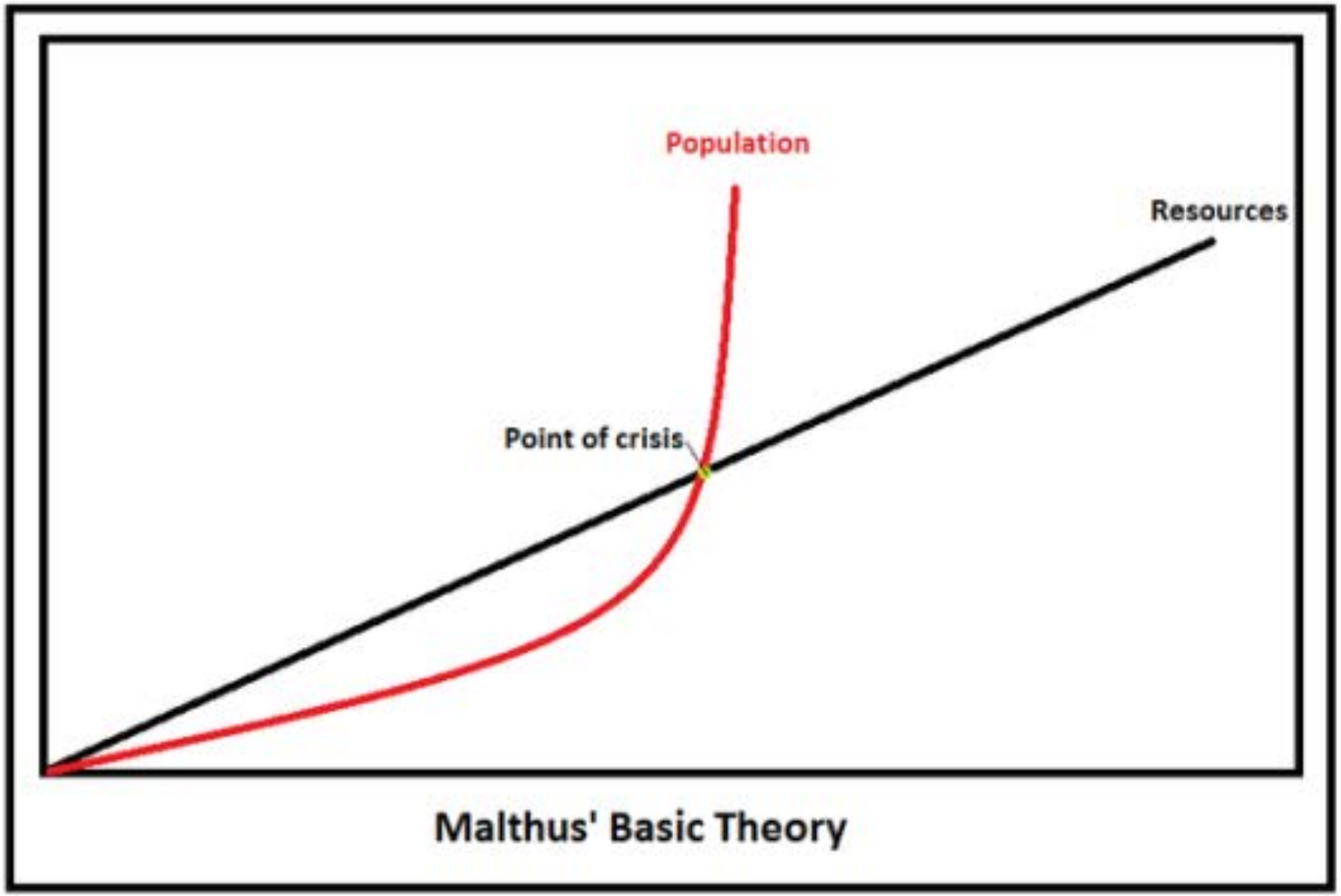


- **Lamarckism** (or **Lamarckian inheritance**) is the idea that an organism can pass on characteristics that it acquired during its lifetime to its offspring (also known as heritability of acquired characteristics or soft inheritance).
- 1880-present

Thomas Robert Malthus [1766-1834]

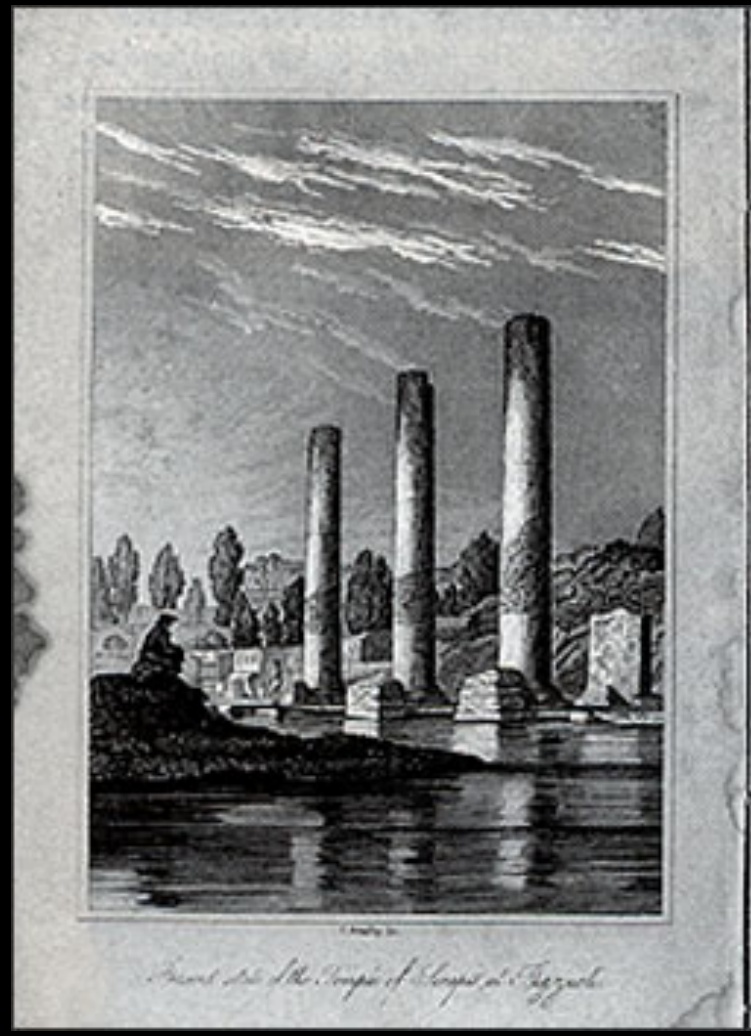
- English cleric and early political economist
- *An Essay on the Principal of Population* (1798)
- Malthus observed that an increase in a nation's food production improved the well-being of the populace, but the improvement was temporary because it led to population growth, which in turn restored the original per capita production level.
- “That the increase of population is necessarily limited by the means of subsistence,
  That population does invariably increase when the means of subsistence increase, and,
  That the superior power of population is repressed by moral restraint, vice and misery.”
- Malthus' theory informed the birth control and eugenics movements in the United States in the early 20th century.
- Eugenics is a movement to genetically improve the human race by regulating reproduction




Population
Resources
Point of crisis
Malthus' Basic Theory

Charles Lyell [1797-1875]

- British lawyer and geologist
- Deist
- Uniformitarianism - the assumption that the same natural laws and processes that operate in the universe now have always operated in the universe in the past and apply everywhere. It refers to invariance in the principles underpinning science, such as the constancy of causality, or causation, throughout time
- Charles Darwin read, and was much influenced by, Lyell's *Principles of Geology* (1830) while aboard HMS *Beagle*. This frontispiece image illustrates the main point of the book: that evidence of the forces of geological change that have been shaping Earth for millennia is observable today. The temple columns, with their high-water marks and evidence of marine encrustation, showed that the sea levels had changed several times, and so gradually that the monument was undisturbed.



PRINCIPLES
OF
GEOLOGY,

BEING

AN ATTEMPT TO EXPLAIN THE FORMER CHANGES
OF THE EARTH'S SURFACE,

BY REFERENCE TO CAUSES NOW IN OPERATION.

BY

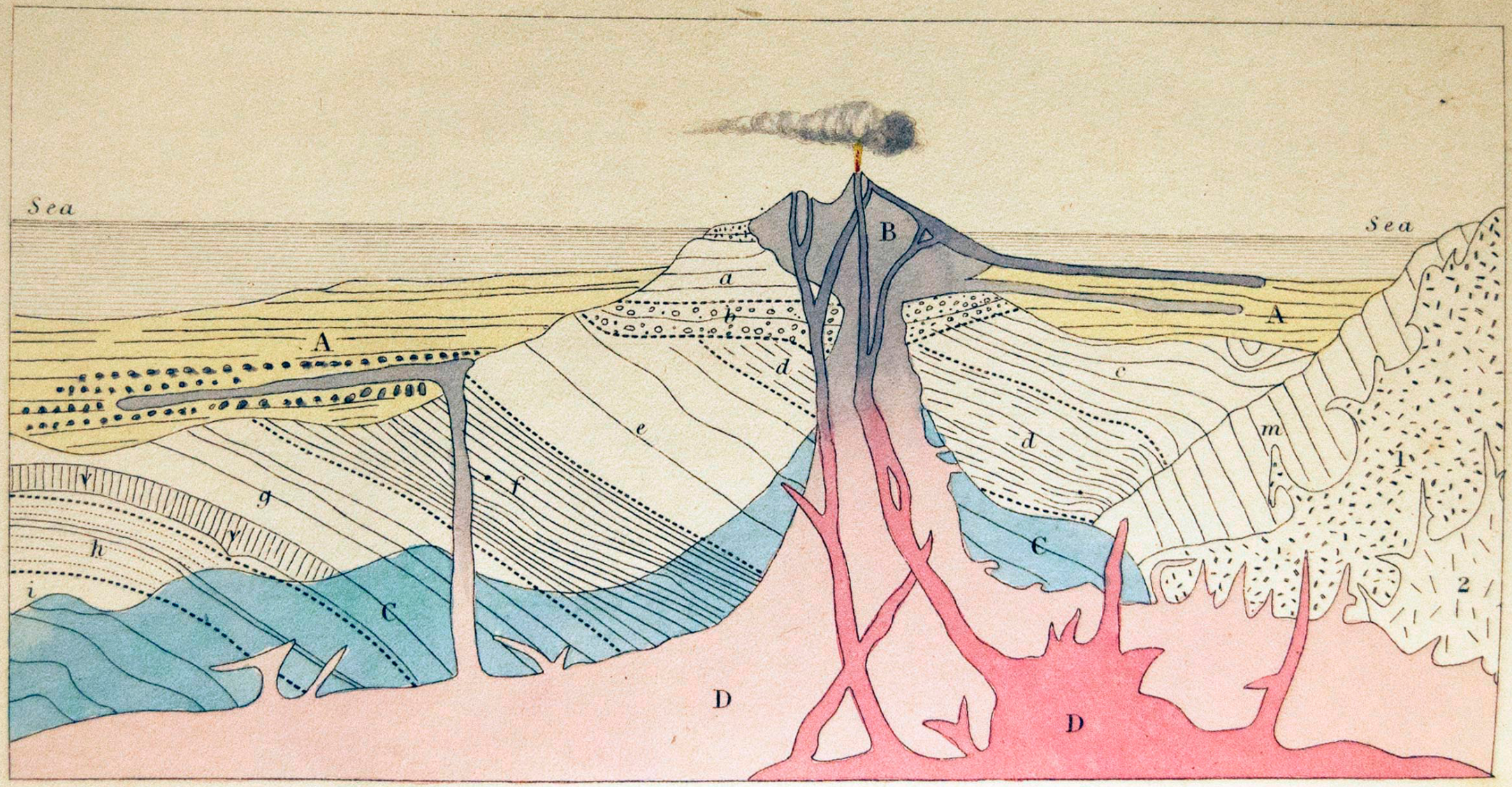
CHARLES LYELL, Esq., F.R.S.

FOR. SEC. TO THE GEOL. SOC., &c.

IN TWO VOLUMES.

Vol. I.

LONDON:
JOHN MURRAY, ALBEMARLE-STREET.



IDEAL SECTION of part of the Earth's crust *explaining the theory of the contemporaneous origin of the four great classes of rocks.—see Chap.1.*

A Aqueous

B Volcanic

C Metamorphic *(Gneiss, micaceous schist &c.)*

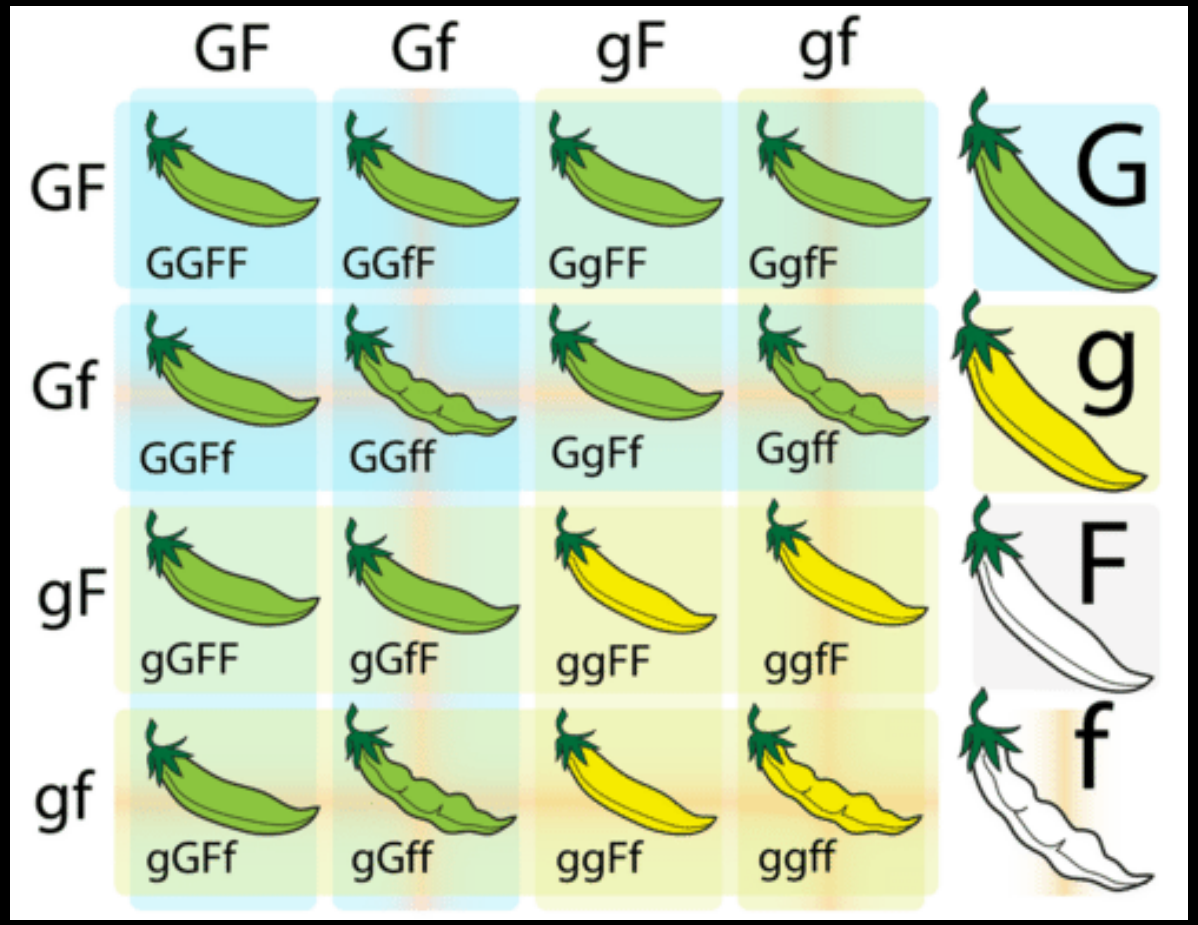
D Plutonic *(Granite &c.)*

All the rocks older than A.B.C.D *are left uncoloured.*

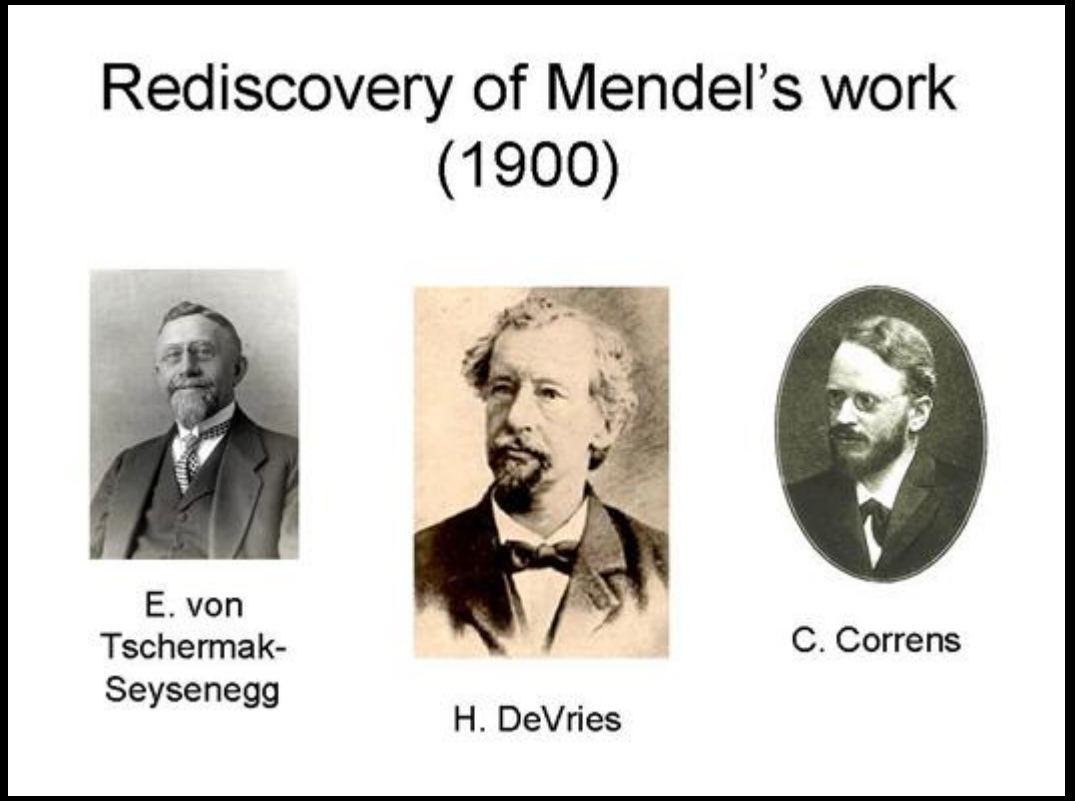
Gregor Mendel [1822-1884]

- Born in modern-day Czech Repulblic
- Scientist and Catholic Friar/Monk
- Referred to as the “Father of Genetics”
- Very shy; loved flowers; and kept extensive records of weather and stars
- Mendel did not set out to conduct the first well-controlled and brilliantly-designed experiments in genetics. His goal was to create hybrid pea plants and observe the outcome. His observations led to more experiments, which led to unusually prescient conclusions. By simply counting peas and keeping meticulous notes, Mendel established the principles of inheritance, coined the terms dominant and recessive, and was the first to use statistical methods to analyze and predict hereditary information. For eight years, Mendel cultivated thousands of pea plants and used a paintbrush to painstakingly transfer pollen from one plant to another to make his crosses (all the while still attending to his duties as a monk and a teacher).
- On February 8, 1865, Mendel presented his work to the Brunn Society for Natural Science. His paper, "Experiments on Plant Hybridization," was published the next year. While his work was appreciated for its thoroughness, no one seemed to grasp its importance. The work was simply too ahead of its time, too contrary to popular beliefs about heredity. "My time will come," Mendel once said, but it was over 30 years before his work was appreciated.

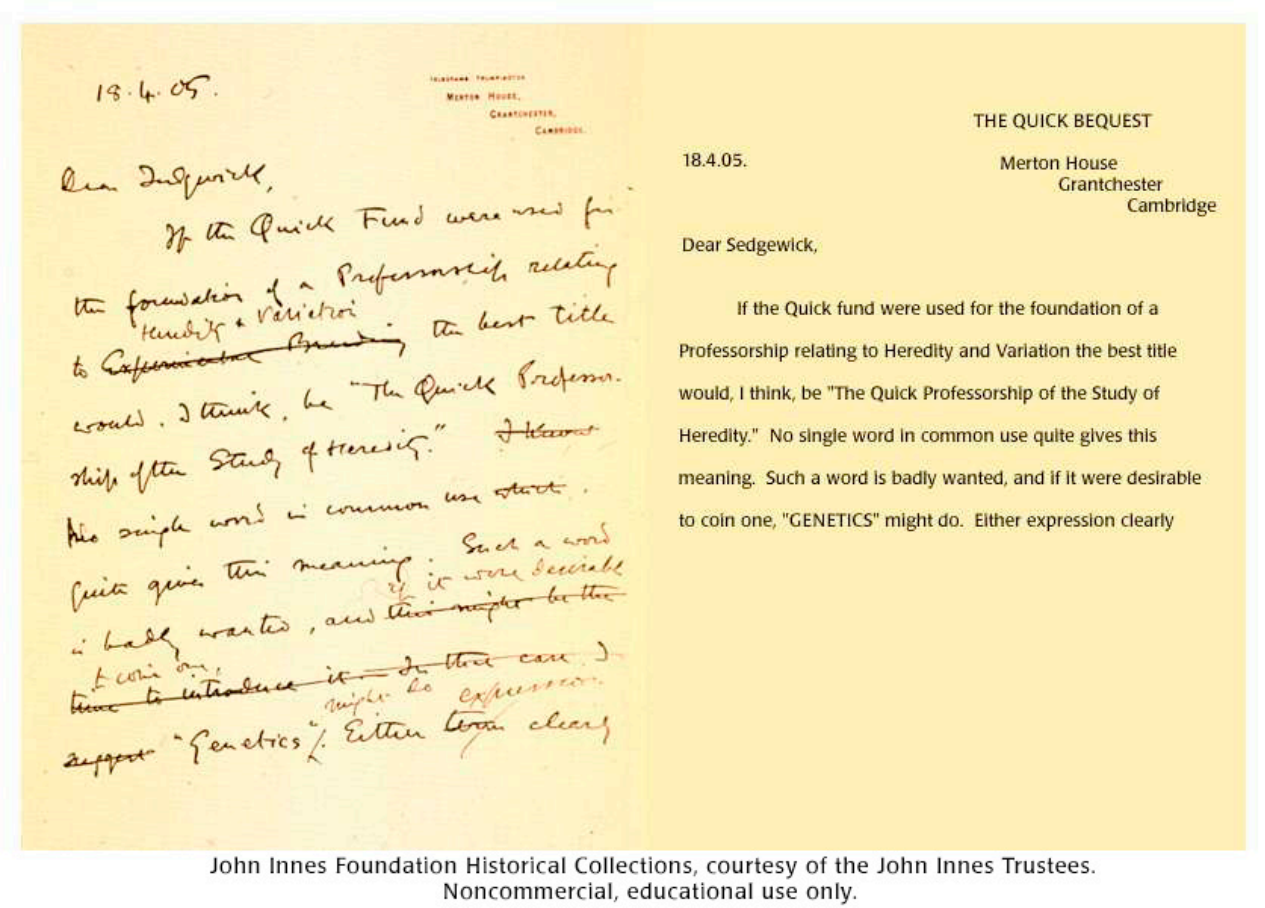
Mendelian Inheritance



- Three botanists - Hugo DeVries, Carl Correns and Erich von Tschermak - independently rediscovered Mendel's work in the same year, a generation after Mendel published his papers. They helped expand awareness of the Mendelian laws of inheritance in the scientific world.
- The three Europeans, unknown to each other, were working on different plant hybrids when they each worked out the laws of inheritance. When they reviewed the literature before publishing their own results, they were startled to find Mendel's old papers spelling out those laws in detail. Each man announced Mendel's discoveries and his own work as confirmation of them.
- By 1900, cells and chromosomes were sufficiently understood to give Mendel's abstract ideas a physical context.



British naturalist William Bateson [1861-1926] in 1905 coined the term genetics from the word gene. First page of a 1905 letter written by William Bateson, first Director of the John Innes Institute, to Adam Sedgewick, Cambridge professor. Bateson coined the term "genetics" in this letter.



18.4.05.

THE QUICK BEQUEST

Merton House
Grantchester
Cambridge

Dear Sedgewick,

If the Quick fund were used for the foundation of a Professorship relating to Heredity and Variation the best title would, I think, be "The Quick Professorship of the Study of Heredity." No single word in common use quite gives this meaning. Such a word is badly wanted, and if it were desirable to coin one, "GENETICS" might do. Either expression clearly

John Innes Foundation Historical Collections, courtesy of the John Innes Trustees.
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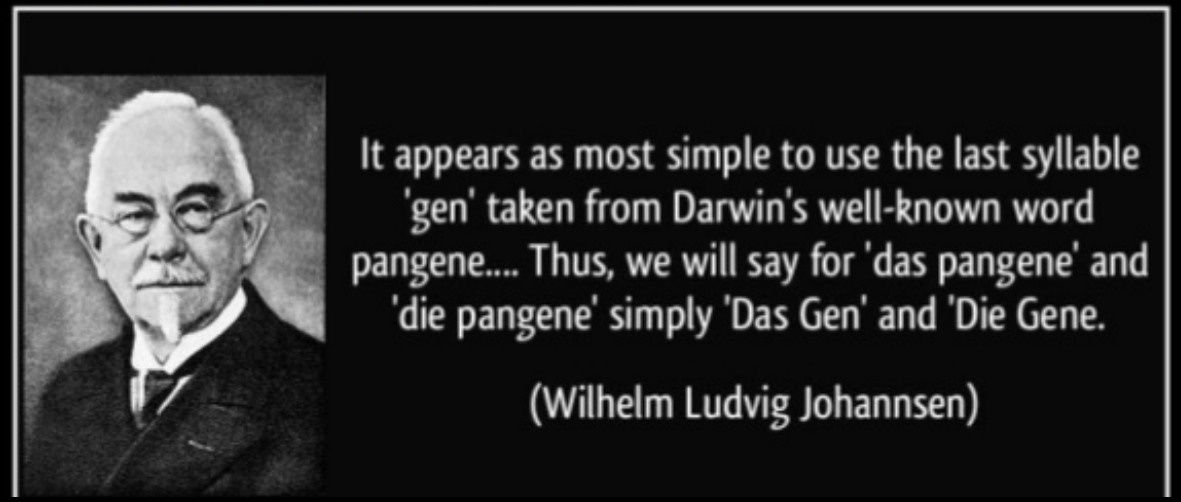
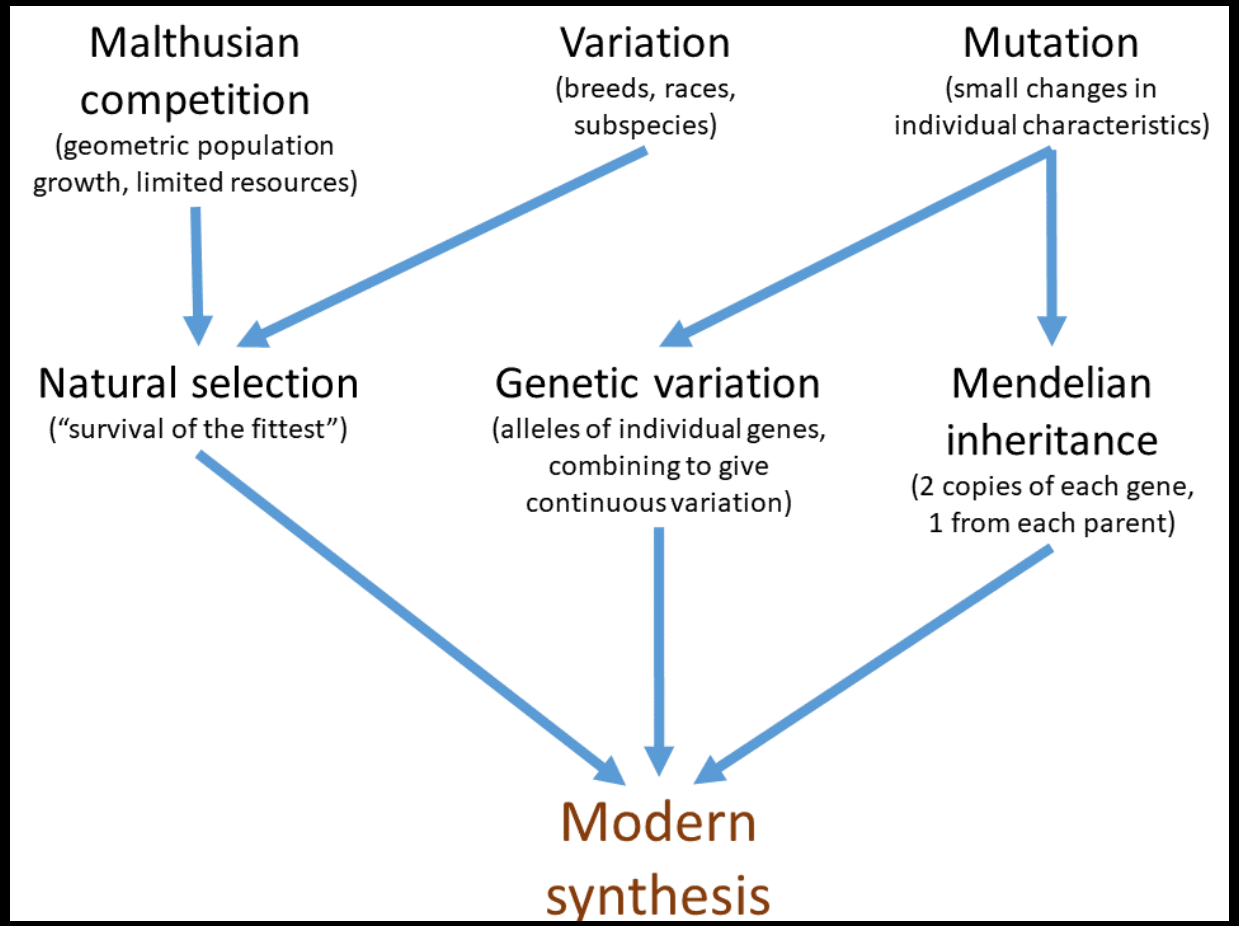
- 1909: the word gene was coined by Wilhelm Johannsen, thus giving genetics its name



Danish botanist and plant physiologist Wilhelm Johannsen [1857-1927] coined the terms “gene” and ”genotype.”

Theodosius Dobzhansky [1900-1975]

- Russian-American geneticist and evolutionary biologist
- He provided laboratory evidence for natural selection and variation where previously there had been only field observation.
- Dobzhansky's work with *Drosophila*, or fruit flies, provided new evidence that supported Darwin’s theory that natural selection, acting on genetic variation in populations, is a driving force in evolution.
- Dobzhansky's ability to combine genetics and natural history attracted many other biologists to join him in the effort to find a unified explanation of how evolution happens. Their combined work, known as "The Modern Synthesis," brought together genetics, paleontology, systematics, and many other sciences into one powerful explanation of evolution, showing how mutations and natural selection could produce large-scale evolutionary change. The Modern Synthesis certainly did not bring the study of evolution to an end, but it became the foundation for future research.



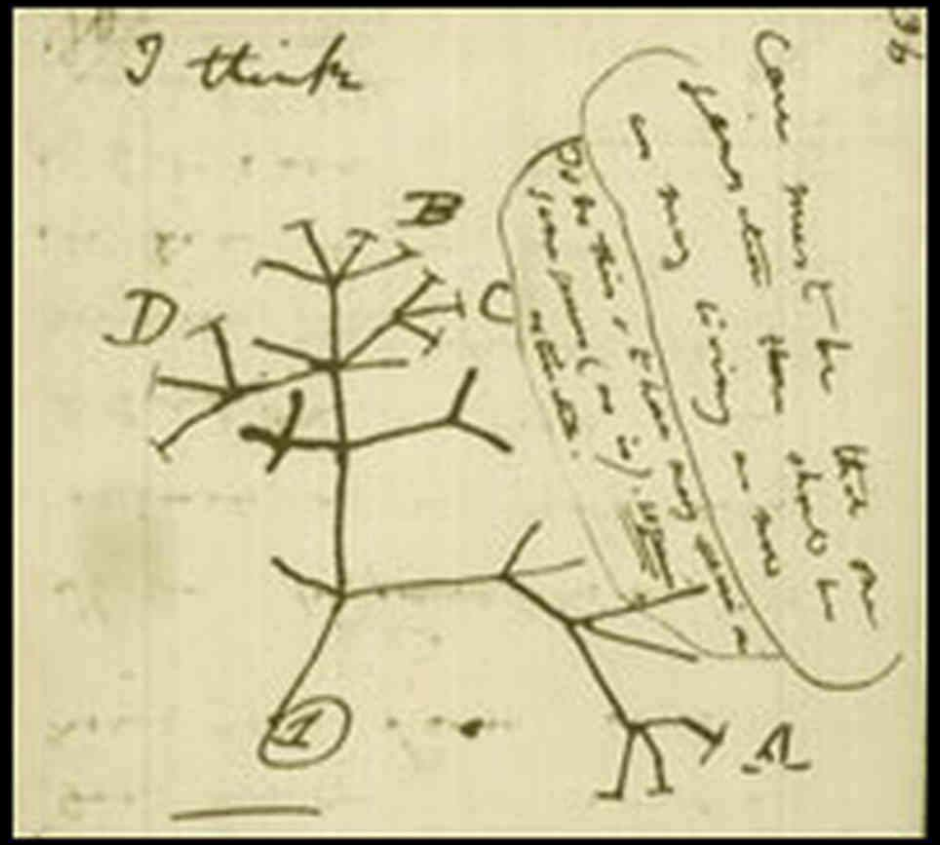
The Modern Synthesis describes the fusion (merger) of Mendelian genetics with Darwinian evolution that resulted in a unified theory of evolution. It is sometimes referred to as the Neo-Darwinian theory. The Modern Synthesis was developed by a number of now-legendary evolutionary biologists in the 1930s and 1940s.

Terms

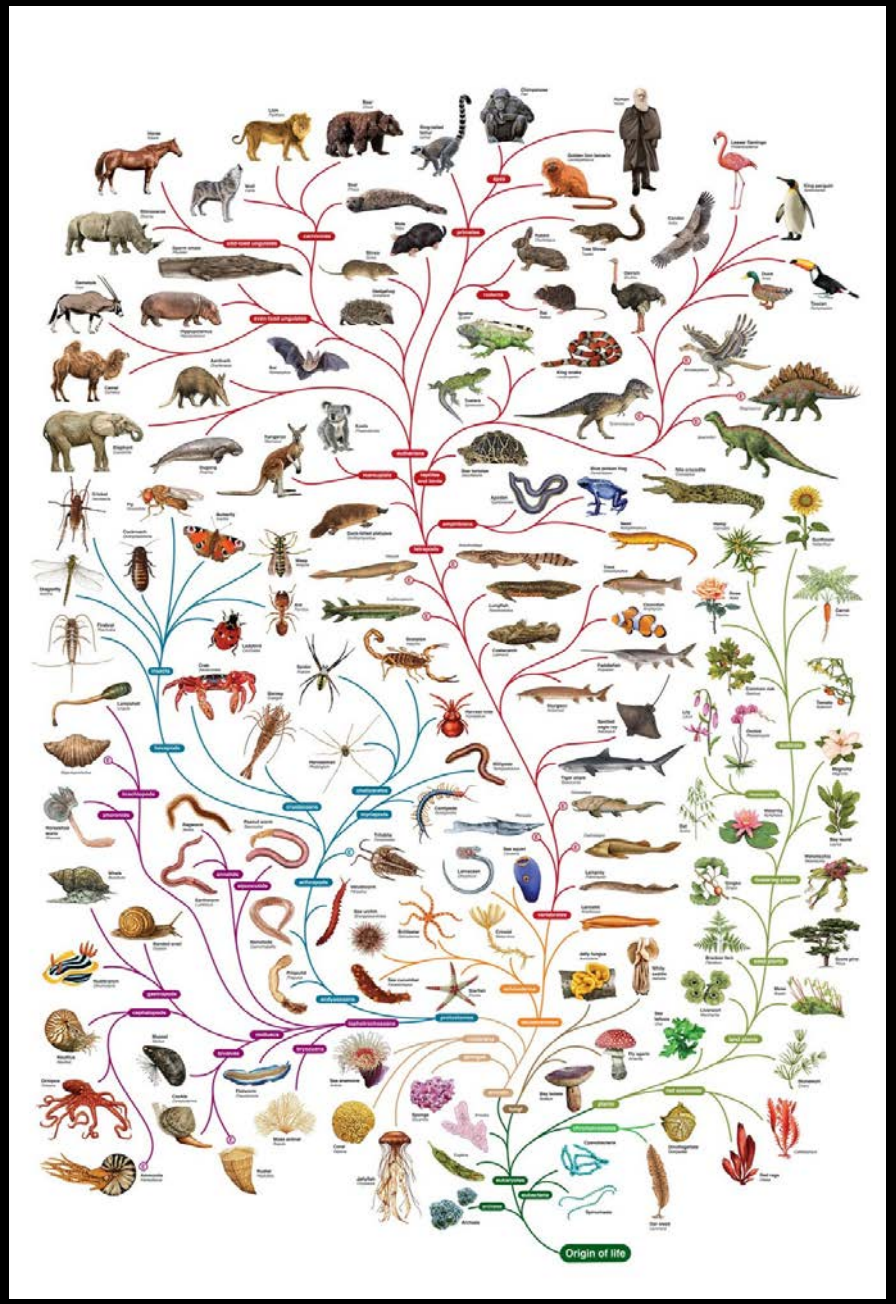
- Natural Selection
- Adaption
- Chance
- Phylogeny
- Ontogeny
- Fitness
- Systems/Complex Systems
- Developmental Genetics
- Nonlinear dynamics
- Modern Synthesis
- Expanded Synthesis

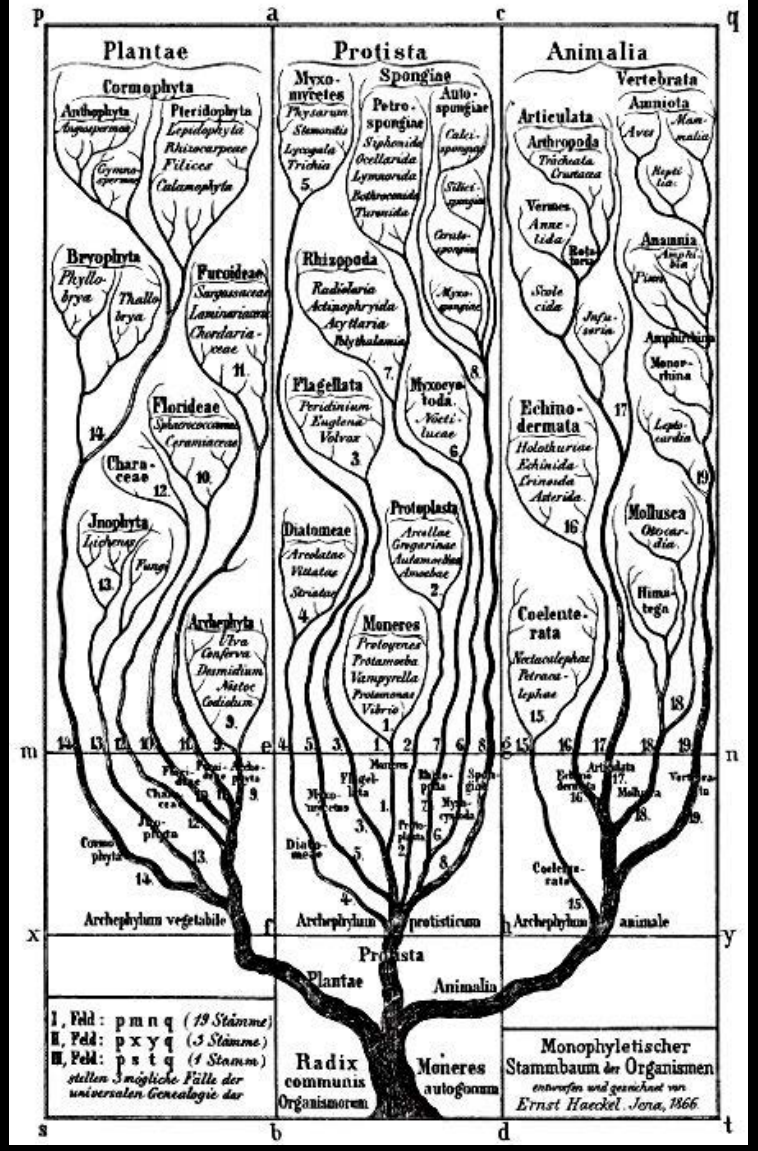
- Malthusianism, Adam Smith, and Political Economy within Darwin's theory of evolution
- Newtonian physics versus Second Law of Thermodynamics
- Punctuated equilbrium
- Evolvability
- Reductionism
- "Between physics envy and physics allergy." (25)
- Models and metaphors

Charles Darwin and Visualizations of His Ideas

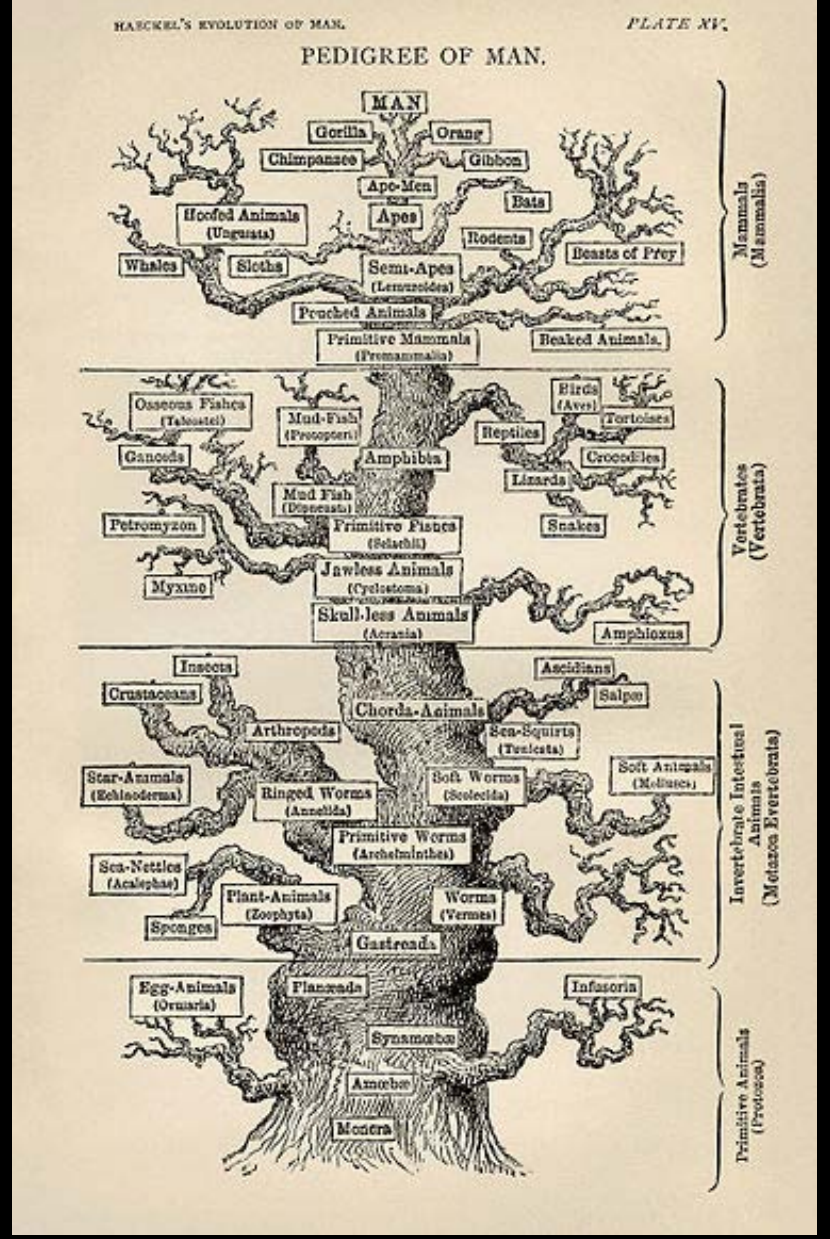


Charles Darwin, Tree of Life, 1837

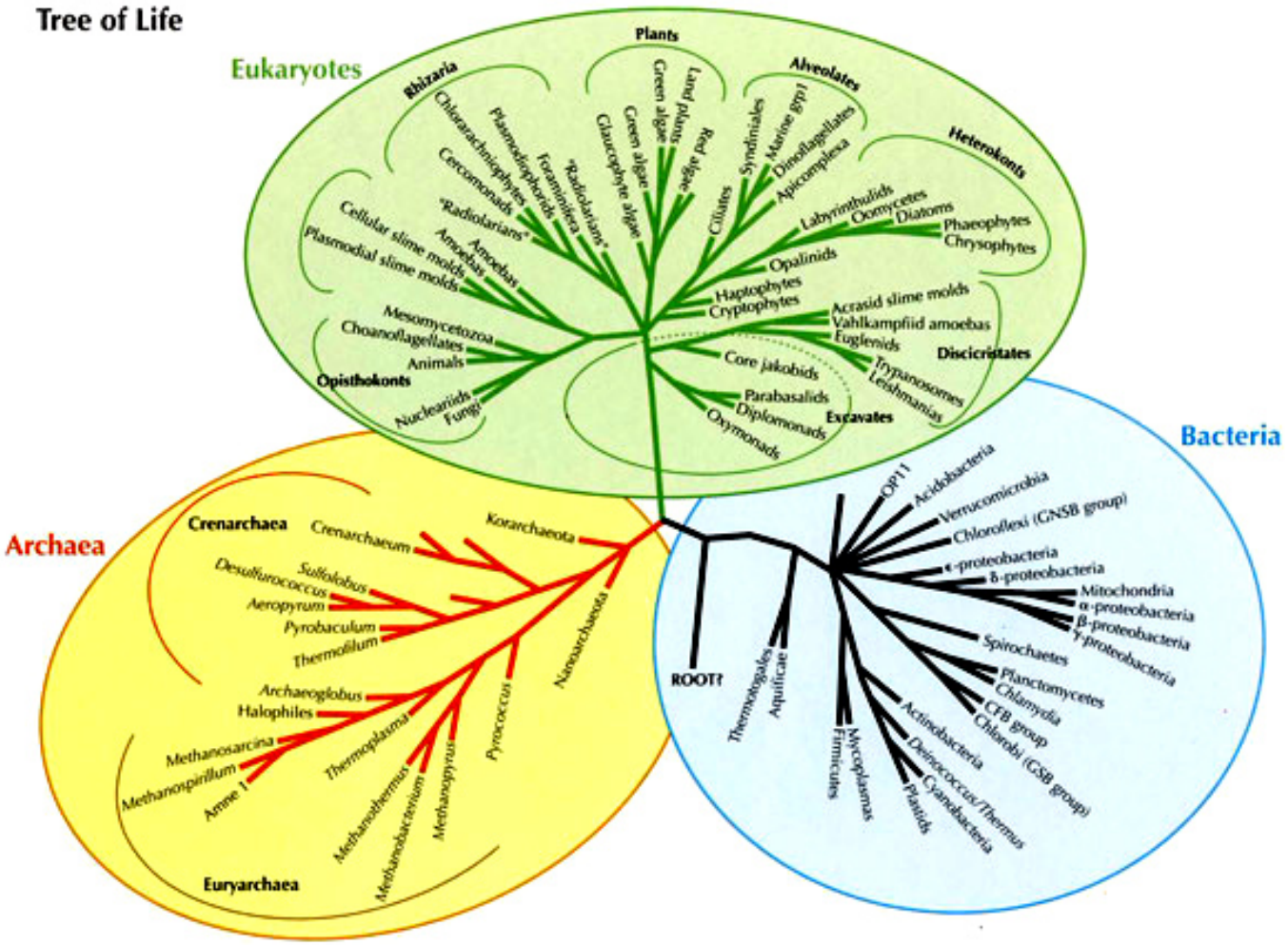


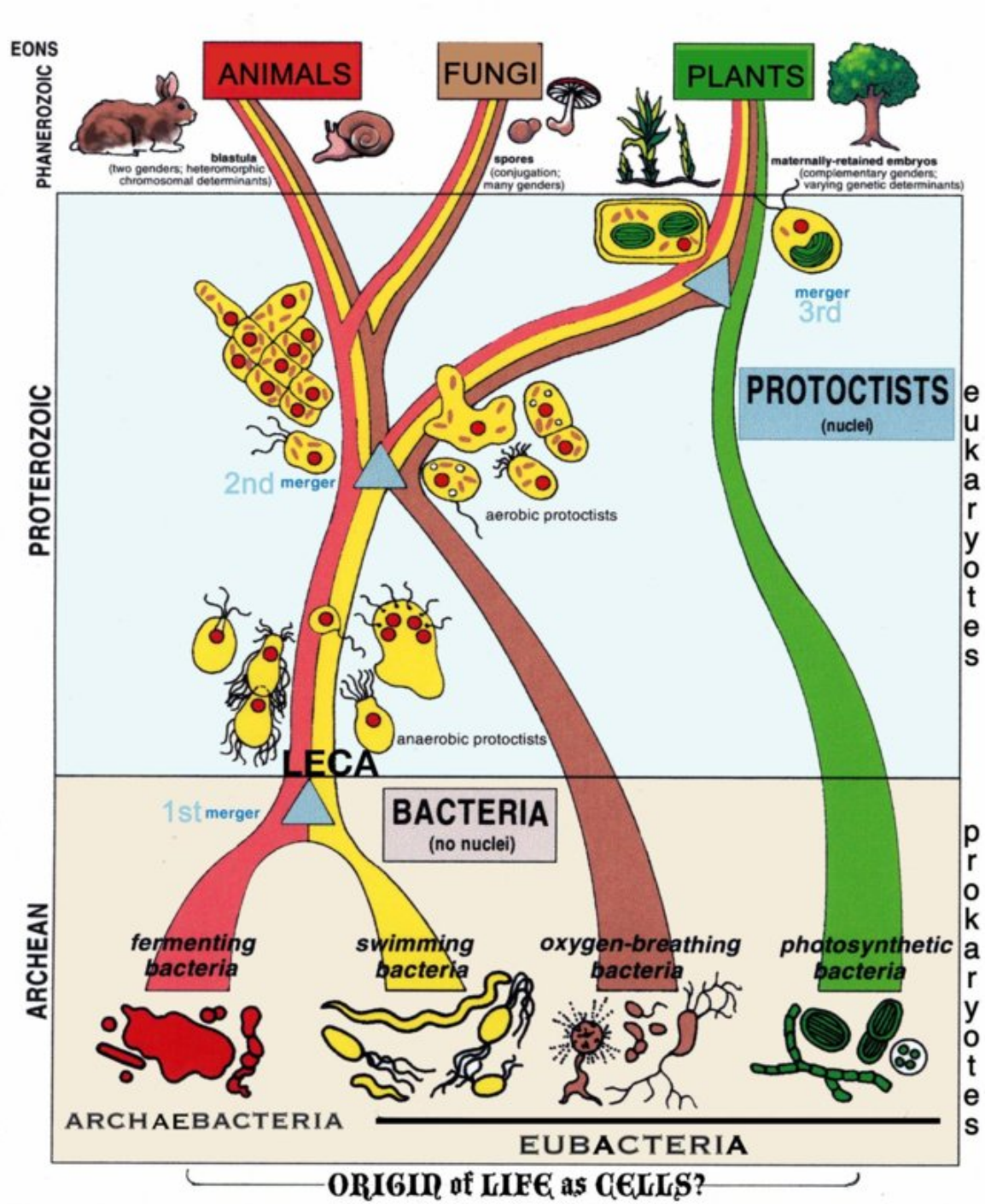


Ernst Haeckel's *Monophyletic tree of organisms*, 1866. Biologists at the time identified three major groups of species: animals, plants and *protista*; primitive, mostly unicellular, organisms. Modern biologists also classify all life into three groups, but now animals and plants are considered to belong to the same group, with two different types of bacteria making up the other two groups.

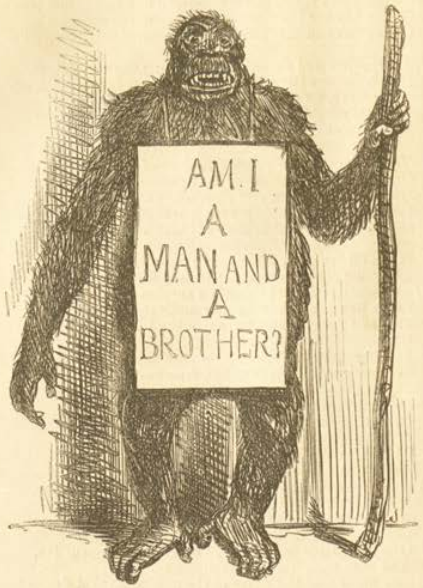


Tree of Life by Ernst Haeckel in *The Evolution of Man* (1879) illustrates the 19th-century view that evolution was a progressive process leading towards man.


Tree of Life
Eukaryotes
Archaea
Bacteria
Plants
Rhizaria
Alveolates
Heterokonts
Opisthokonts
Discicristates
Excavates
Crenarchaea
Euryarchaea
Korarchaeota
Nanoarchaeota
Pyrococcus
ROOT?
Thermotogales
Aquificae
Mycoplasmas
Firmicutes
Actinobacteria
Deinococcus/Thermus
Cyanobacteria
Plastids
Spirochaetes
Planctomycetes
Chlamydia
CFB group
Chlorobi (GSB group)
OP11
Acidobacteria
Verrucomicrobia
Chloroflexi (GNSB group)
δ-proteobacteria
Mitochondria
α-proteobacteria
β-proteobacteria
γ-proteobacteria
Green algae
Land plants
Red algae
Glaucophyte algae
Ciliates
Syndiniales
Marine grp I
Dinoflagellates
Apicomplexa
Labyrinthulids
Oomycetes
Diatoms
Phaeophytes
Chrysophytes
Opalinids
Haptophytes
Cryptophytes
Acrasid slime molds
Vahlkampfiid amoebas
Euglenids
Trypanosomes
Leishmanias
Core jakobids
Parabasalids
Diplomonads
Oxymonads
Chlorarachniophytes
Plasmodiophorids
Foraminifera
"Radiolarians"
Cercomonads
"Radiolarians"
Amoebas
Cellular slime molds
Amoebas
Plasmodial slime molds
Mesomycetozoa
Choanoflagellates
Animals
Nucleariids
Fungi
Crenarchaeum
Desulfurococcus
Sulfolobus
Aeropyrum
Pyrobaculum
Thermofilum
Archaeoglobus
Halophiles
Methanosarcina
Methanospirillum
Arme 1
Thermoplasma
Methanothermus
Methanobacterium
Methanopyrus


EONS
PHANEROZOIC
PROTEROZOIC
ARCHEAN
ANIMALS
FUNGI
PLANTS
blastula
(two genders; heteromorphic chromosomal determinants)
spores
(conjugation; many genders)
maternally-retained embryos
(complementary genders; varying genetic determinants)
merger 3rd
PROTOCTISTS
(nuclei)
2nd merger
aerobic protoctists
anaerobic protoctists
LECA
1st merger
BACTERIA
(no nuclei)
fermenting bacteria
swimming bacteria
oxygen-breathing bacteria
photosynthetic bacteria
ARCHAEBACTERIA
EUBACTERIA
eukaryotes
prokaryotes
ORIGIN of LIFE as CELLS?

MONKEYANA.



AM I satyr or man?
Pray tell me who can,
And settle my place in the scale.
A man in ape's shape,
An anthropoid ape,
Or monkey deprived of his tail?

The *Vestiges* taught,
That all came from naught
By "development," so called, "progressive;"
That insects and worms
Assume higher forms
By modification excessive.

Then DARWIN set forth.
In a book of much worth,
The importance of "Nature's selection;"
How the struggle for life
Is a laudable strife,
And results in "specific distinction."

Let pigeons and doves
Select their own loves,
And grant them a million of ages,
Then doubtless you'll find
They've altered their kind,
And changed into prophets and sages.

LEONARD HORNER relates,
That Biblical dates
The age of the world cannot trace;
That Bible tradition,
By Nile's deposition,
Is put to the right about face.

Then there's PENGELLY
Who next will tell ye
That he and his colleagues of late
Find celts and shaped stones
Mixed up with cave bones
Of contemporaneous date.

Then PRESTWICH, he pelts
With hammers and celts
All who do not believe his relation,
That the tools he exhumes
From gravelly tombs
Date before the Mosaic creation.

Then HUXLEY and OWEN,
With rivalry glowing,
With pen and ink rush to the scratch;
'Tis Brain *versus* Brain,
Till one of them's slain;
By Jove! it will be a good match!

Says OWEN, you can see
The brain of Chimpanzee
Is always exceedingly small,
With the hindermost "horn"
Of extremity shorn,
And no "Hippocampus" at all.

The Professor then tells 'em
That man's "cerebellum,"
From a vertical point you can't see;
That each "convolution"
Contains a solution,
Of "Archencephalic" degree.

Then apes have no nose,
And thumbs for great toes,
And a pelvis both narrow and slight;
They can't stand upright,
Unless to show fight,
With "DU CHAILLU," that chivalrous knight!

Next HUXLEY replies,
That OWEN he lies,
And garbles his Latin quotation;
That his facts are not new,
His mistakes not a few,
Detrimental to his reputation.

"To twice slay the slain,"
By dint of the Brain,
(Thus HUXLEY concludes his review)
Is but labour in vain,
Unproductive of gain,
And so I shall bid you "Adieu!"

Zoological Gardens, May, 1861. GORILLA.

PUNCH'S ESSENCE OF PARLIAMENT.

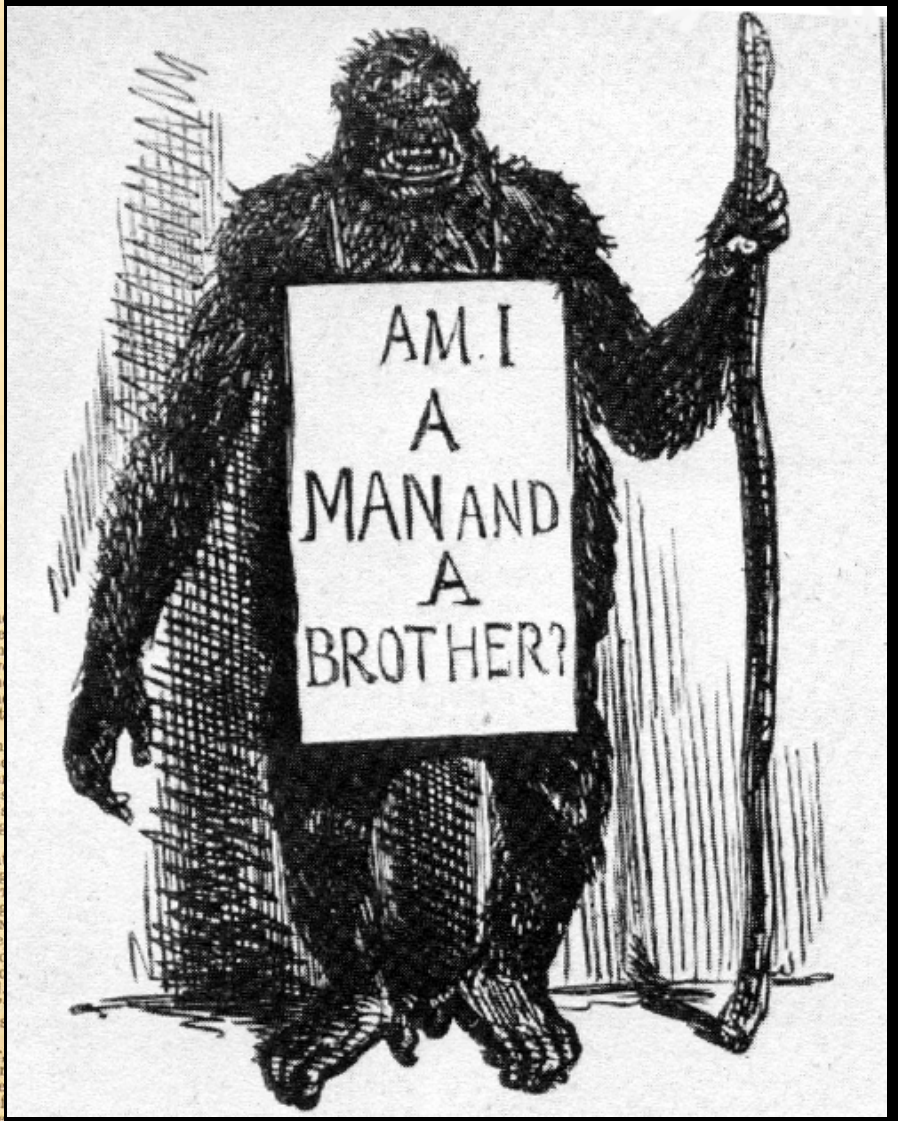
MONDAY, *May* 6. The Lords had a discussion about the Canal of the Future, that is to say, the impossible trench which M. LESSEPS pre tends to think he can cut through the Isthmus of Suez. The Govern ment opinion upon the subject is, that if the Canal could be made, w ought not, for political reasons, to allow it, but that inasmuch as th Canal cannot be cut, the subject may, and the wise course is to let th speculators ruin themselves and diddle the Pacha. This seems straight forward and benevolent enough.

MR. SPEAKER DENISON, who had had a relapse into indisposition re-appeared, and made his apologies for having been ill. The Hous cheered him so loudly that he began to think he had done a clever thing, rather than not, in catching the rheumatism. *Mr. Punch* hopes to behold the brave Speaker "astir in his saddle" (as MR. DISRAELI's song goes) in due season, and to see him, like a true Whig, following Fox and avoiding pit.

LORD JOHN RUSSELL made an important reply to an important question from MR. GREGORY. The American Difficulty is beginning to create English difficulties. The North is calling on PRESIDENT LINCOLN to blockade the ports of the South, and the South is sending out Privateers to intercept the commerce of the North. LORD JOHN announced that England can recognise no blockade except a real one and that she is prepared to regard the South as sufficiently consolidated to entitle her to be treated as a Belligerent, not as a mere rebel, and therefore her right to issue letters of marque must be acknowledged. This is a very prosaic paragraph, but *Mr. Punch* "reserves to himself" the right to be grave, gay, lively, and severe exactly when it pleases him.

Our Daughter ALICE is to have £30,000 down, and £6,000 a year. LORD PALMERSTON remarking, very properly, that she is not our Eldest Daughter, and may not require the same allowance as the future QUEEN OF PRUSSIA, but that it is not for the honour of England that her Princesses should go out as paupers. Quite the reverse, and what is more, *Mr. Punch* insists that all the money be settled on his amiable young friend ALICE, so that she may draw her own cheques, and not have to ask her husband for money every time she wants to buy pins or postage stamps, or a little present to send over to her dear *Mr. Punch*.

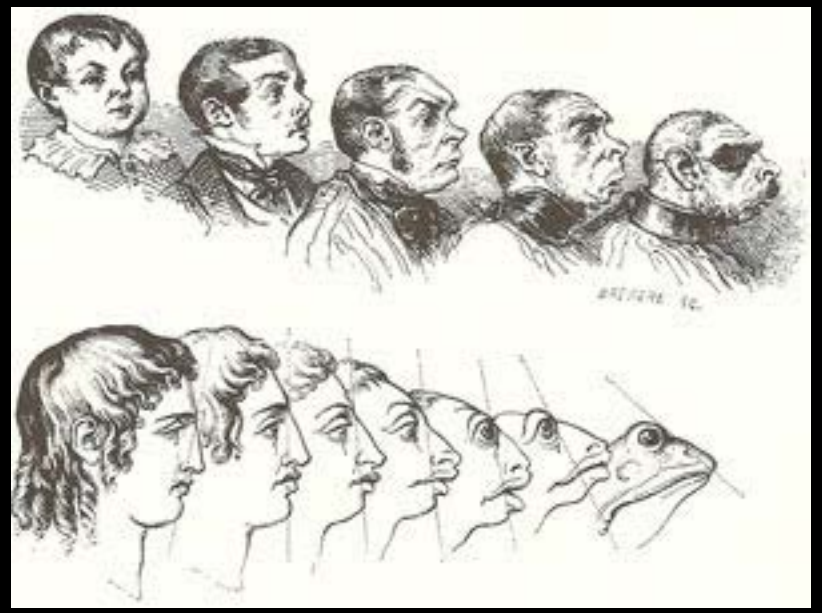
Then was the Paper Resolution moved by MR. GLADSTONE. LORD ROBERT CECIL opposed it, and hoped the Lords would reject the Bill to be based on it; MR. LEVESON GOWER approved it, and paraded the

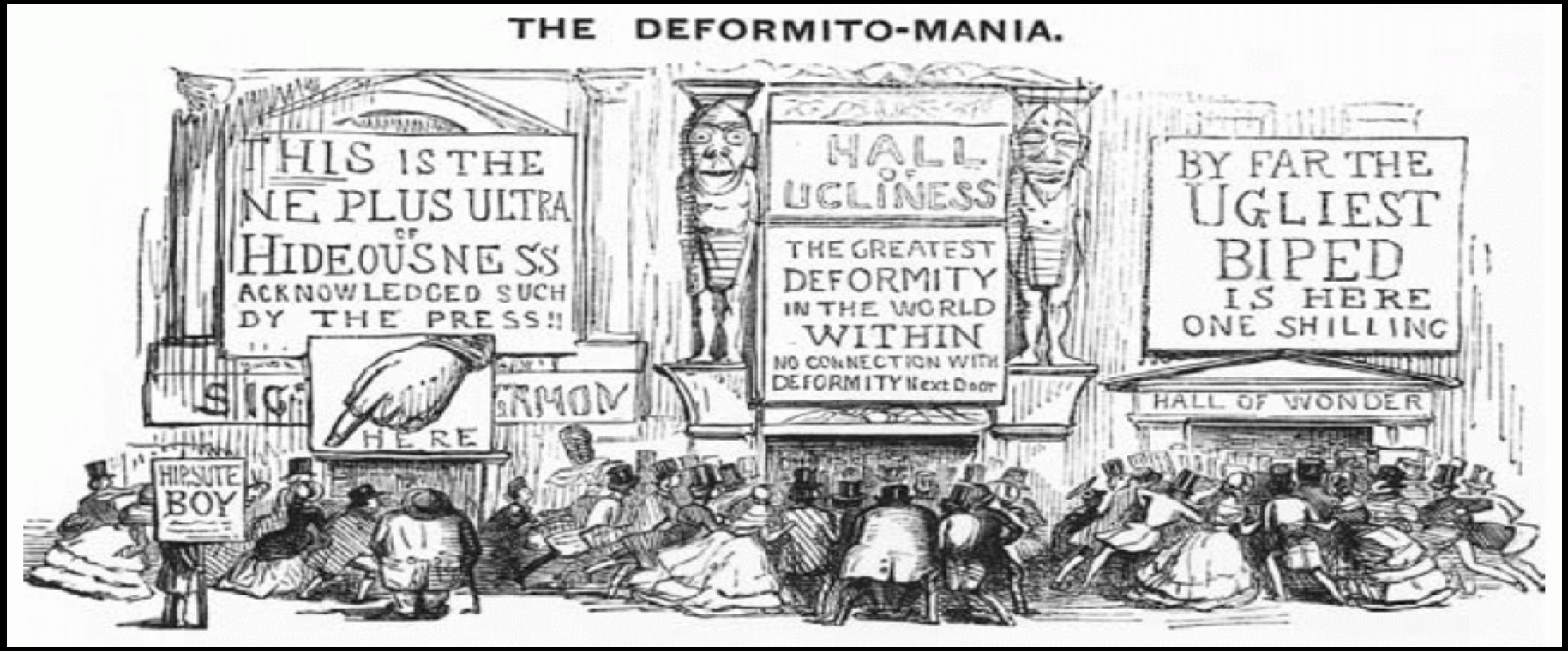


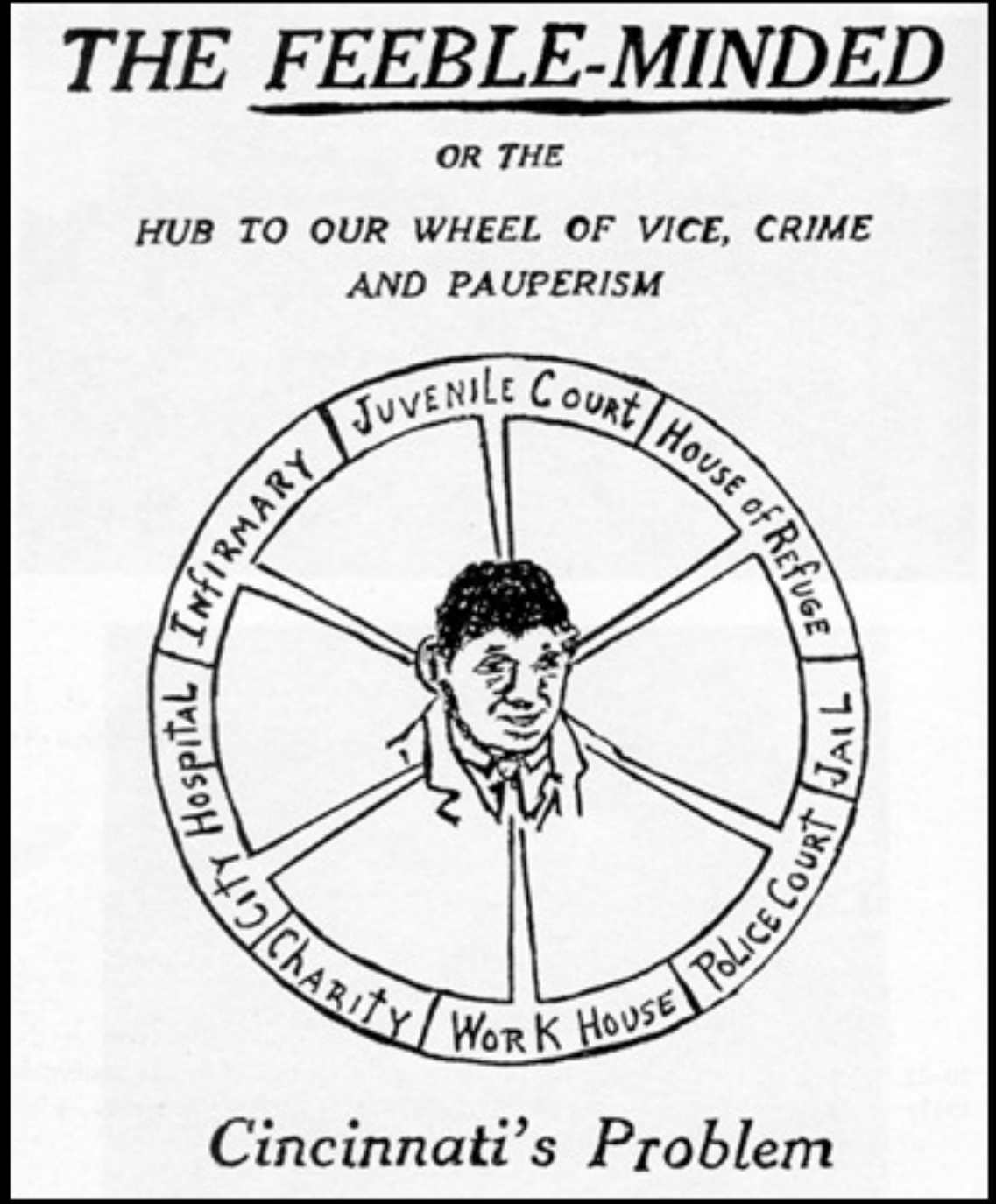
PUNCH'S FANCY PORTRAITS.—No. 54

CHARLES ROBERT DARWIN, LL.D., F.R.S.

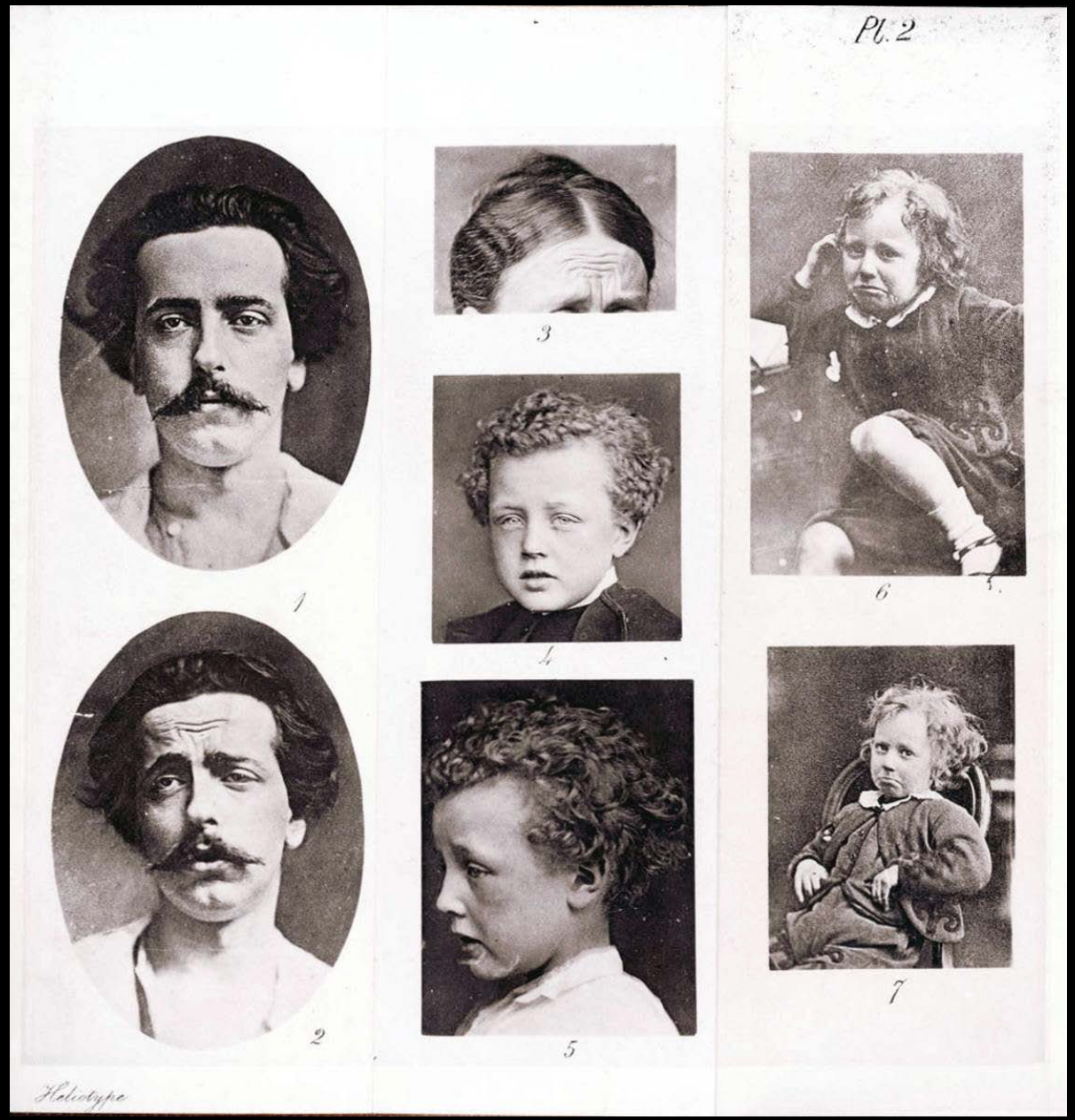
IN HIS *DESCENT OF MAN* HE BROUGHT HIS OWN SPECIES DOWN AS LOW AS POSSIBLE—*I.E.*, TO "A HAIRY QUADRUPED FURNISHED WITH A TAIL AND POINTED EARS, AND PROBABLY *ARBOREAL* IN ITS HABITS"—WHICH IS A REASON FOR THE VERY GENERAL INTEREST IN A "FAMILY TREE." HE HAS LATELY BEEN TURNING HIS ATTENTION TO THE "POLITIC WORM."




THE DEFORMITO-MANIA.
THIS IS THE NE PLUS ULTRA OF HIDEOUSNESS ACKNOWLEDGED SUCH BY THE PRESS!!
HERE
HIPSUITE BOY
HALL OF UGLINESS
THE GREATEST DEFORMITY IN THE WORLD WITHIN
NO CONNECTION WITH DEFORMITY Next Door
BY FAR THE UGLIEST BIPED IS HERE ONE SHILLING
HALL OF WONDER



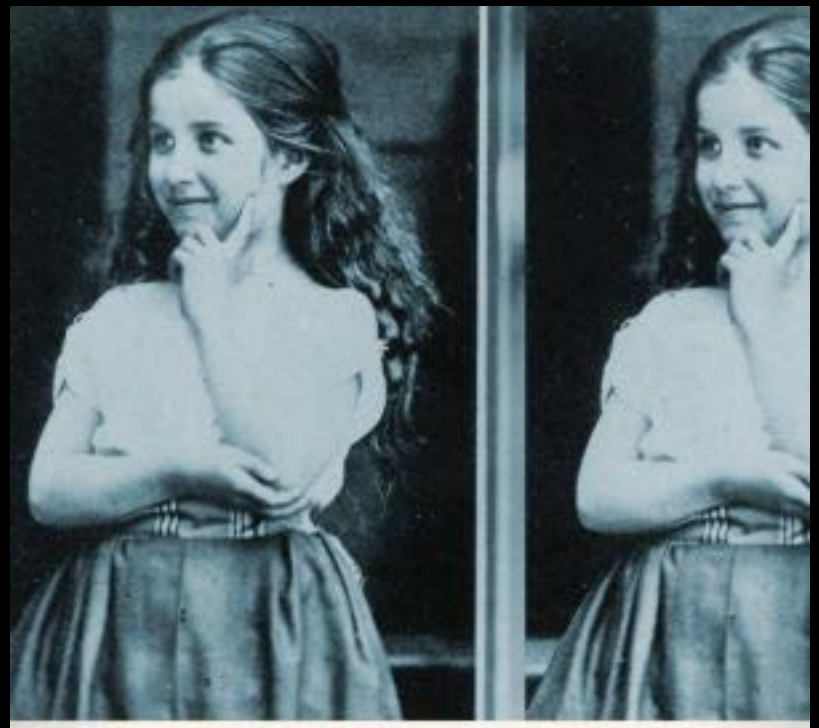
Social Darwinism



In 1872, some thirteen years after *The Origin of Species*, **Charles Darwin** published *The Expression of the Emotions in Man and Animals,* one of the first scientific texts to use photographic illustrations.

A page of photographs by Oscar Rejlander from the Darwin Archive, 1871-1872. Albumen prints.

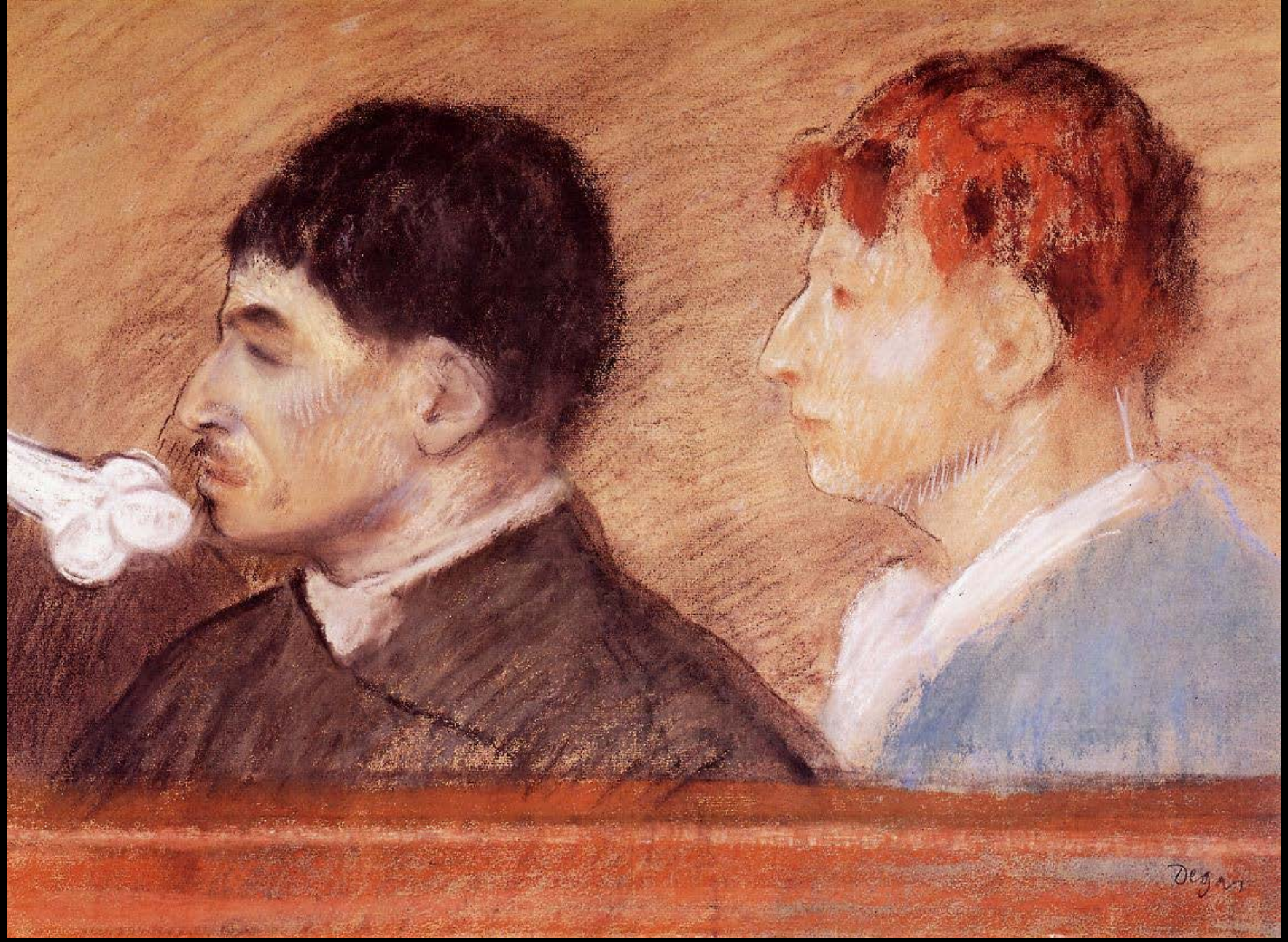
Infants: Suffering and Weeping. Heliotype print.



PHILLIP PRODGER

DARWIN'S CAMERA

ART AND PHOTOGRAPHY IN THE THEORY OF EVOLUTION



Edgar Degas, Criminal Physiognomies, 1881

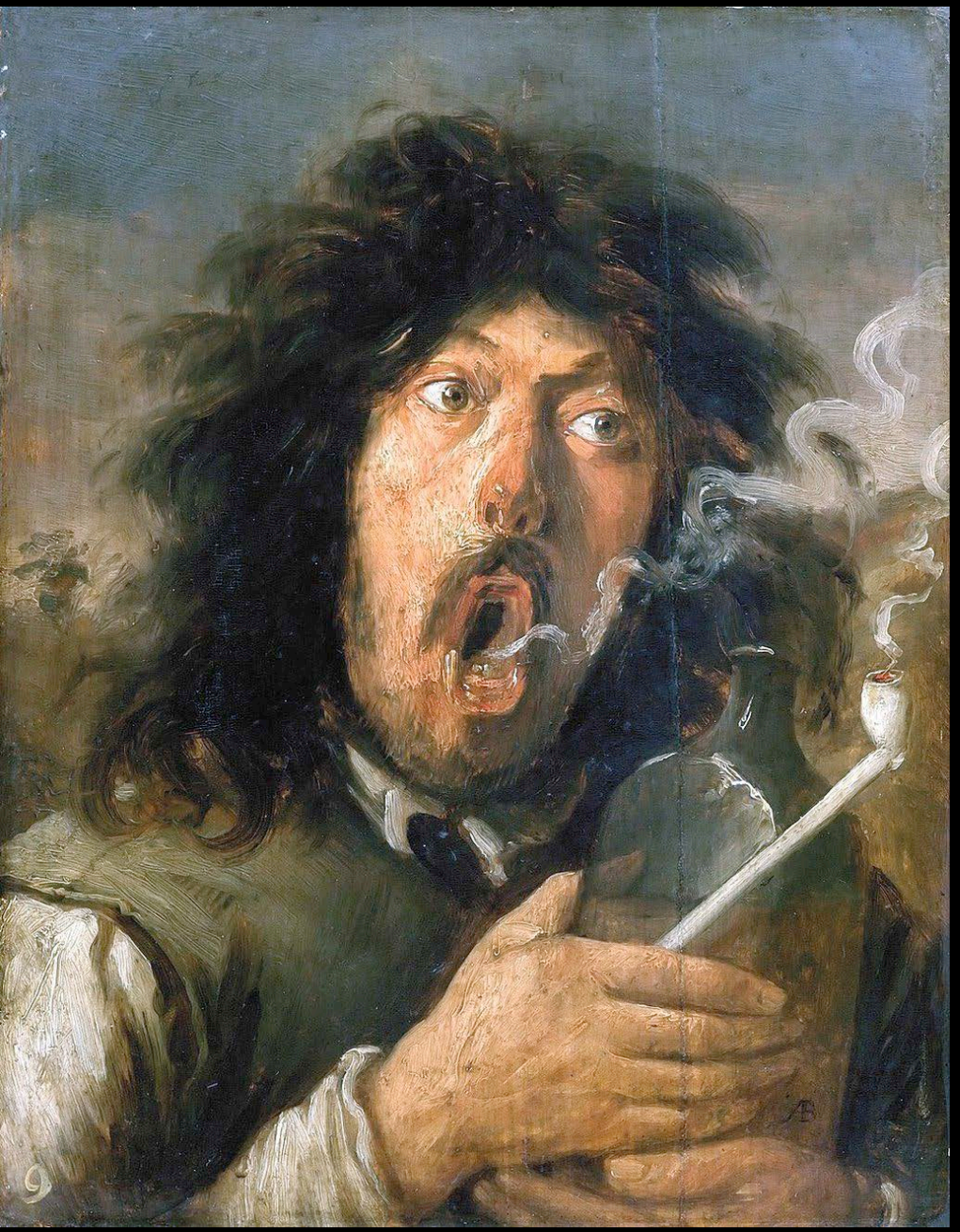
Tronie painting

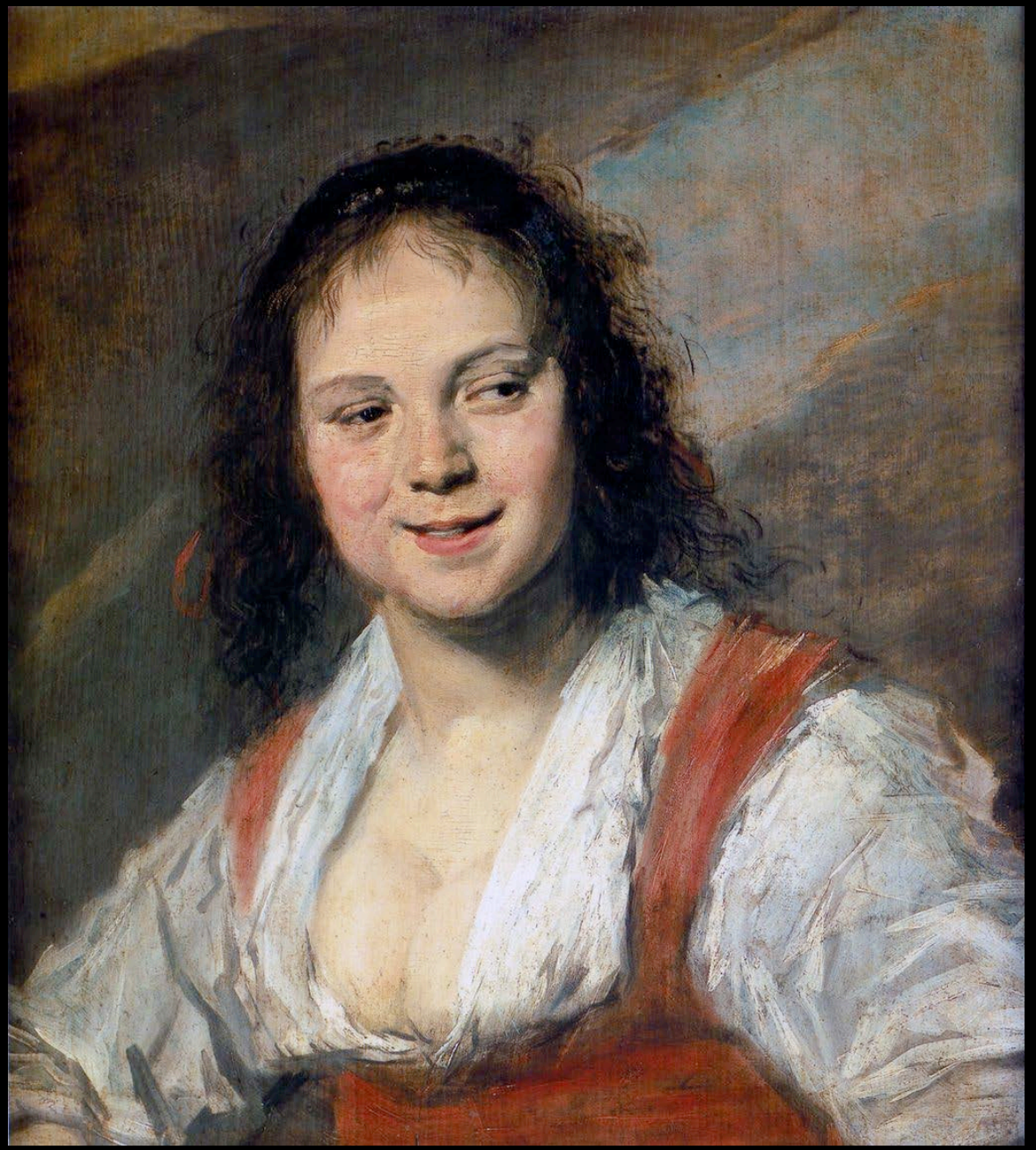
Typological Paintings

“face” or “head” painting

Johannes Vermeer, The Girl with a Pearl Earring, c. 1665

Leonardo da Vinci, Studies of grotesque heads, c.1494





Left: Joos van Craesbeeck, The Smoker, 1635

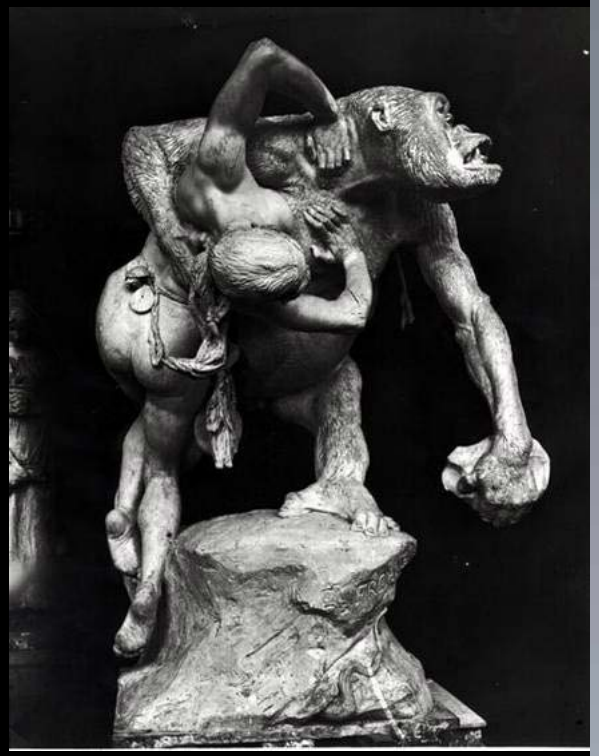
Right: Frans Hals, The Gypsy Girl, 1628

Left: Govert Flinck ,Portrait of African Male, c. 1645

Right: Govert Flinck, A Young Archer, 1639-40

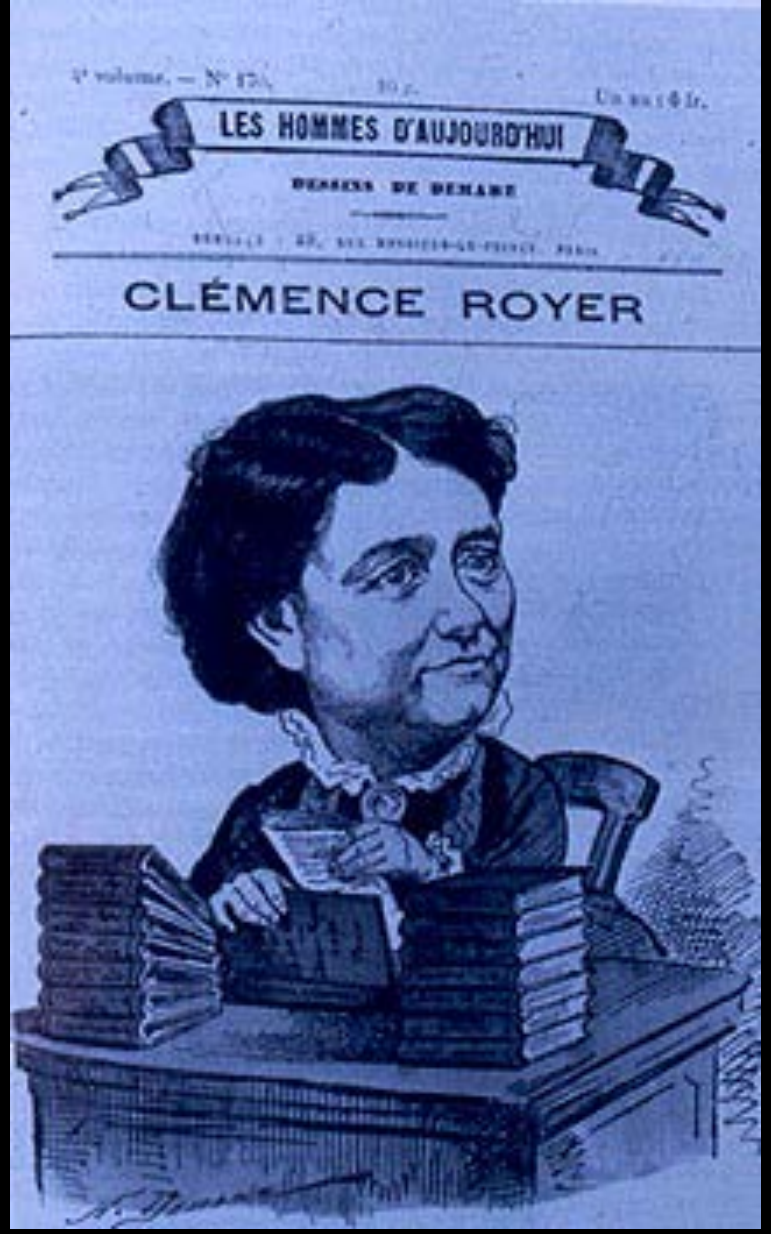
Left: Frans Hals, Malle Babbe, 1633-35

Right: Adriaen Brouwer, Youth Making a Face, 1632



Emmanuel Frémiet, Gorilla Carrying off a Native Woman, 1859

Emmanuel Frémiet, Pan and Bears, 1876



Clémence Royer translated Darwin's *Origin of Species* into French, respected theorist of evolution and women's rights. Renan said she was "almost a man of genius."

DE L'ORIGINE

DES ESPÈCES

OU

DES LOIS DU PROGRÈS CHEZ LES ÊTRES ORGANISÉS

PAR

CH. DARWIN

Traduit en français sur la troisième Édition avec l'autorisation de l'Auteur

PAR

Mlle CLÉMENCE-AUGUSTE ROYER

AVEC UNE PRÉFACE ET DES NOTES DU TRADUCTEUR

PARIS

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PLACE DE L'ÉCOLE DE MÉDECINE

1862

Dorothea Tanning, ***Message 11***
1989

Dorothea Tanning [1910-2012], **The Hotel de Pavot 202, 1972**

Dorothea Tanning, Birthday, 1942

Dorothea Tanning, ***Message 11***
1989