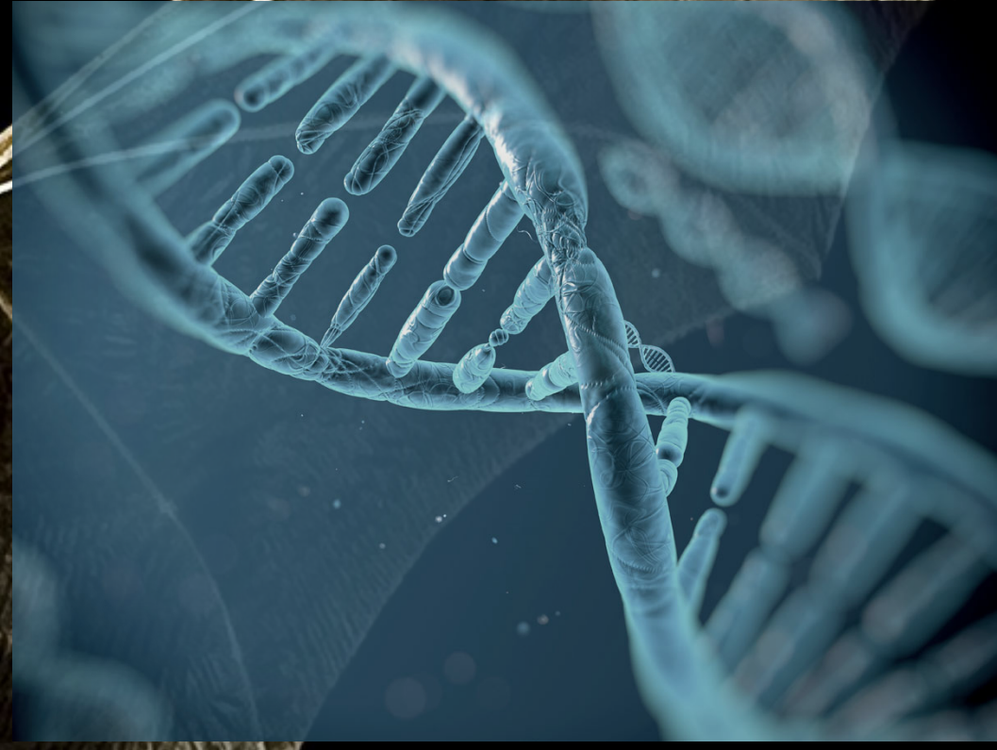


Philosophy of Biology

Stavros Ioannidis / MA Cont. Phil.

General information

Day/time: Thursday 15.15 - 18.00, Library

Office hours: Monday 18.00 - 19.00

(old building, ground floor, first office on your left)

Email: stavros.ioannidis.phil@gmail.com

Main Bibliography

- **Godfrey-Smith** (2016) *Philosophy of Biology*, Princeton University Press.
- **Hull & Ruse** (2017) *The Cambridge Companion to the Philosophy of Biology, Cambridge University Press.*
- **Rosenberg & McShea** (2008) *Philosophy of Biology: a contemporary introduction*, Routledge.
- **Sober** (ed.) (2006) *Conceptual Issues in Evolutionary Biology*, Cambridge, Massachusetts: MIT Press.
- **Sterelny & Griffiths** (1999), *Sex and Death: An Introduction to the Philosophy of Biology*, Chicago: University of Chicago Press.
- **Sterelny** (2003) *Dawkins Vs Gould: Survival of the Fittest, Icon Books.*

Other sources

Griffiths, P.E. & K. Stotz (2013) *Genetics and Philosophy: an introduction*, New York: Cambridge University Press.

Stanford Encyclopedia of Philosophy: http://plato.stanford.edu

Darwin (1859) *On the Origin of Species* (first edition).

http://darwin-online.org.uk/content/frameset?itemID=F373&viewtype=text&pageseq=1

(intro, ch. 1-4, 6, 14)

Assessment

- **Presentation of one or two papers**
- **Final essay** (4,500-5,000 words, without the references)

Emergence of philosophy of biology in the 70s

Three main reasons:

- **physics-centrism** of traditional philosophy of science

- central place of biology in 20th century science
  -> **conceptual** problems within biology

- '**naturalistic** turn' in philosophy

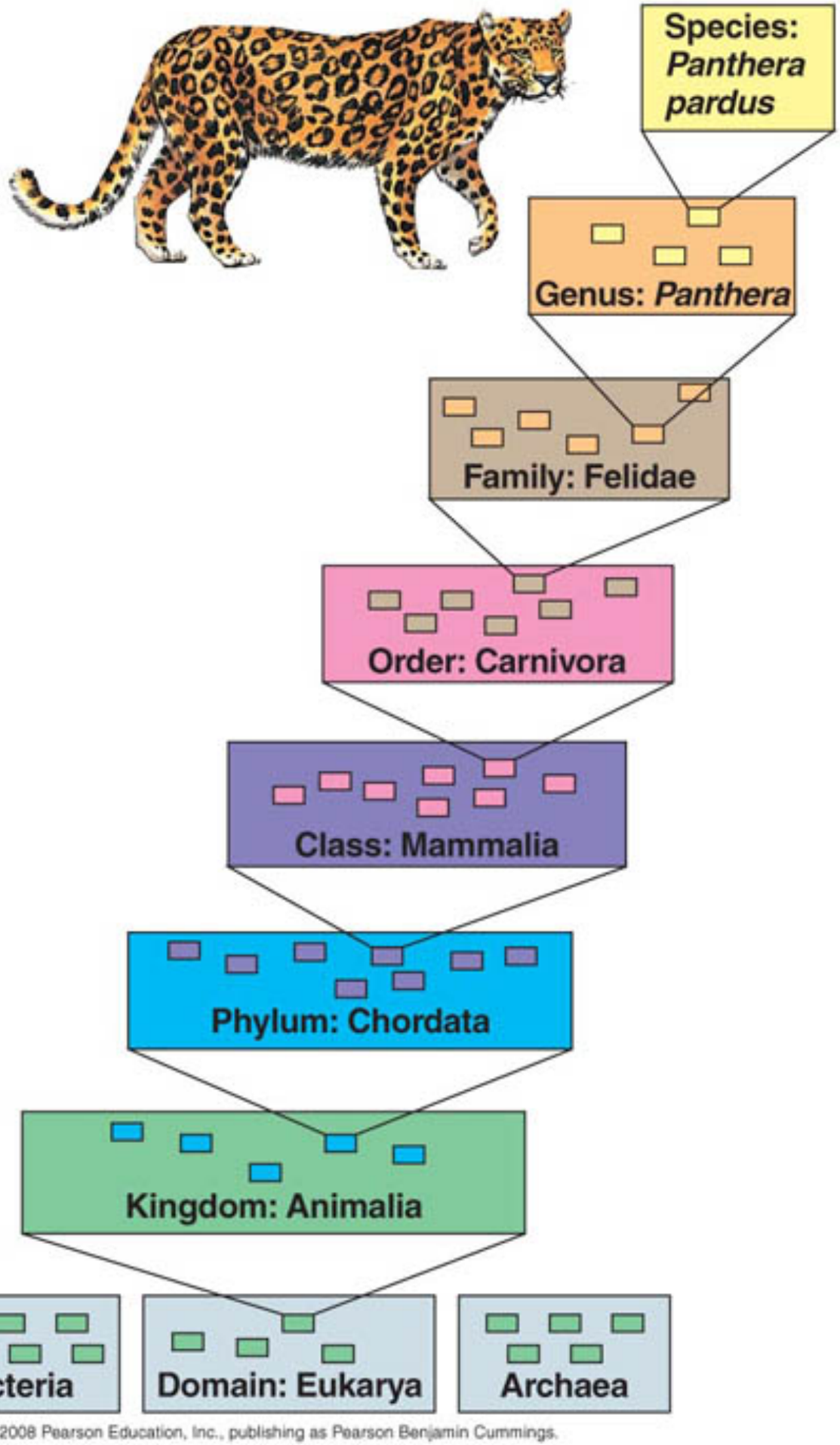
100

ETT HUNDRA KRONOR

SVERIGES RIKSBANK

6420210532

100



Binomial nomenclature

CAROLI LINNÆI

EQUITIS DE STELLA POLARI,

ARCHIATRI REGII, MED. & BOTAN. PROFESS. UPSAL.;
ACAD. UPSAL. HOLMENS. PETROPOL. BEROL. IMPER.
LOND. MONSPEL. TOLOS. FLORENT. SOC.

SYSTEMA NATURÆ

PER

REGNA TRIA NATURÆ,

SECUNDUM

CLASSES, ORDINES,
GENERA, SPECIES,

CUM

CHARACTERIBUS, DIFFERENTIIS,
SYNONYMIS, LOCIS.

TOMUS I.

10
EDITIO DECIMA, REFORMATA.

Cum Privilegio S:æ R:æ M:tis Sveciæ.

HOLMIÆ,
IMPENSIS DIRECT. LAURENTII SALVII,
1758.

TABLEAU

SERVANT A MONTRER L'ORIGINE DES DIFFÉRENTS ANIMAUX

Vers.

Infusoires.
Polypes.
Radiaires.

Insectes.
Arachnides.
Crustacés.

Annelides.
Cirrhipèdes.
Mollusques.

Poissons.
Reptiles.

Oiseaux.

Monotrèmes.

M. Amphibies.

M. Cétacés.

M. Ongules.

M. Onguiculés.

ORDRE présumé de la formation des Animaux, offrant 2 séries séparées, subrameuses.

[1] SÉRIE DES ANIMAUX INARTICULÉS.

[2] SÉRIE DES ANIMAUX ARTICULÉS.

Animaux apathiques.

Infusoires.
Polypes.
Radiaires.
Ascidiens.
Vers.
Epizoaires.

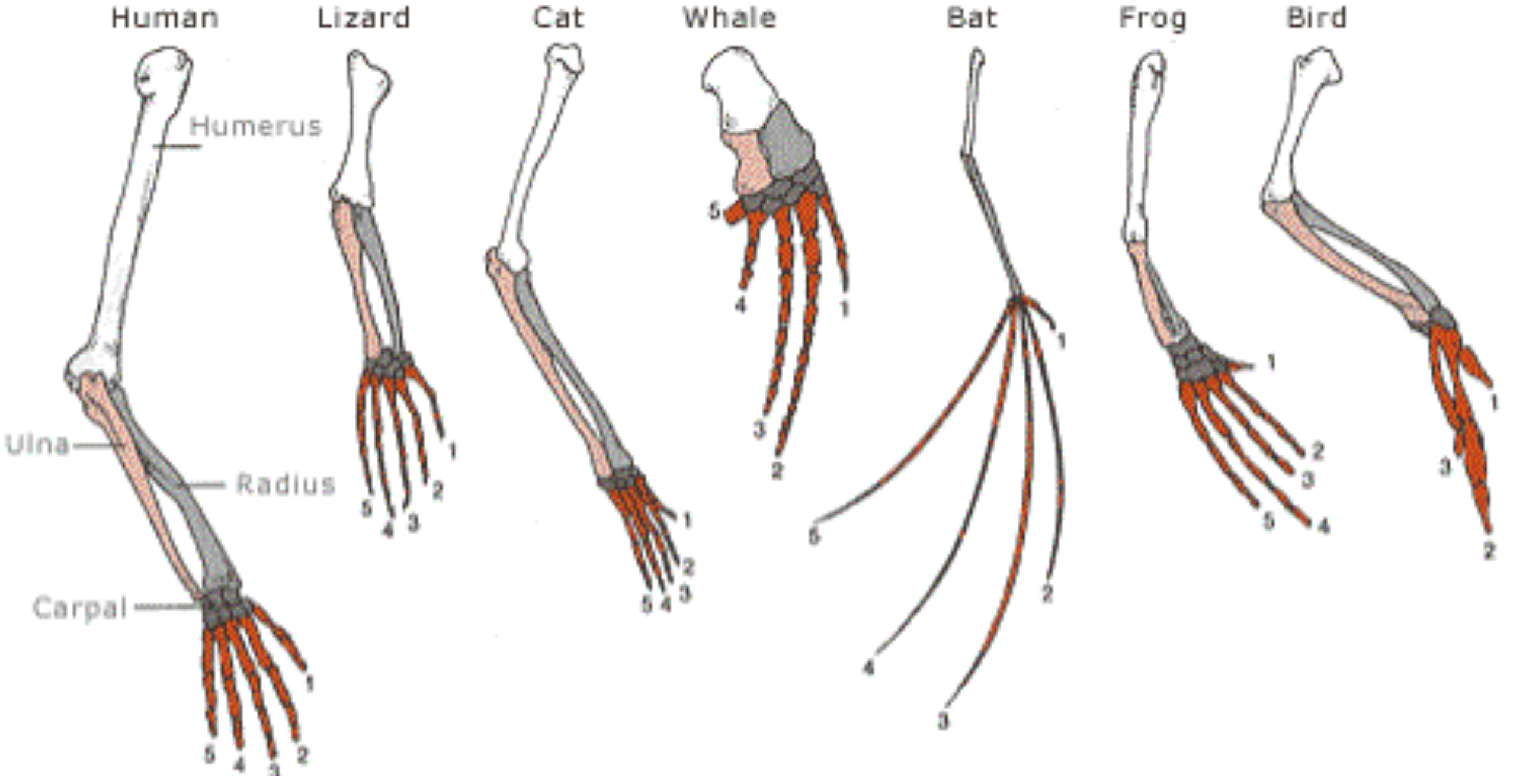
Idem sensibles.

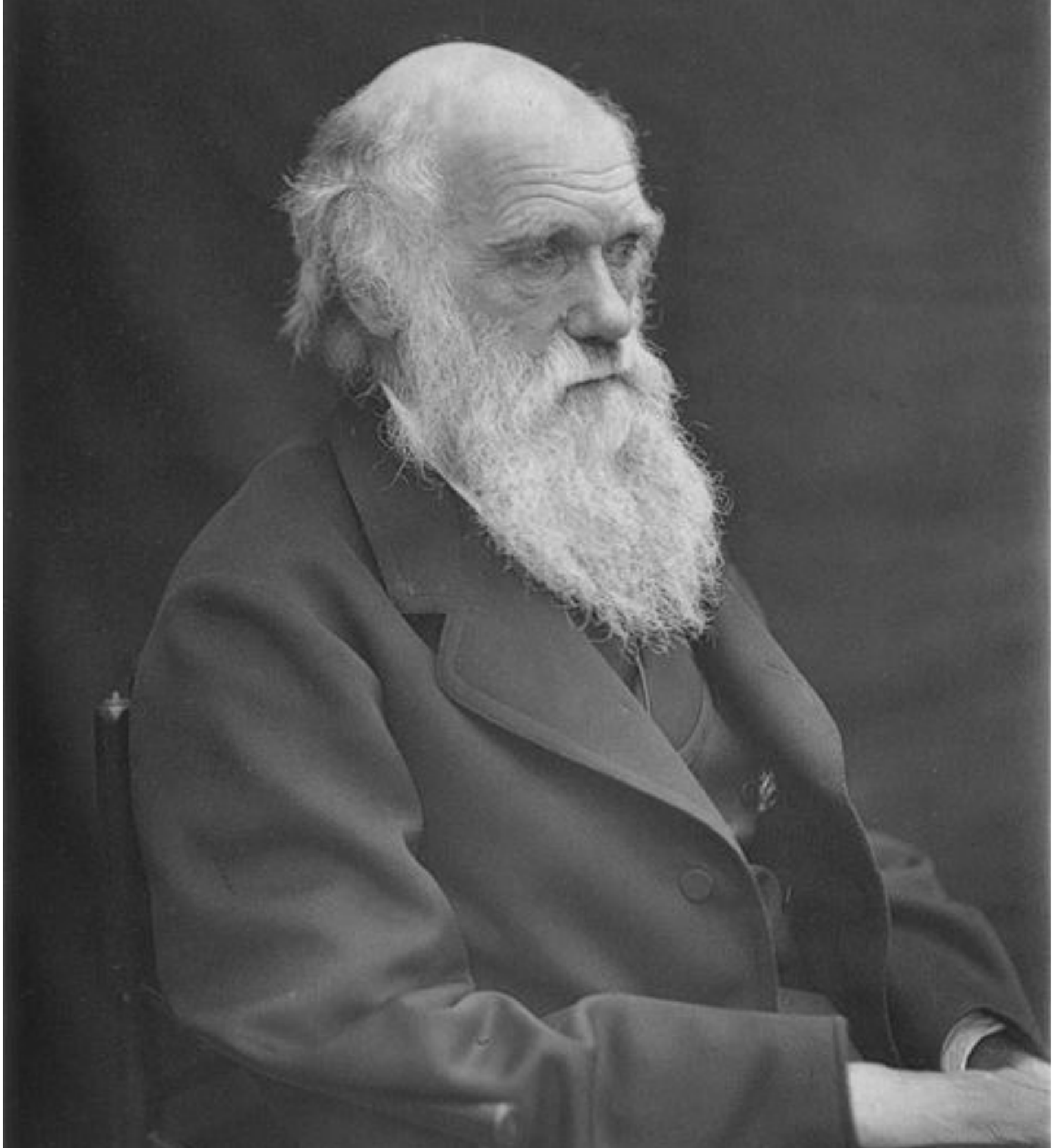
Acéphales.
Mollusques.
Annelides.
Insectes.
Arachnides.
Crustacés.
Cirrhipèdes.

Id. intelligens.

Poissons.
Reptiles.
Oiseaux.
Mammifères.

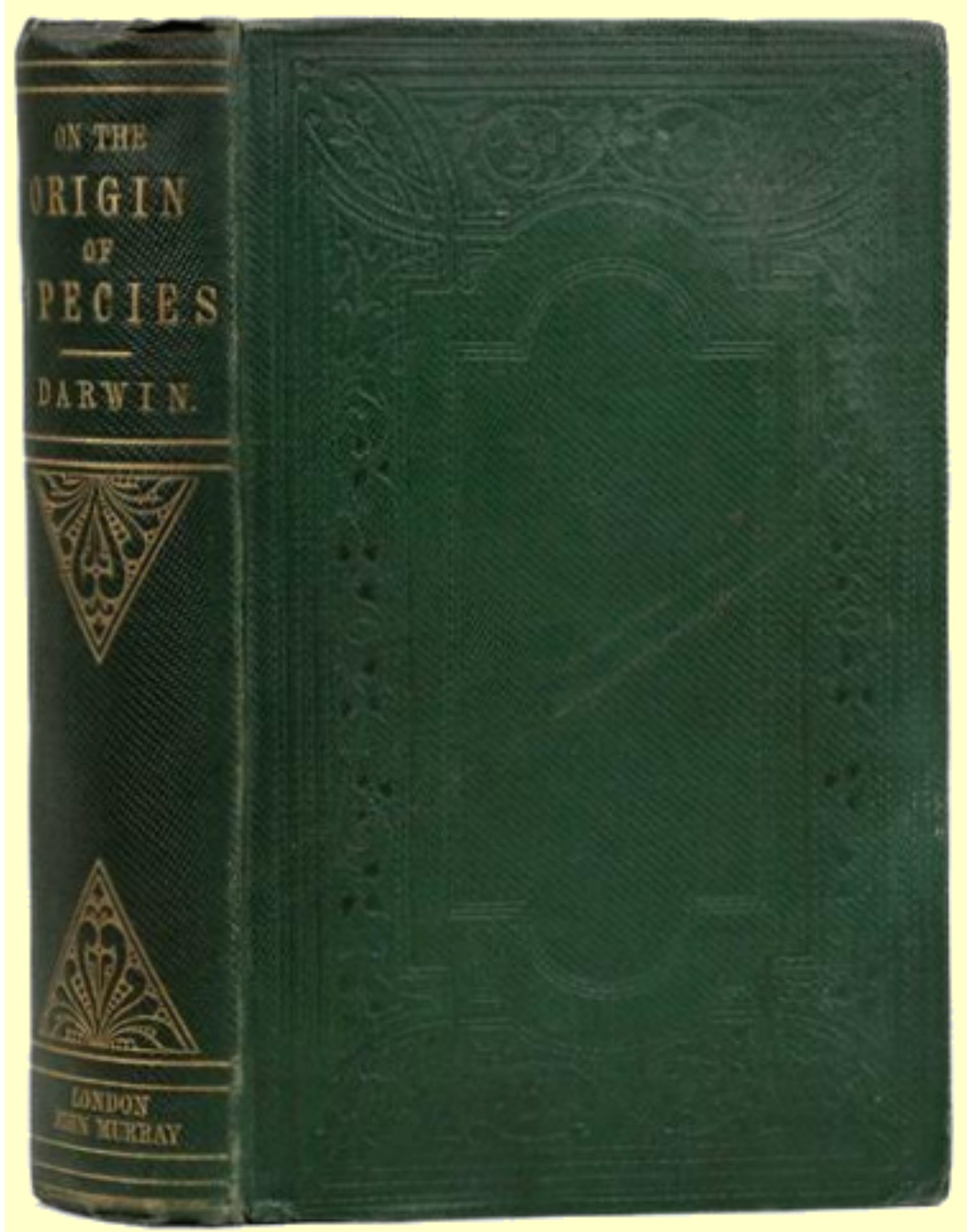
Evolution of animals according to Lamack, as depicted in *Zoological Philosophy* (1809, left), and in *Natural History of Invertebrate Animals* (1815, right).


Human
Lizard
Cat
Whale
Bat
Frog
Bird
Humerus
Ulna
Radius
Carpal



1809 – 1882

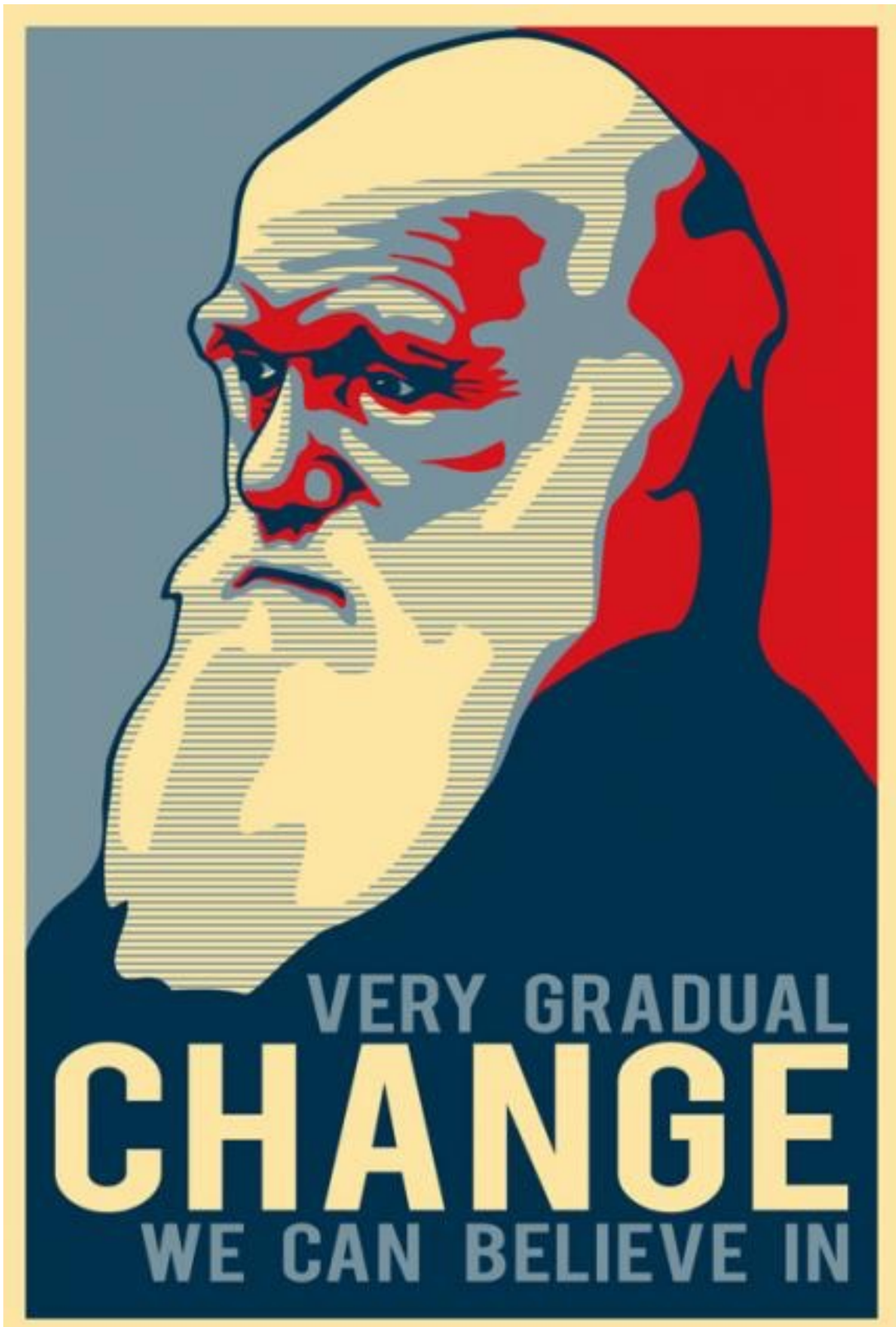
1859
Origin of
Species

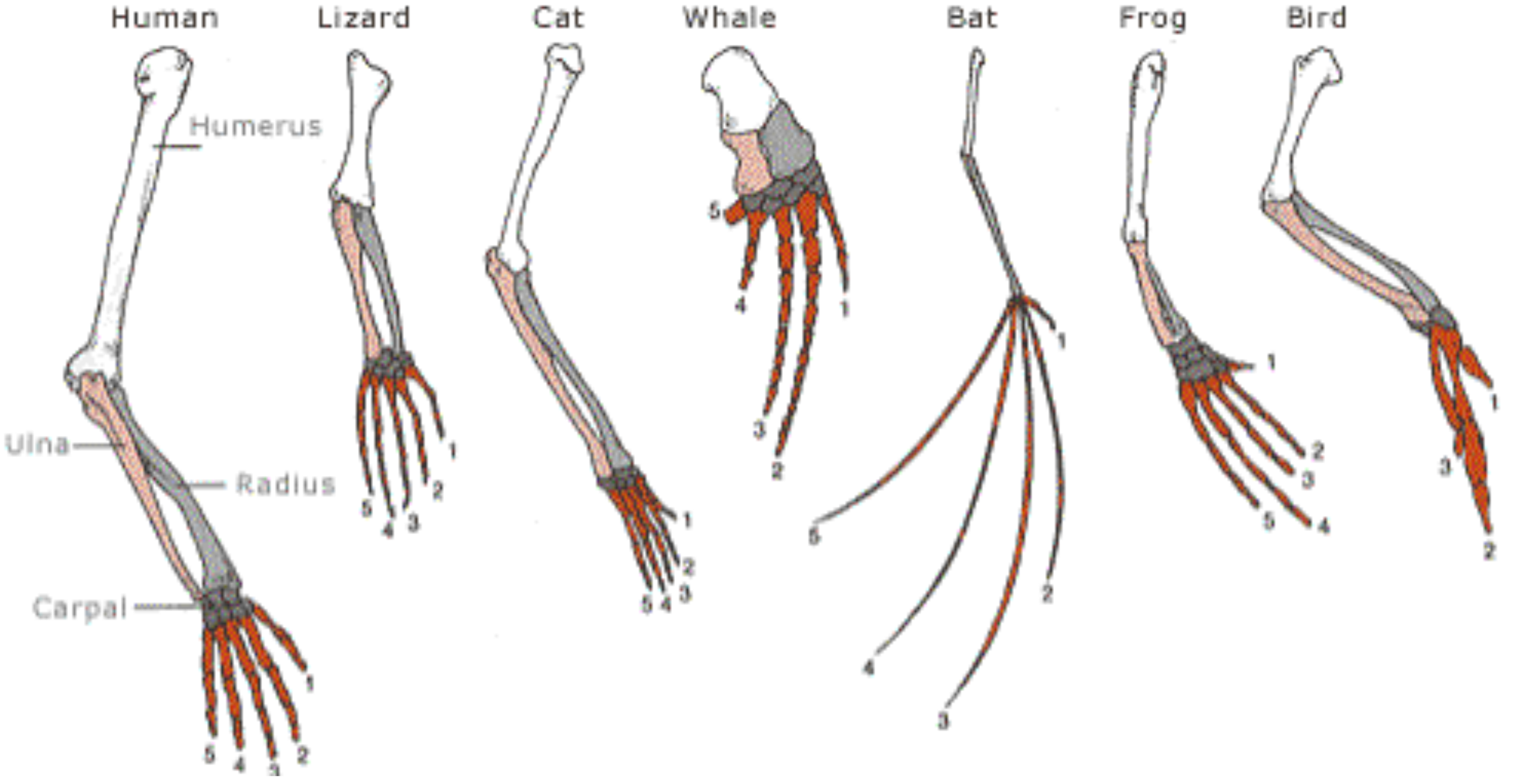


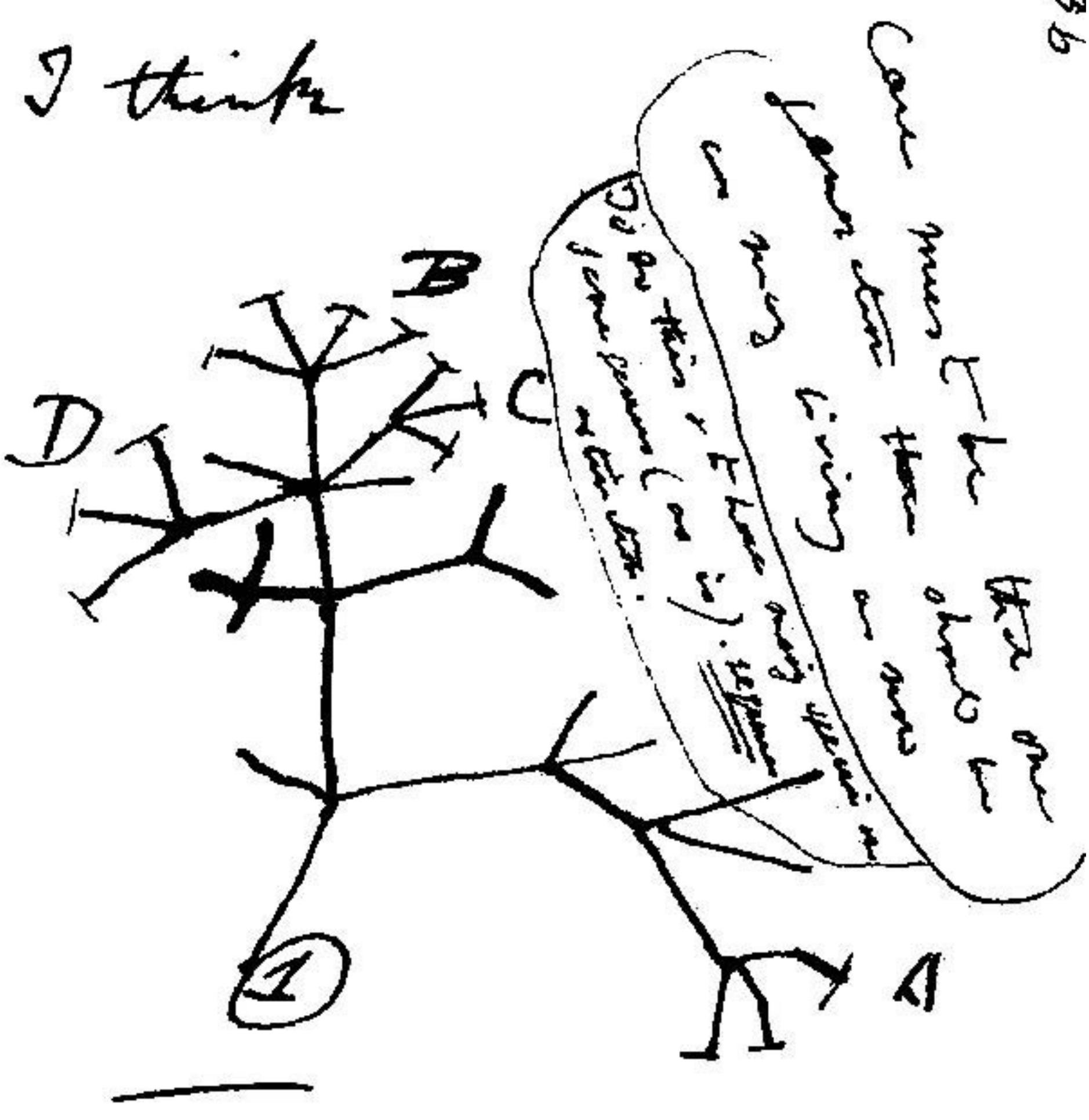
What is the theory of evolution?

1. Life **evolves**: populations **change** with time

2. This change happens **gradually** (over hundreds or millions of years)




Human
Lizard
Cat
Whale
Bat
Frog
Bird
Humerus
Ulna
Radius
Carpal



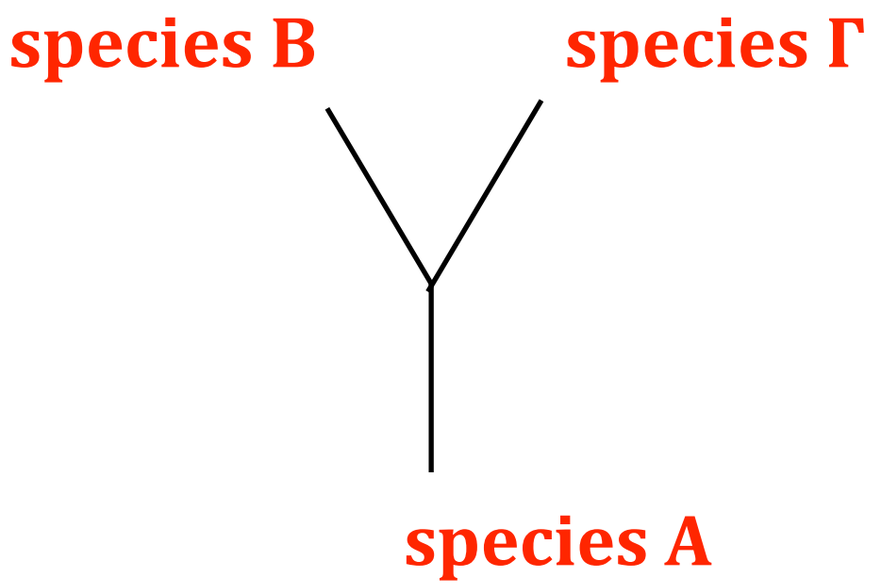
organised beings represent a tree. Irregularly branched some branches far more branched. - Hence Genera. - «as many terminal buds dying, as new ones generated»
(1837, Notebook B)

What is the theory of evolution?

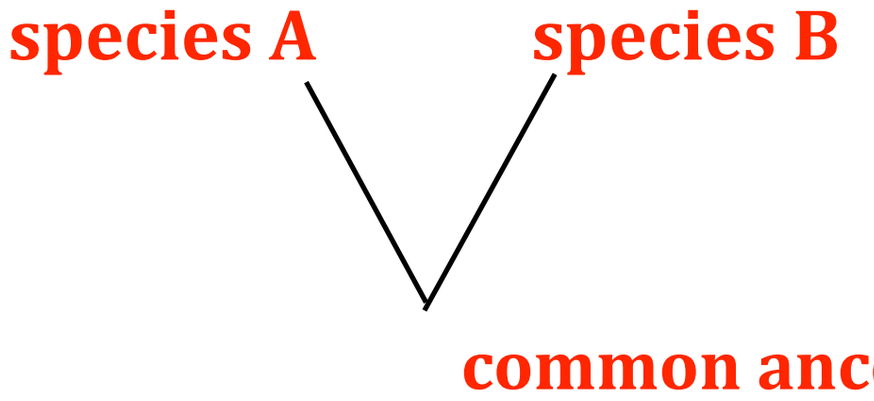
1. Life **evolves**: populations **change** with time
2. This change happens **gradually** (over hundreds or millions of years)

What is the theory of evolution?

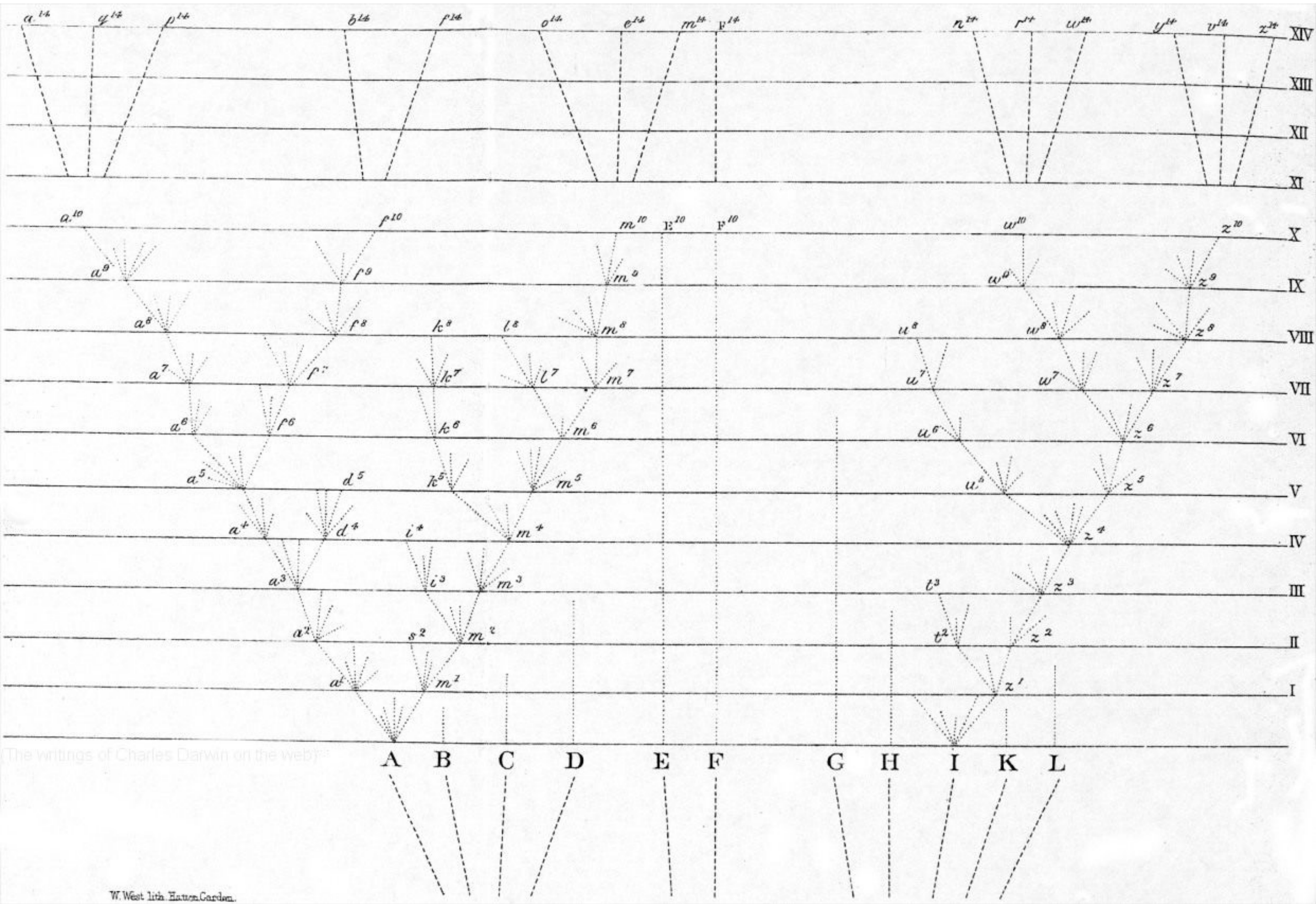
3. **Speciation** occurs (one species splits into two or more)



What is the theory of evolution?



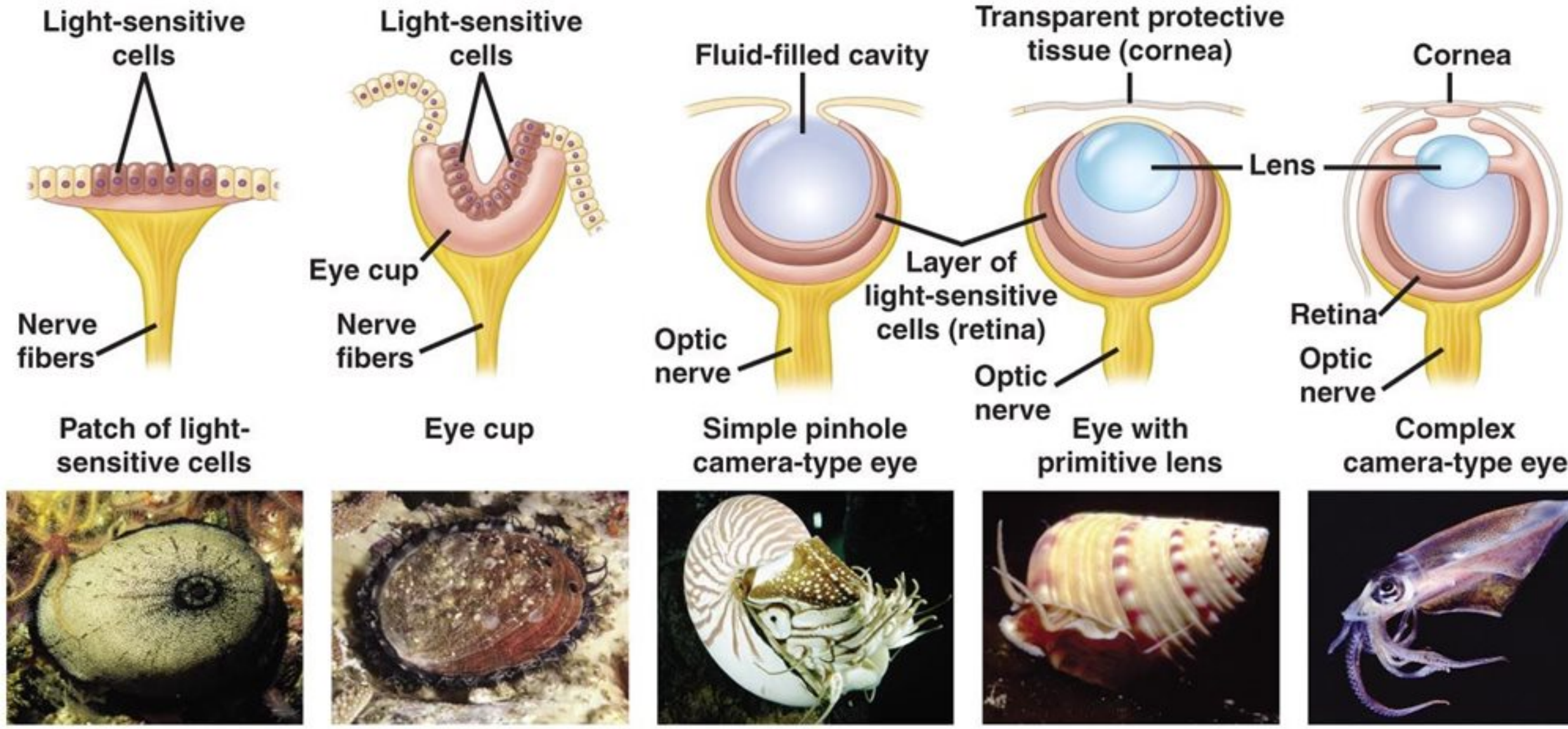
4. All species share a **common ancestor**!



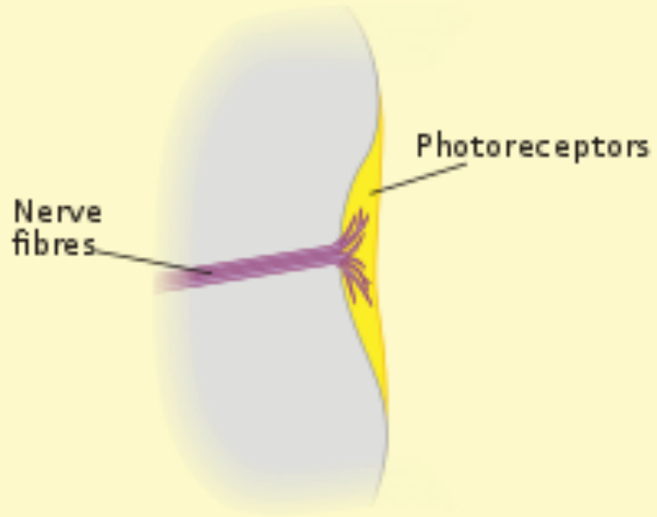
The tree of life, the only picture in *Origin*

What is the theory of evolution?

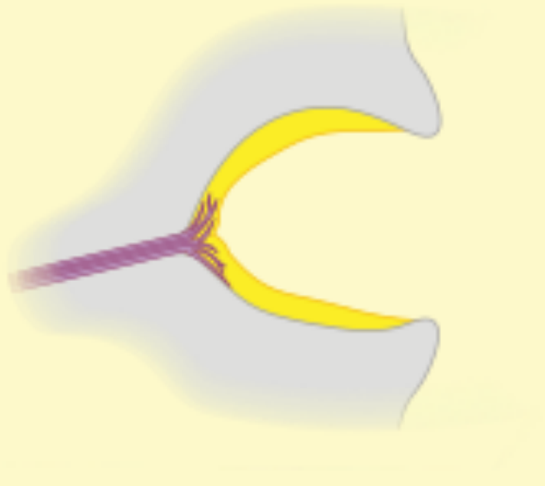
5. Evolution occurs through **natural selection**, which produces adaptations in organisms (organisms appear as if they have been designed)



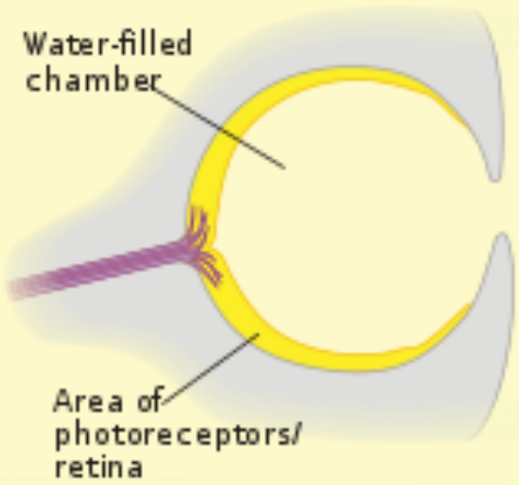
a) Region of photosensitive cells



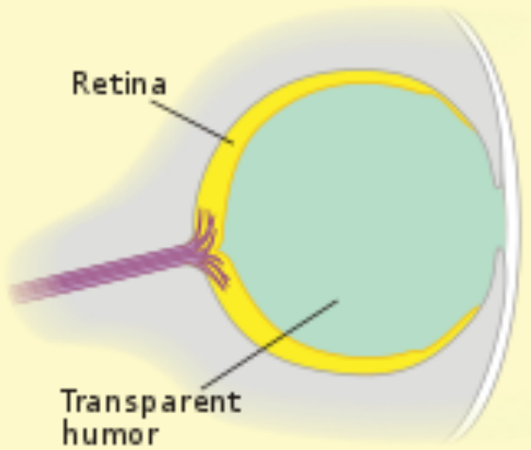
b) Depressed/folded area allows limited directional sensitivity



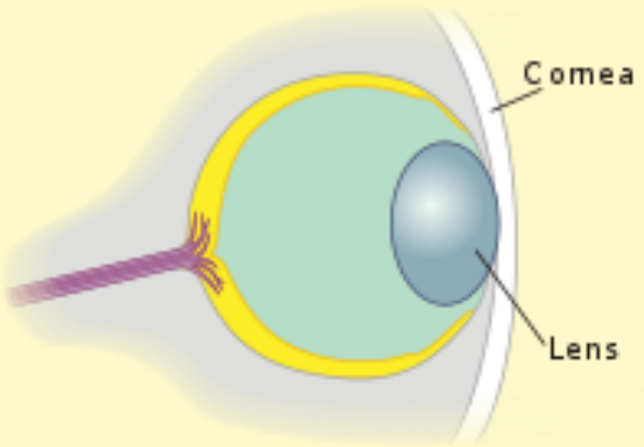
c) "Pinhole" eye allows finer directional sensitivity and limited imaging



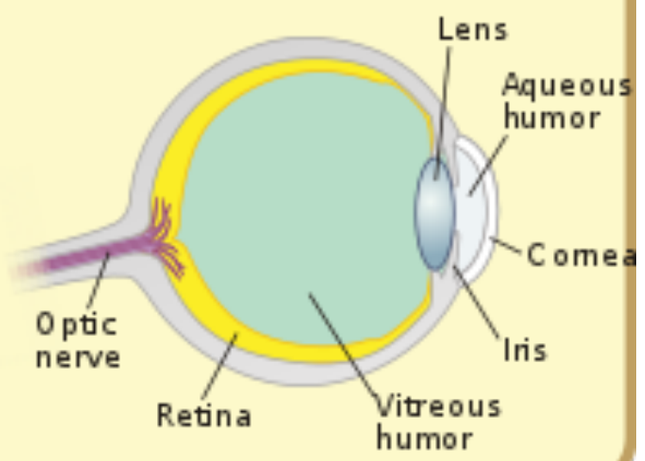
d) Transparent humor develops in enclosed chamber

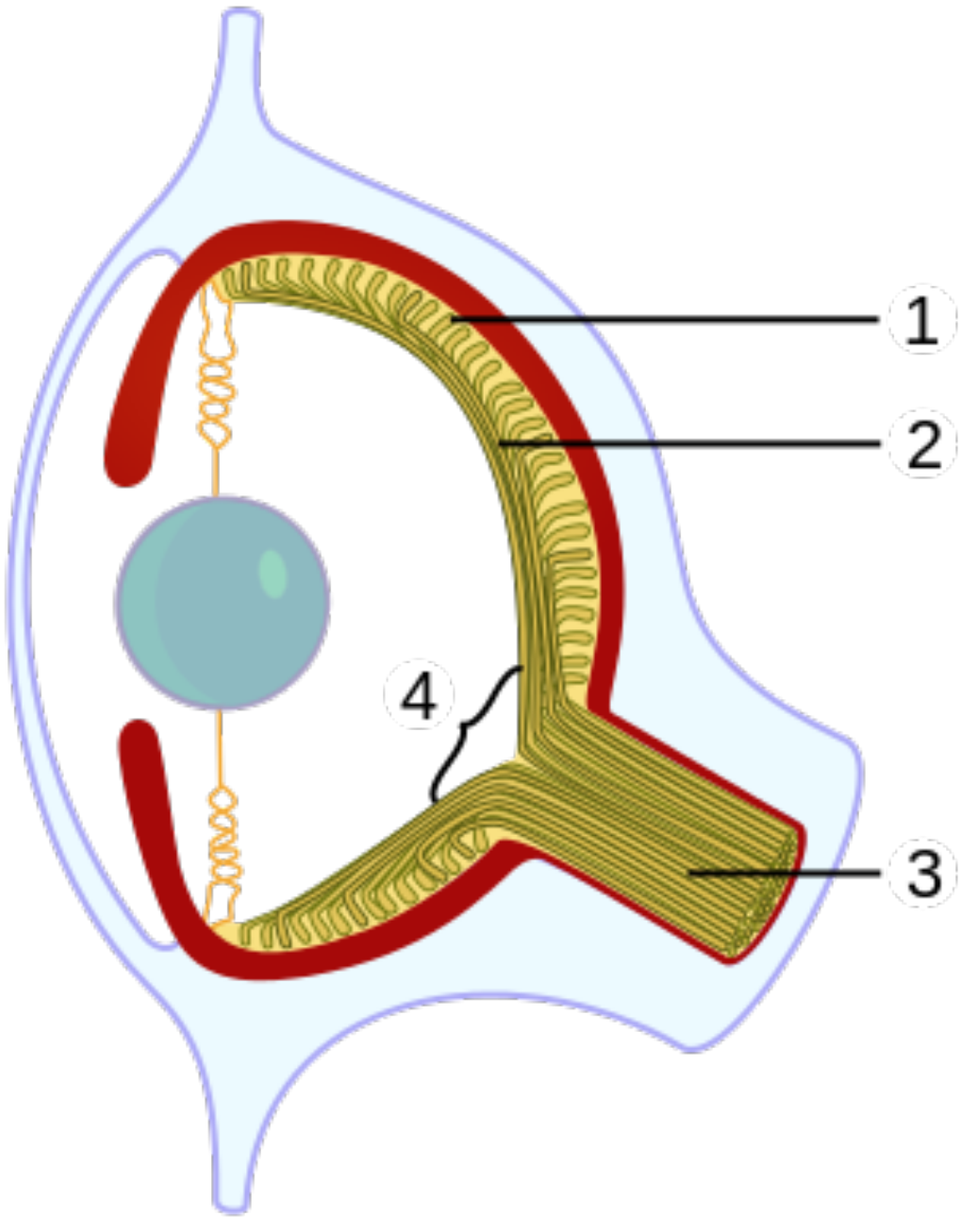


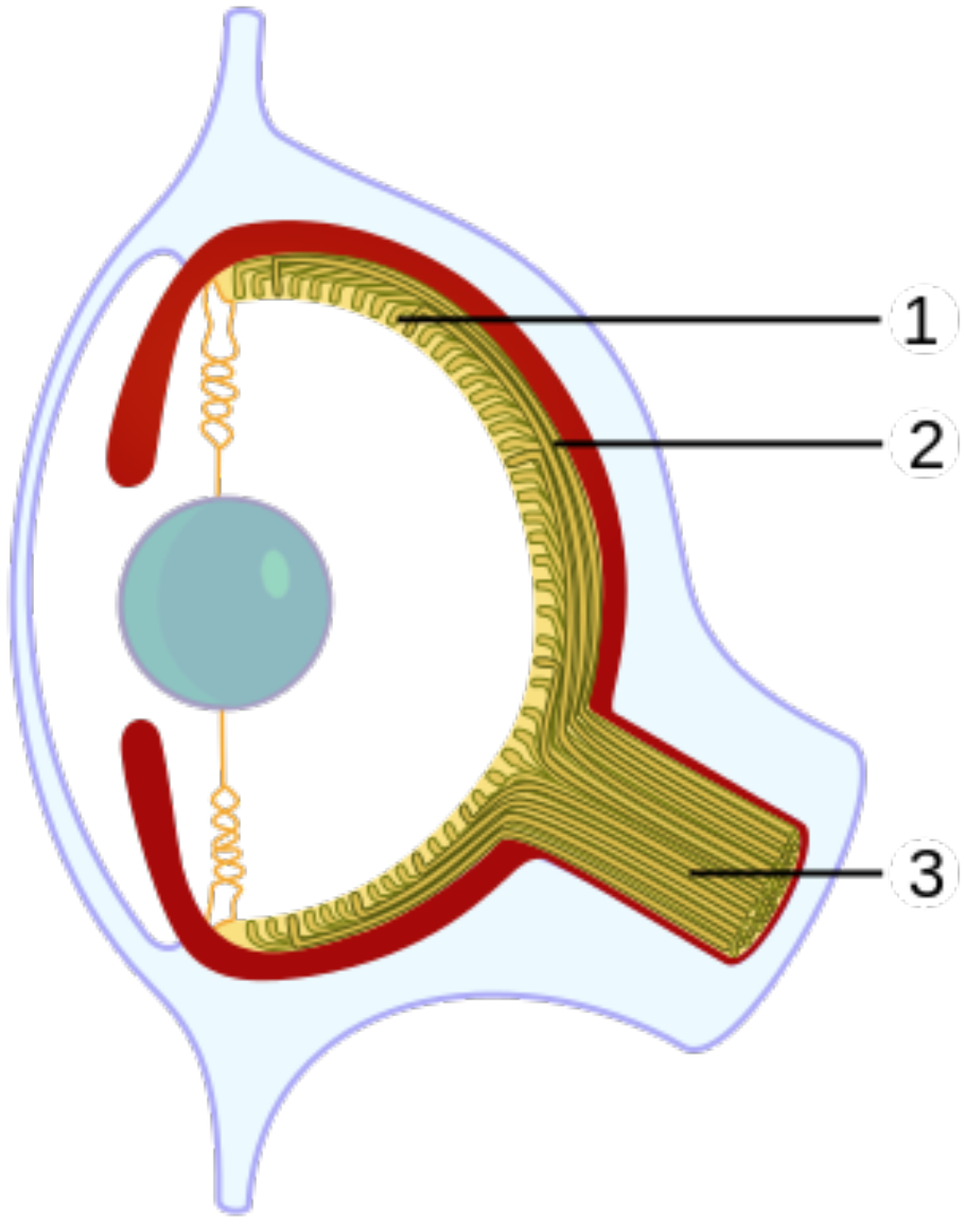
e) Distinct lens develops



f) Iris and separate cornea develop




1
2
4
3


1
2
3

What is the theory of evolution?

1. Life **evolves**

2. This change happens **gradually**

3. **Speciation** occurs

4. All species share a **common ancestor**

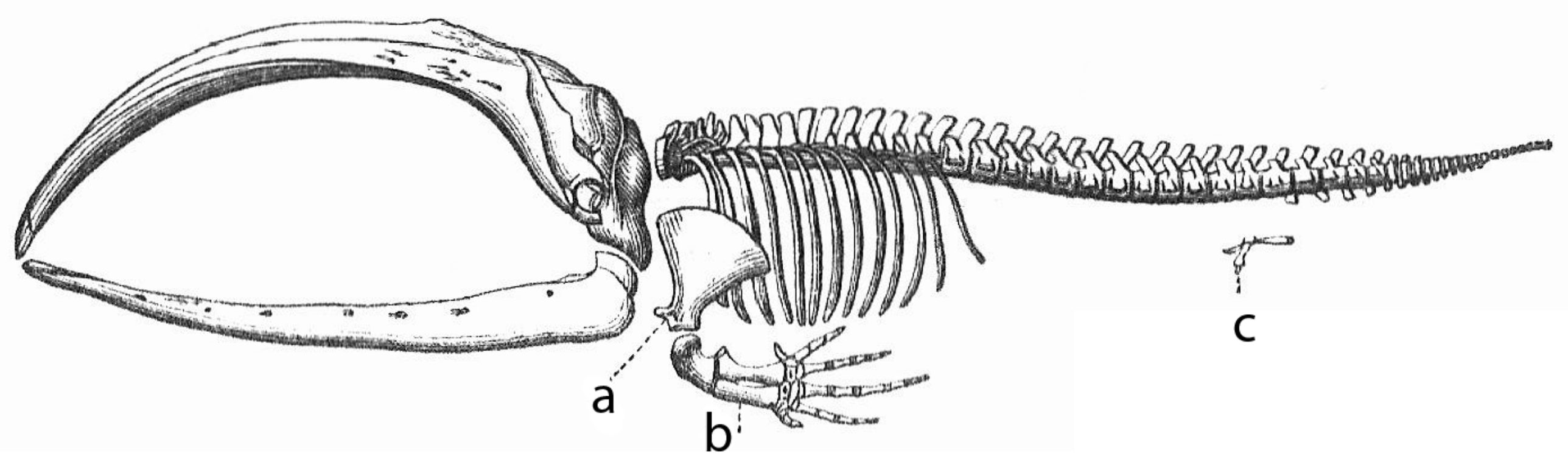
5. Evolution occurs through **natural selection**

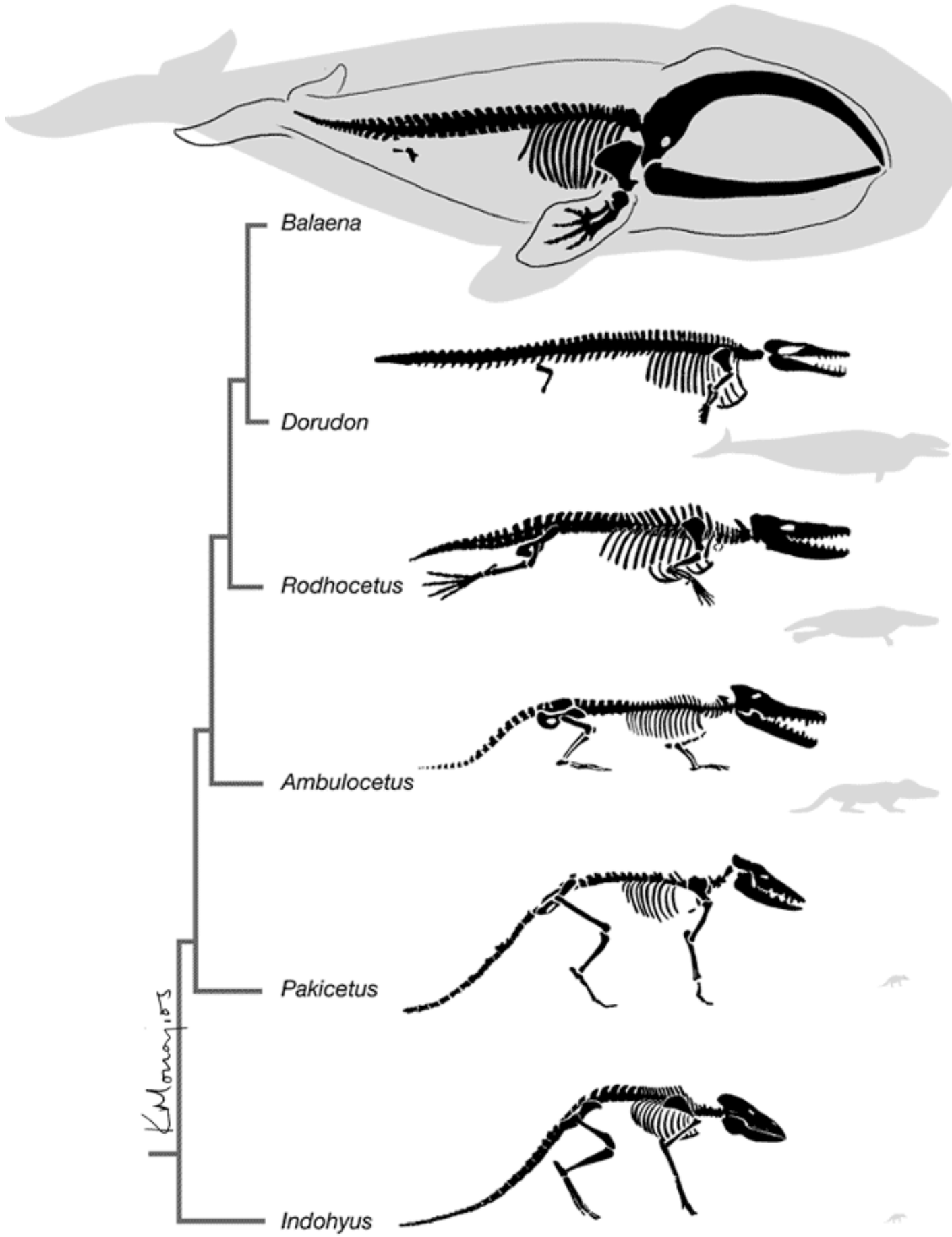
I

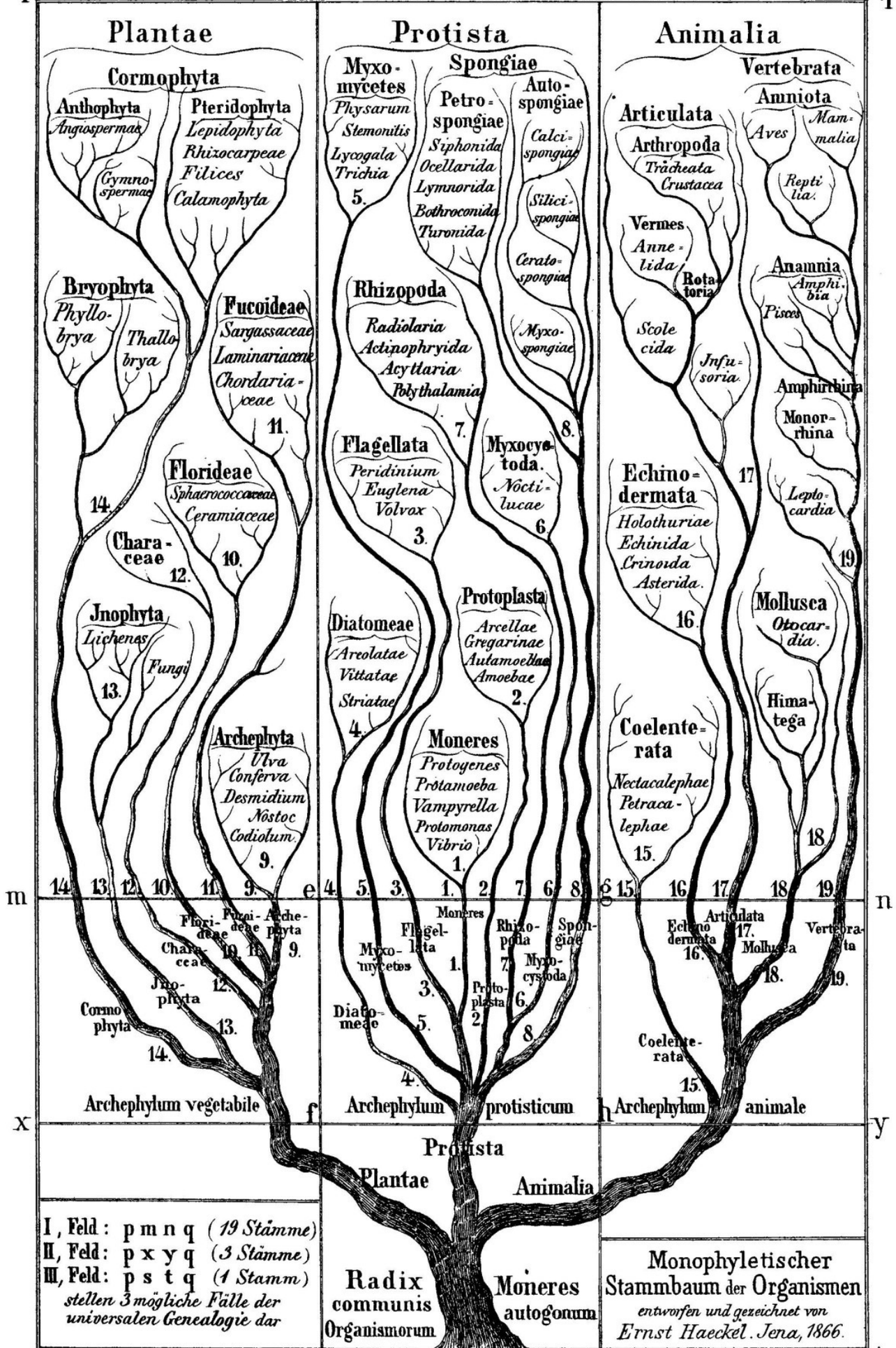
II

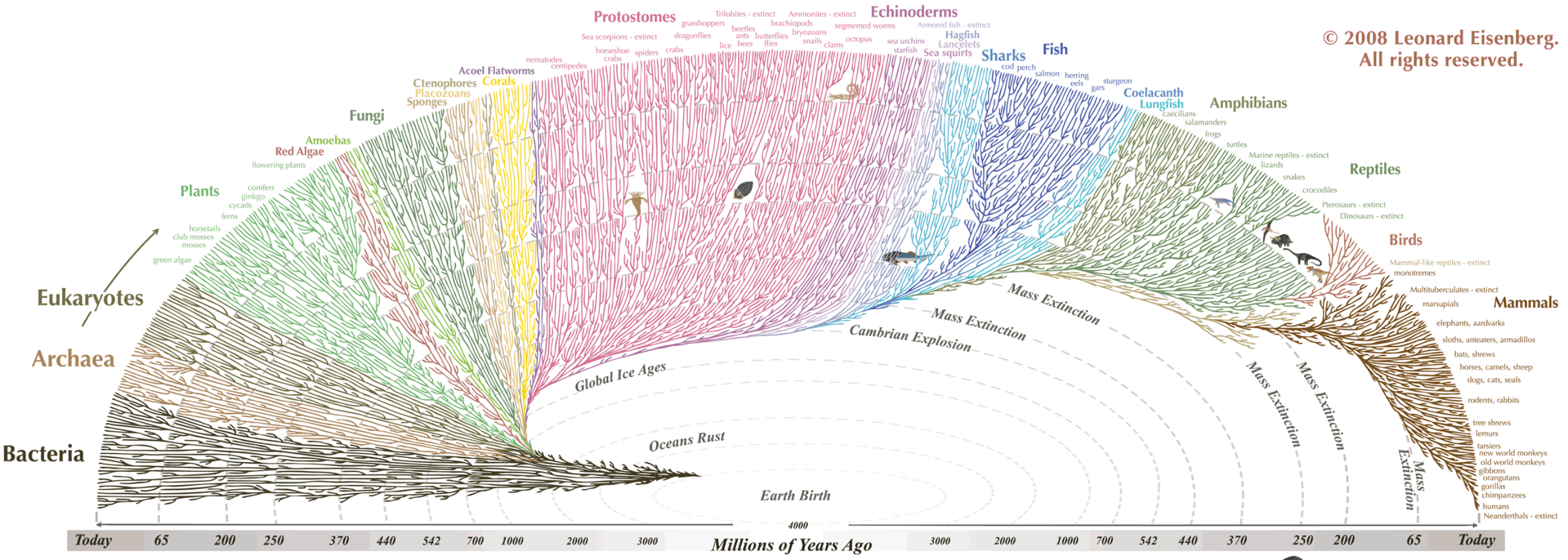
III

Fish Salamander Tortoise Chick Hog Calf Rabbit Human


a
b
c


Balaena
Dorudon
Rodhocetus
Ambulocetus
Pakicetus
Indohyus


Plantae
Protista
Animalia
Cormophyta
Anthophyta
Angiospermae
Gymnospermae
Pteridophyta
Lepidophyta
Rhizocarpeae
Filices
Calamophyta
Bryophyta
Phyllobrya
Thallobrya
Fucoideae
Sargassaceae
Laminariaceae
Chordariaceae
11.
Florideae
Sphaerococcaceae
Ceramiaceae
10.
14.
Characeae
12.
Jnophyta
Lichenes
Fungi
13.
Archephyta
Ulva
Conferva
Desmidium
Nostoc
Codiolum
9.
Myxomycetes
Physarum
Stemonitis
Lycogala
Trichia
5.
Spongiae
Petrospongiae
Siphonida
Ocellarida
Lymnorida
Bothroconida
Turonida
Autospongiae
Calcispongiae
Silicispongiae
Ceratospongiae
Myxospongiae
Rhizopoda
Radiolaria
Actipophryida
Acyttaria
Polythalamia
7.
8.
Flagellata
Peridinium
Euglena
Volvox
3.
Myxocystoda.
Noctilucae
6.
Protoplasta
Arcellae
Gregarinae
Autamoebae
Amoebae
2.
Diatomeae
Areolatae
Vittatae
Striatae
4.
Moneres
Protogenes
Protamoeba
Vampyrella
Protomonas
Vibrio
1.
Vertebrata
Amniota
Aves
Mammalia
Reptilia.
Anamnia
Amphibia.
Pisces
Articulata
Arthropoda
Tracheata
Crustacea
Vermes
Annelida
Rotatoria
Scolecida
Infusoria.
Amphirhina
Monorrhina
Leptocardia
19
Echinodermata
Holothuriae
Echinida
Crinoida
Asterida.
16.
17
Mollusca
Otocardia.
Himatega
18.
Coelenterata
Nectacalephae
Petracalephae
15.
m
n
e
f
g
h
x
y
14 13 12 10 11 9 4 5 3 1 2 7 6 8 15 16 17 18 19
Archephylum vegetabile
Archephylum protisticum
Archephylum animale
Protista
Plantae
Animalia
I, Feld: p m n q (19 Stämme)
II, Feld: p x y q (3 Stämme)
III, Feld: p s t q (1 Stamm)
stellen 3 mögliche Fälle der universalen Genealogie dar
Radix communis Organismorum
Moneres autogonum
Monophyletischer Stammbaum der Organismen
entworfen und gezeichnet von
Ernst Haeckel. Jena, 1866.



All the major and many of the minor living branches of life are shown on this diagram, but only a few of those that have gone extinct are shown. Example: Dinosaurs - extinct

Marine reptiles - extinct
lizards
snakes
crocodiles
Pterosaurs - extinct
Dinosaurs - extinct

Reptiles

Birds

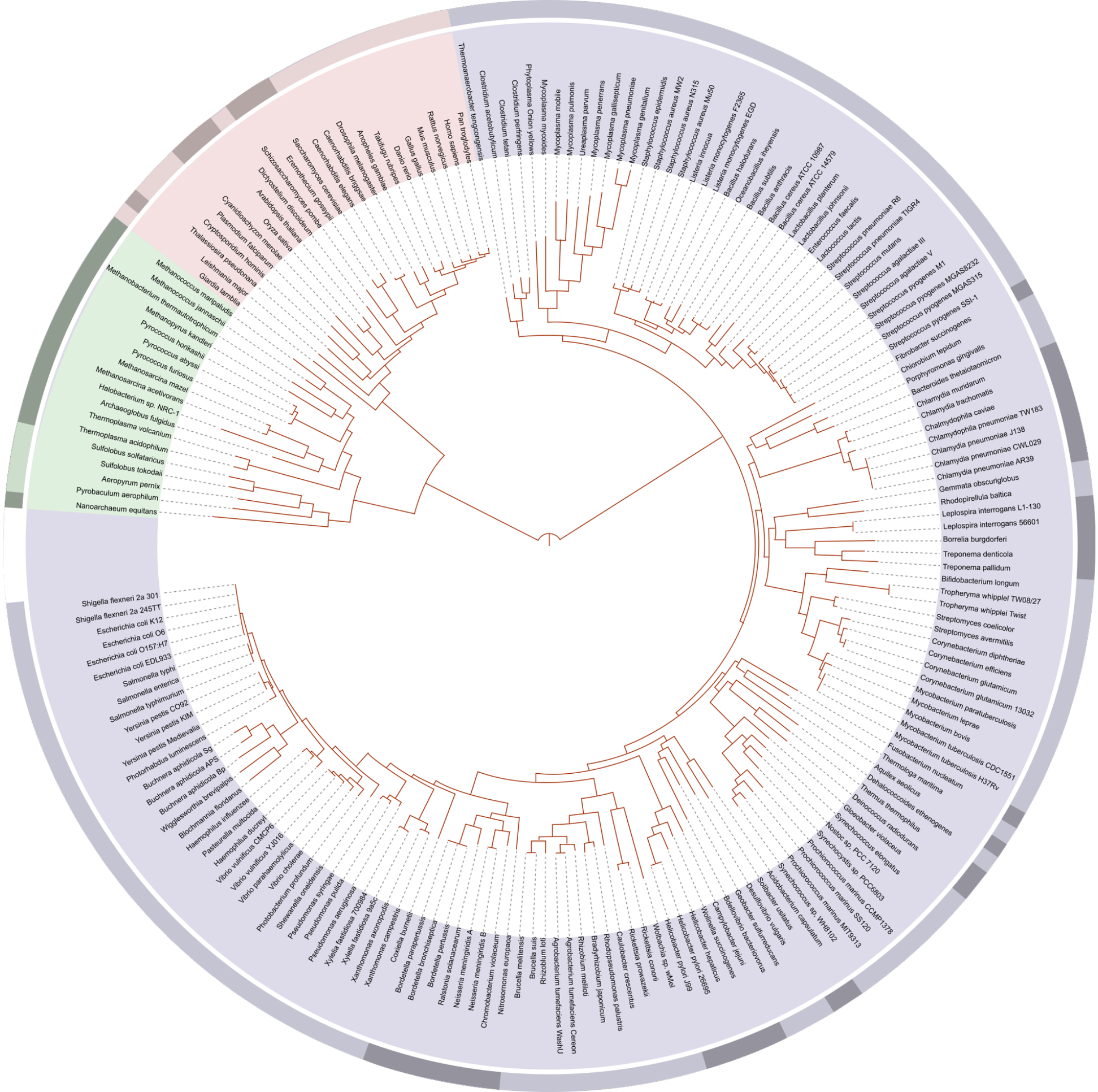
Mammal-like reptiles - extinct
monotremes
Multituberculates - extinct
marsupials

Mammals

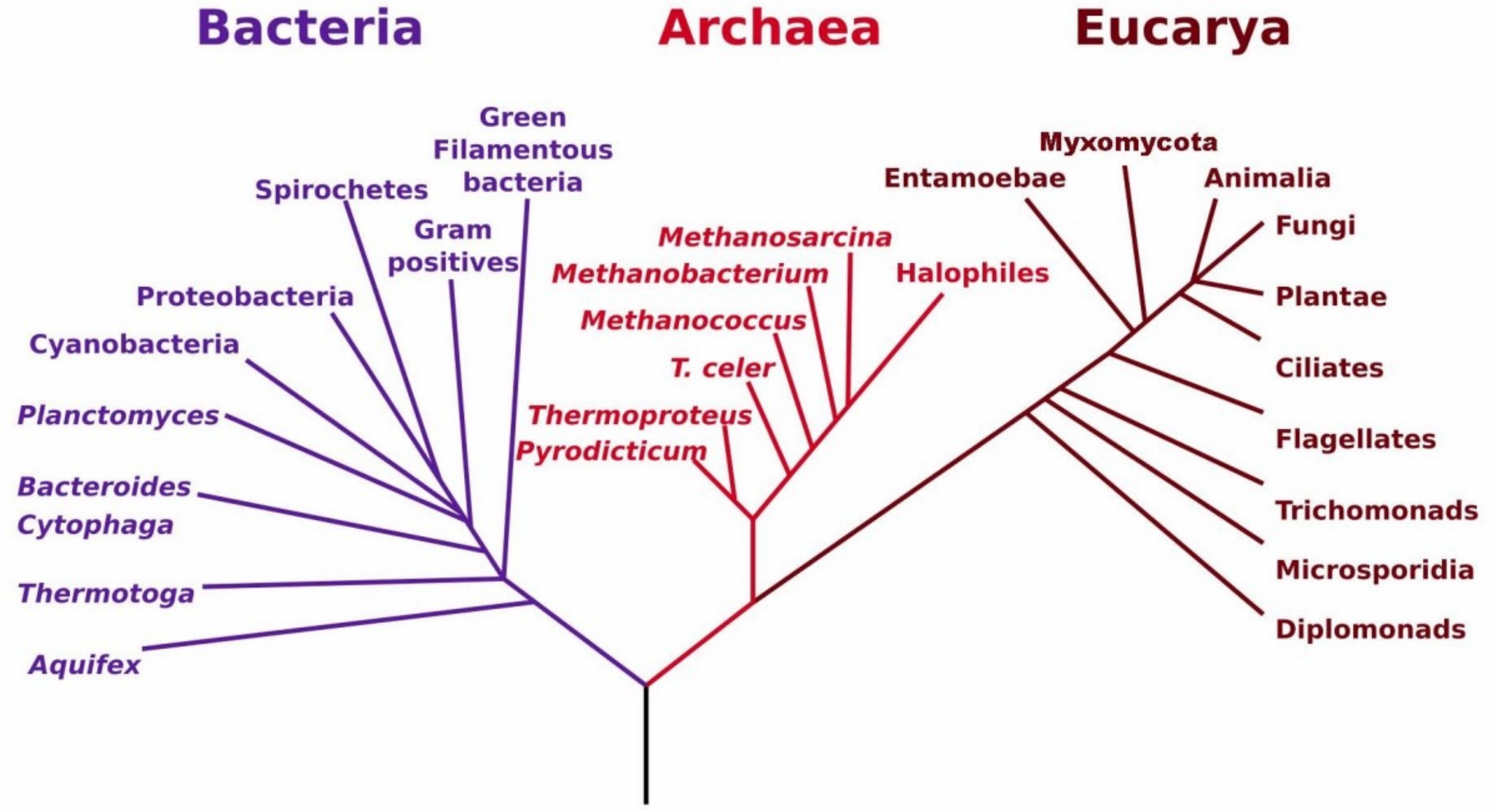
elephants, aardvarks
sloths, anteaters, armadillos
bats, shrews
horses, camels, sheep
dogs, cats, seals
rodents, rabbits
tree shrews
lemurs
tarsiers
new world monkeys
old world monkeys
gibbons
orangutans
gorillas
chimpanzees
humans
Neanderthals - extinct

Extinction
Mass Extinction
Mass Extinction
Mass Extinction
Mass Extinction

1000 *700* *542* *440* *370* *250* *200* *65* *Today*


Thermoanaerobacter tengcongensis
Clostridium acetobutylicum
Clostridium tetani
Clostridium perfringens
Phytoplasma Onion yellows
Mycoplasma mobile
Mycoplasma mycoides
Mycoplasma pulmonis
Ureaplasma parvum
Mycoplasma penetrans
Mycoplasma gallisepticum
Mycoplasma pneumoniae
Mycoplasma genitalium
Staphylococcus epidermidis
Staphylococcus aureus MW2
Staphylococcus aureus N315
Staphylococcus aureus Mu50
Listeria innocua
Listeria monocytogenes F2365
Listeria monocytogenes EGD
Bacillus halodurans
Oceanobacillus iheyensis
Bacillus subtilis
Bacillus anthracis
Bacillus cereus ATCC 10987
Bacillus cereus ATCC 14579
Lactobacillus plantarum
Lactobacillus johnsonii
Enterococcus faecalis
Lactococcus lactis
Streptococcus pneumoniae R6
Streptococcus pneumoniae TIGR4
Streptococcus mutans
Streptococcus agalactiae III
Streptococcus agalactiae V
Streptococcus pyogenes M1
Streptococcus pyogenes MGAS8232
Streptococcus pyogenes MGAS315
Streptococcus pyogenes SSI-1
Fibrobacter succinogenes
Chlorobium tepidum
Porphyromonas gingivalis
Bacteroides thetaiotaomicron
Chlamydia muridarum
Chlamydia trachomatis
Chalmydophila caviae
Chlamydophila pneumoniae TW183
Chlamydia pneumoniae J138
Chlamydia pneumoniae CWL029
Chlamydia pneumoniae AR39
Gemmata obscuriglobus
Rhodopirellula baltica
Leplospira interrogans L1-130
Leplospira interrogans 56601
Borrelia burgdorferi
Treponema denticola
Treponema pallidum
Bifidobacterium longum
Tropheryma whipplei TW08/27
Tropheryma whipplei Twist
Streptomyces coelicolor
Streptomyces avermitilis
Corynebacterium diphtheriae
Corynebacterium efficiens
Corynebacterium glutamicum
Corynebacterium glutamicum 13032
Mycobacterium paratuberculosis
Mycobacterium leprae
Mycobacterium bovis
Mycobacterium tuberculosis CDC1551
Mycobacterium tuberculosis H37Rv
Fusobacterium nucleatum
Thermologa maritima
Aquilex aeolicus
Dehalococcoides ethenogenes
Thermus thermophilus
Deinococcus radiodurans
Gloeobacter violaceus
Synechococcus elongatus
Nostoc sp. PCC 7120
Synechocystis sp. PCC6803
Prochlorococcus marinus CCMP1378
Prochlorococcus marinus MIT9313
Prochlorococcus marinus SS120
Synechococcus sp. WH8102
Acidobacterium capsulatum
Solibacter usitatus
Desulfovibrio vulgaris
Geobacter sulfurreducans
Campylobacter jejuni
Wolinella succinogenes
Helicobacter hepaticus
Helicobacter pylori 26695
Helicobacter pylori J99
Wolbachia sp. wMel
Rickettsia conorii
Rickettsia prowazekii
Caulobacter crescentus
Rhodopseudomonas palustris
Bradyrhizobium japonicum
Rhizobium meliloti
Agrobacterium tumefaciens Cereon
Agrobacterium tumefaciens WashU
Brucella melitensis
Brucella suis
Rhizobium loti
Nitrosomonas europaea
Chromobacterium violaceum
Neisseria meningiridis B
Neisseria meningiridis A
Ralstonia solanacearum
Bordetella pertussis
Bordetella bronchiseptica
Bordetella parapertussis
Coxiella burnetii
Xanthomonas campestris
Xanthomonas axonopodis
Xylella fastidiosa 9a5c
Xylella fastidiosa 700964
Pseudomonas aeruginosa
Pseudomonas putida
Pseudomonas syringae
Shewanella oneidensis
Photobacterium profundum
Vibrio cholerae
Vibrio parahaemolyticus
Vibrio vulnificus YJ016
Vibrio vulnificus CMCP6
Haemophilus ducreyi
Haemophilus multocida
Pasteurella multocida
Haemophilus influenzae
Blochmannia floridanus
Wigglesworthia brevipalpis
Buchnera aphidicola Bp
Buchnera aphidicola APS
Buchnera aphidicola Sg
Photorhabdus luminescens
Yersinia pestis Medievalia
Yersinia pestis KIM
Yersinia pestis CO92
Salmonella typhimurium
Salmonella enterica
Salmonella typhi
Escherichia coli EDL933
Escherichia coli O157:H7
Escherichia coli O6
Escherichia coli K12
Shigella flexneri 2a 245TT
Shigella flexneri 2a 301
Nanoarchaeum equitans
Pyrobaculum aerophilum
Aeropyrum pernix
Sulfolobus tokodaii
Sulfolobus solfataricus
Thermoplasma acidophilum
Thermoplasma volcanium
Archaeoglobus fulgidus
Halobacterium sp. NRC-1
Methanosarcina acetivorans
Methanosarcina mazei
Pyrococcus furiosus
Pyrococcus abyssi
Pyrococcus horikashii
Methanopyrus kandleri
Methanobacterium thermautotrophicum
Methanococcus jannaschii
Methanococcus maripaludis
Giardia lamblia
Leishmania major
Thalassiosira pseudonana
Cryptosporidium hominis
Plasmodium falciparum
Cyanidioschyzon merolae
Oryza sativa
Arabidopsis thaliana
Dictyostelium discoideum
Schizosaccharomyces pombe
Eremothecium gossypii
Saccharomyces cerevisiae
Caenorhabditis elegans
Drosophila melanogaster
Anopheles gambiae
Takifugu rubripes
Danio rerio
Gallus gallus
Mus musculus
Rattus norvegicus
Homo sapiens
Pan troglodytes

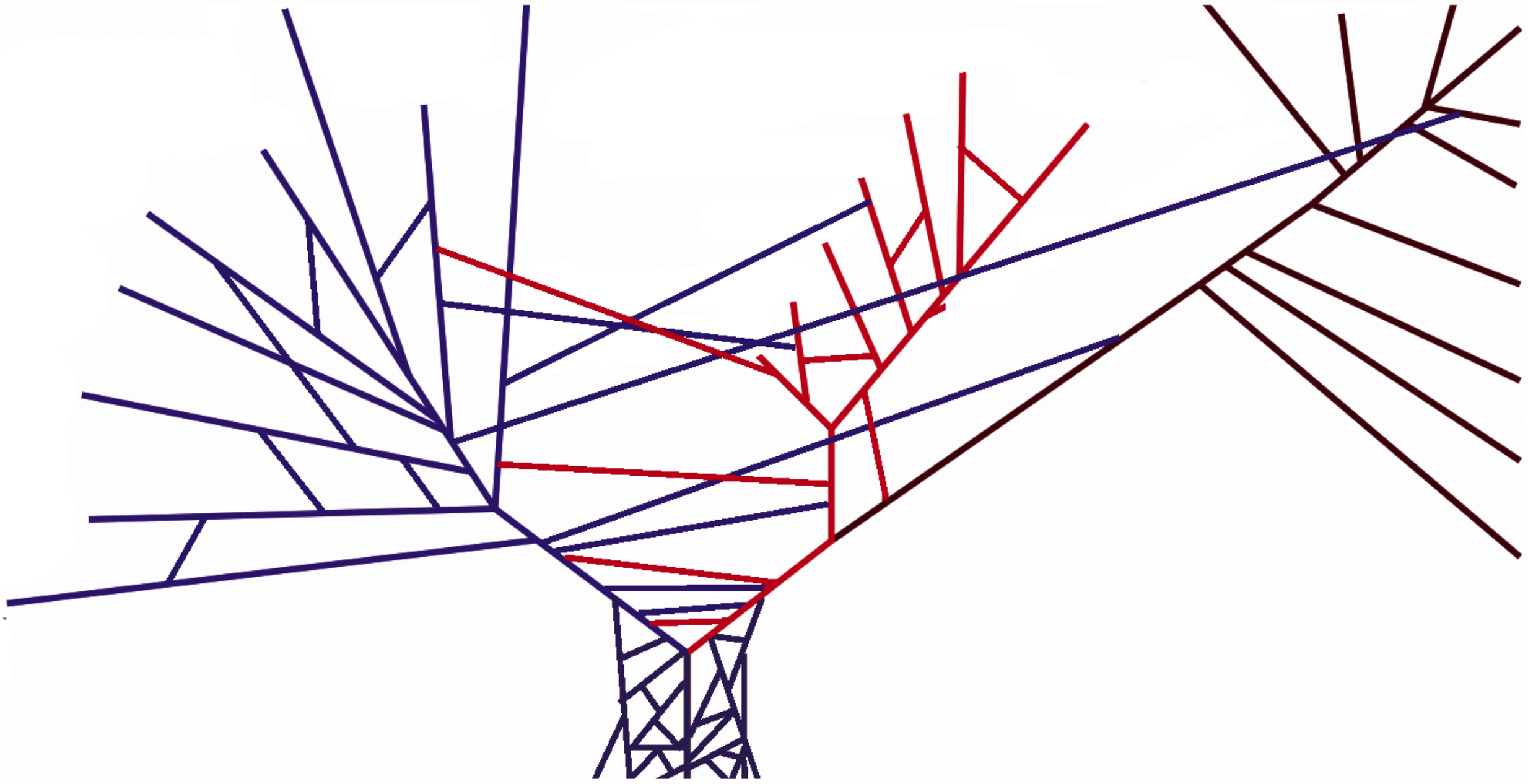
Phylogenetic Tree of Life

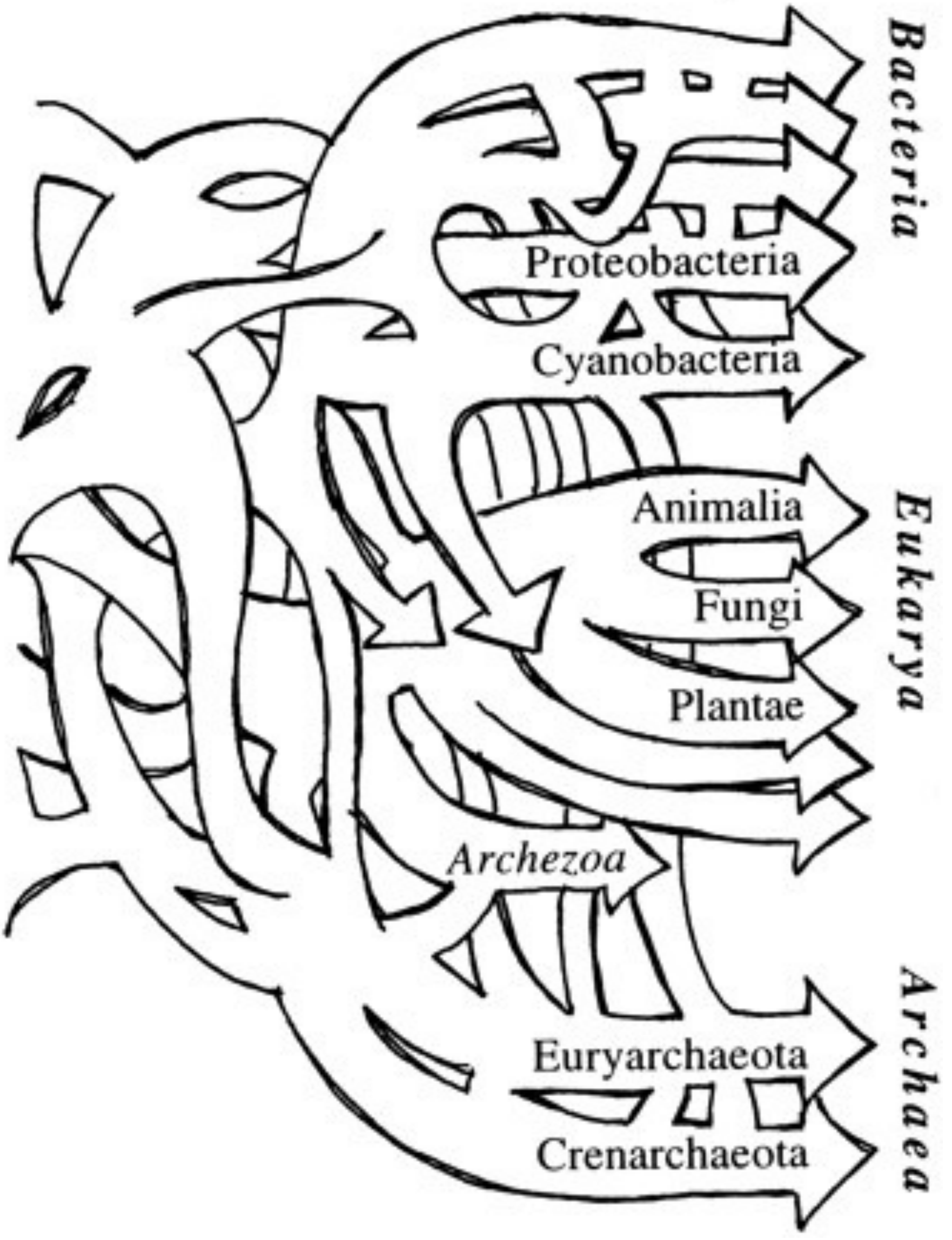


Bacteria

Archaea

Eucarya




Bacteria
Proteobacteria
Cyanobacteria
Eukarya
Animalia
Fungi
Plantae
Archezoa
Archaea
Euryarchaeota
Crenarchaeota

Schem: XI.

Fig: 1.

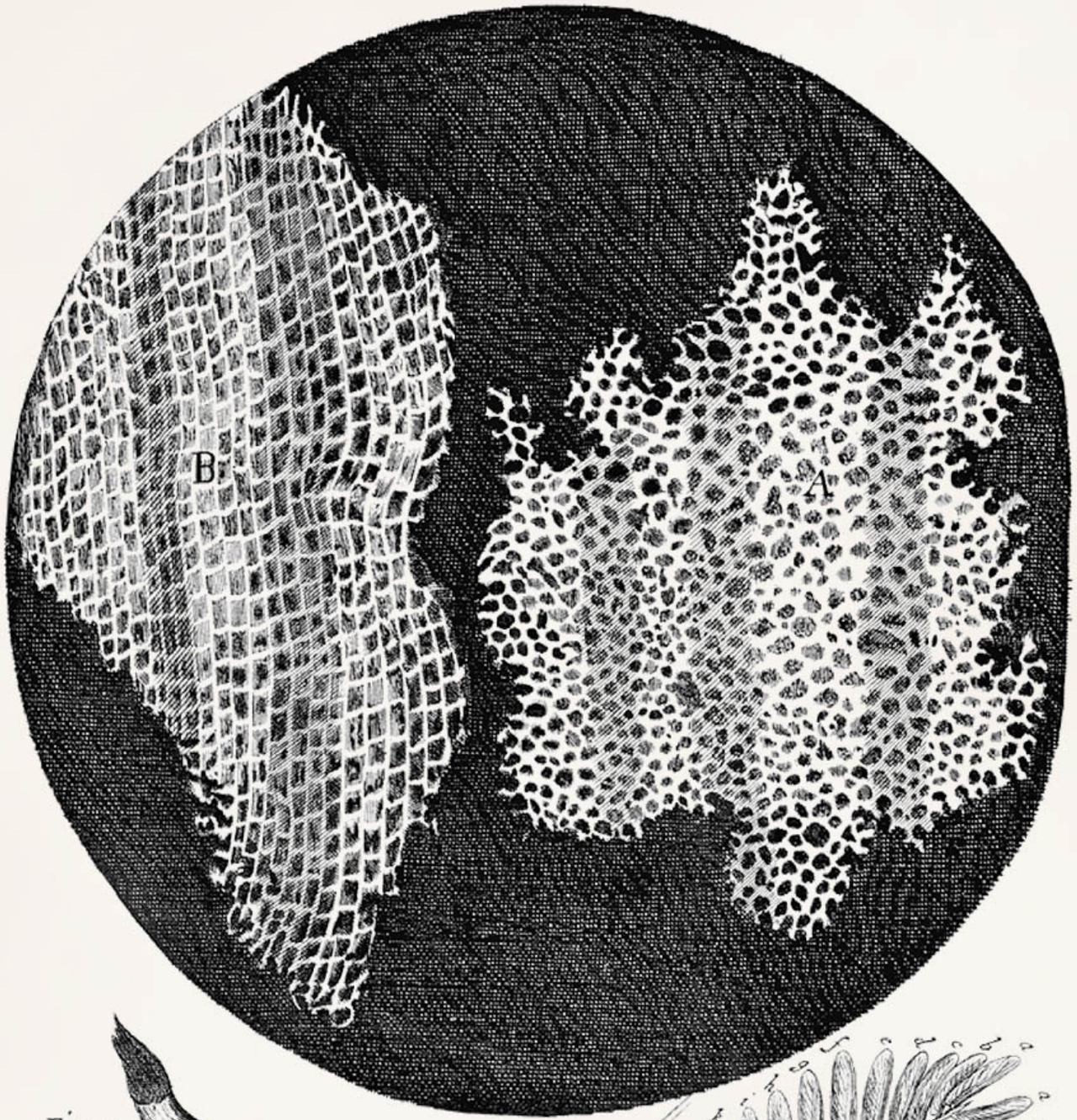
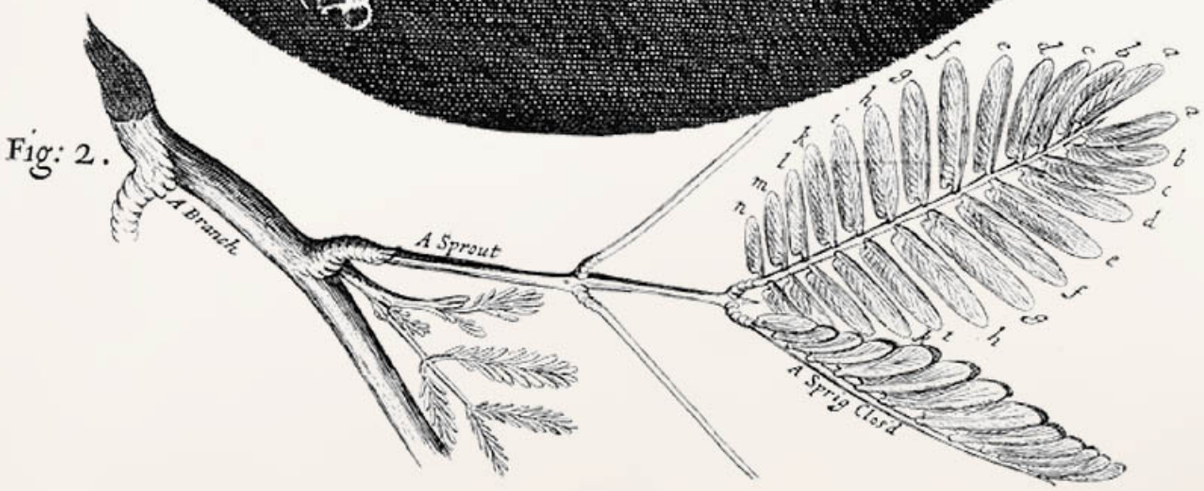


Fig: 2.



Left: Fig. 1 cork cells
Right: Hooke's microscope

Schem: XXVI.

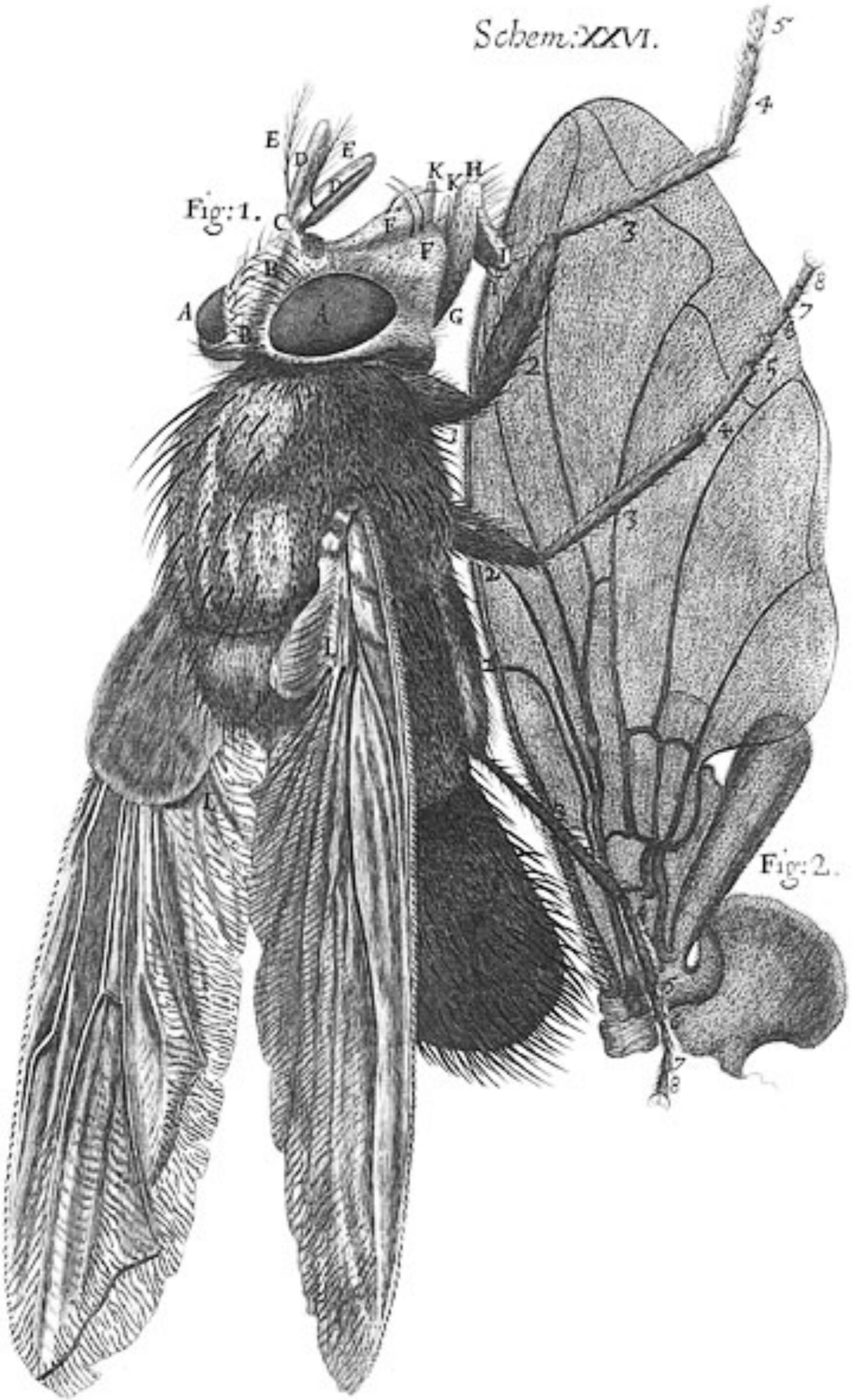


Fig: 2.

Cell theory

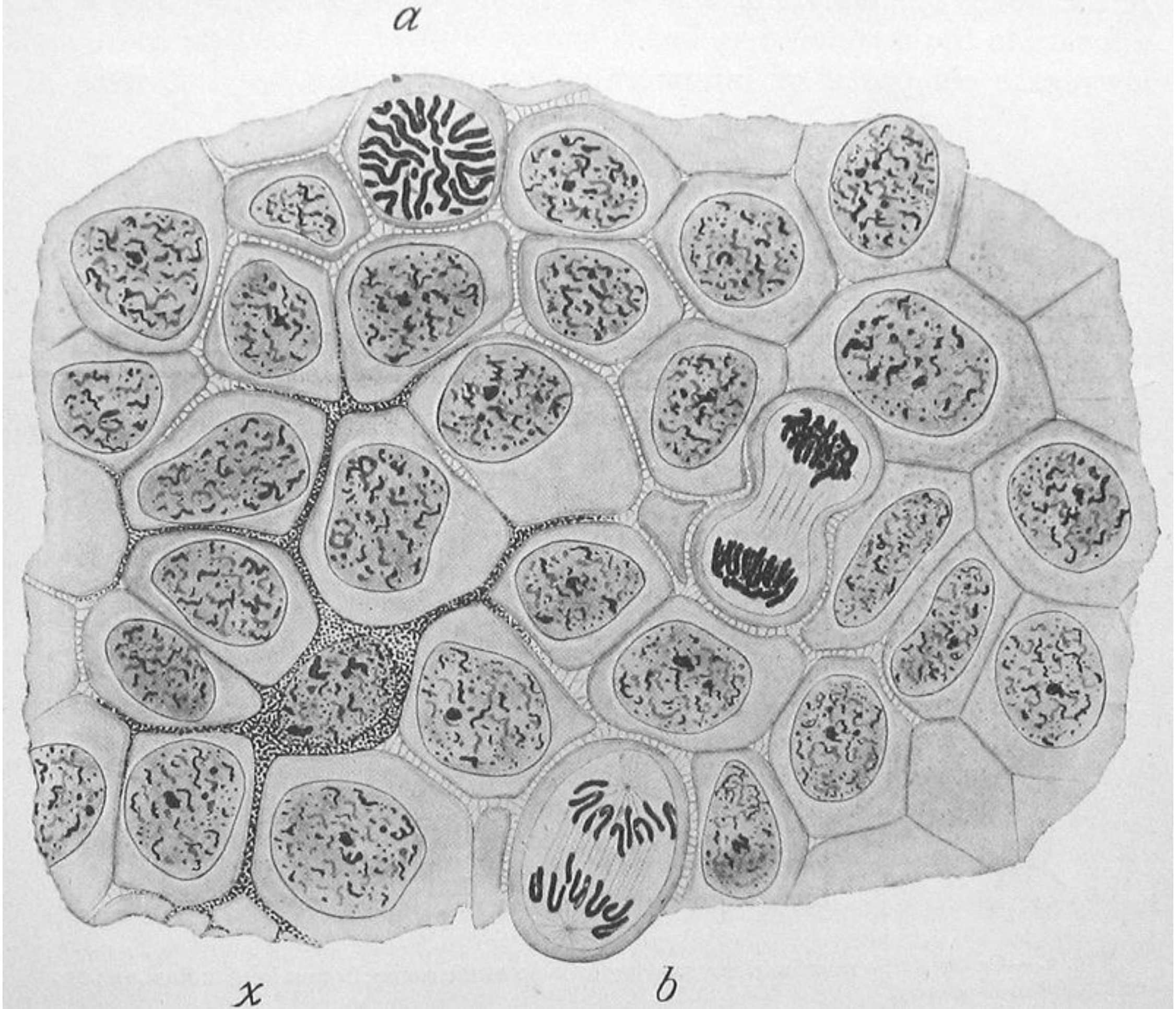
-For the biologists of the **2nd half of the 19th century**, the cell was the **key** to all biological problems.

-> all vital **functions** (**metabolism, development, reproduction, heredity**) could be considered as **cellular activities** - as activities that occur inside cells.

The cell theory consisted of **3 principles**:

1. **all** plants and animals **are made of cells**
2. cells have **all the characteristics of life** (e.g. metabolism, growth, reproduction)
3. all cells arise **by division of preexisting cells**

-> the cell as the universal **structural** and **functional** unit


a
x
b

450 POSTE VATICANE

M. CODONI

I.P.Z.S.-ROMA-1984

White-eyed mutant fly

Red-eyed wild-type fly

non darwinian theories of evolution

mendelians vs biometricians

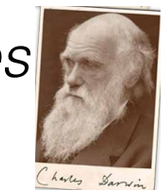
1750 1800 1850 1900 1950

1831-1836
Beagle voyage

~1930-1950
Modern Synthesis or
neo-Darwinism or
synthetic theory

rediscovery of Mendel

1866, Mendel's paper 

1859, *Origin of Species* 

1809, *Philosophie Zoologique*

Modern Synthesis or neo-Darwinism

-evolutionary synthesis or **Modern Synthesis** or **neo-Darwinism** or **synthetic theory**

-> synthesis of **darwinism** and **mendelism**
-> convergence between **naturalists** and **geneticists**

-> **<u>central event</u>** in the history of biology of **20th century**

-the **evolutionary synthesis** took place during the **30s** and **40s**

-for many biologists it constitutes even today the **fundamental framework in evolutionary biology**

-the phrase 'evolutionary synthesis' comes from **Julian Huxley's** (1887–1975) book: ***Evolution: the Modern Synthesis*** **(1942)**

Modern Synthesis or neo-Darwinism

2 main theses:

-> **evolution** occurs **natural selection** that acts on **variation** that results from **mutation** and **recombination**

-> the phenomena observed by **paleontologists**, **systematists**, and **field biologists** can be explained in a manner **compatible** with **already known genetic mechanisms**

-‘**merging**' of different specialties (and not a **replacement** of one 'paradigm' with another)

-conditions of the 2nd world war **favourable** for such a synthesis, as **research** in the field and in labs is **hindered**

Modern Synthesis or neo-Darwinism

-a central tenet of the **synthetic theory**:

-> natural populations contain a large **gene pool**, and thus enough **variation** for **natural selection** to act

- new **mutations** are rarely the **direct** source of variation on which **natural selection** acts

- **variation** mostly results from **genetic recombination**

- there is **no relationship** between **mutation rate** and the **direction** of evolution

-> this view spread during the **40s**

Population Genetics

-emergence of **population genetic** in the 1920s

-<u>quantitative models</u> of evolutionary processes

-evolution as **change in gene frequencies in populations**

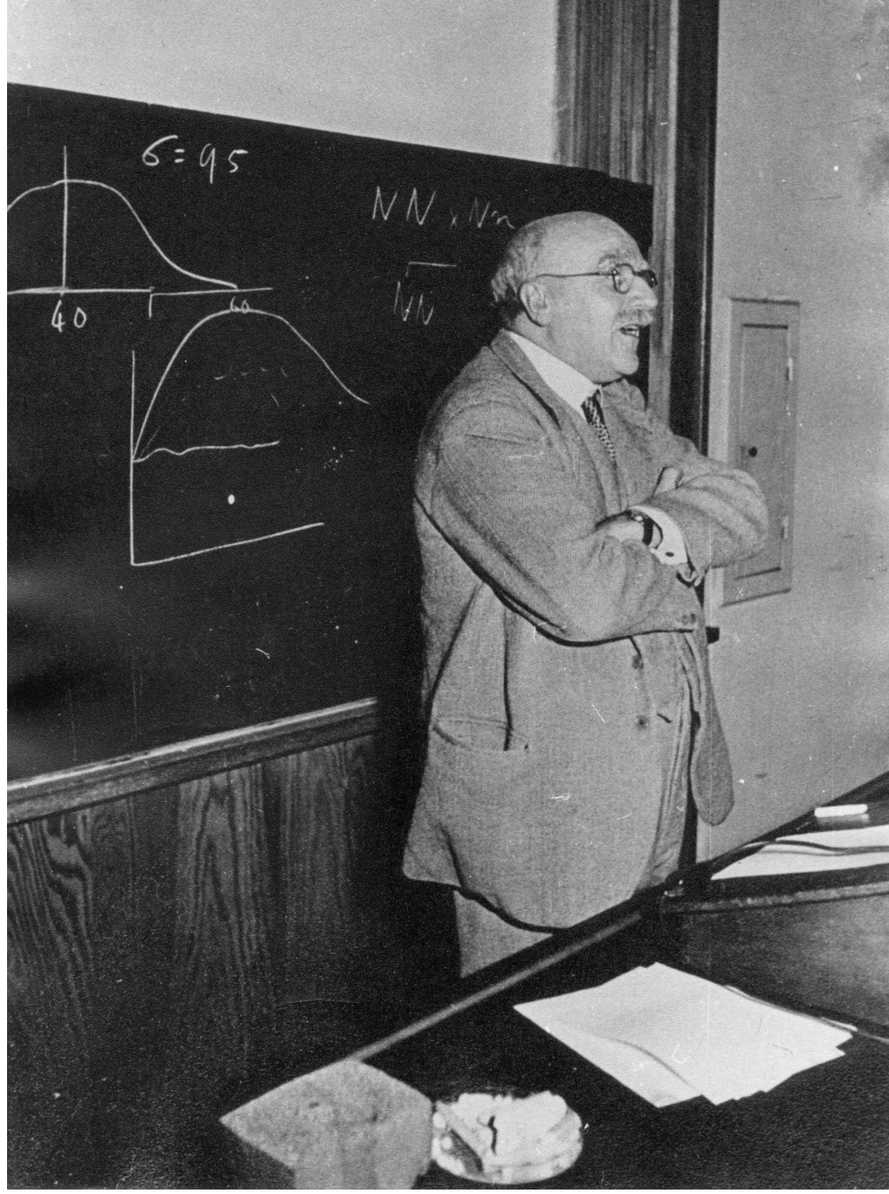
[Hardy-Weinberg equilibrium]

-> **natural selection** as a force that **changes gene frequencies**

-> R. A. **Fisher** (1890–1962) & J. B. S. **Haldane** (1889–1988) in UK
-> Sewall **Wright** (1892–1964) in USA

-founders of theoretical **population genetics**

Population Genetics



Haldane:

-series of articles **between 1924 & 1931**, in which he constructs **population genetics models**

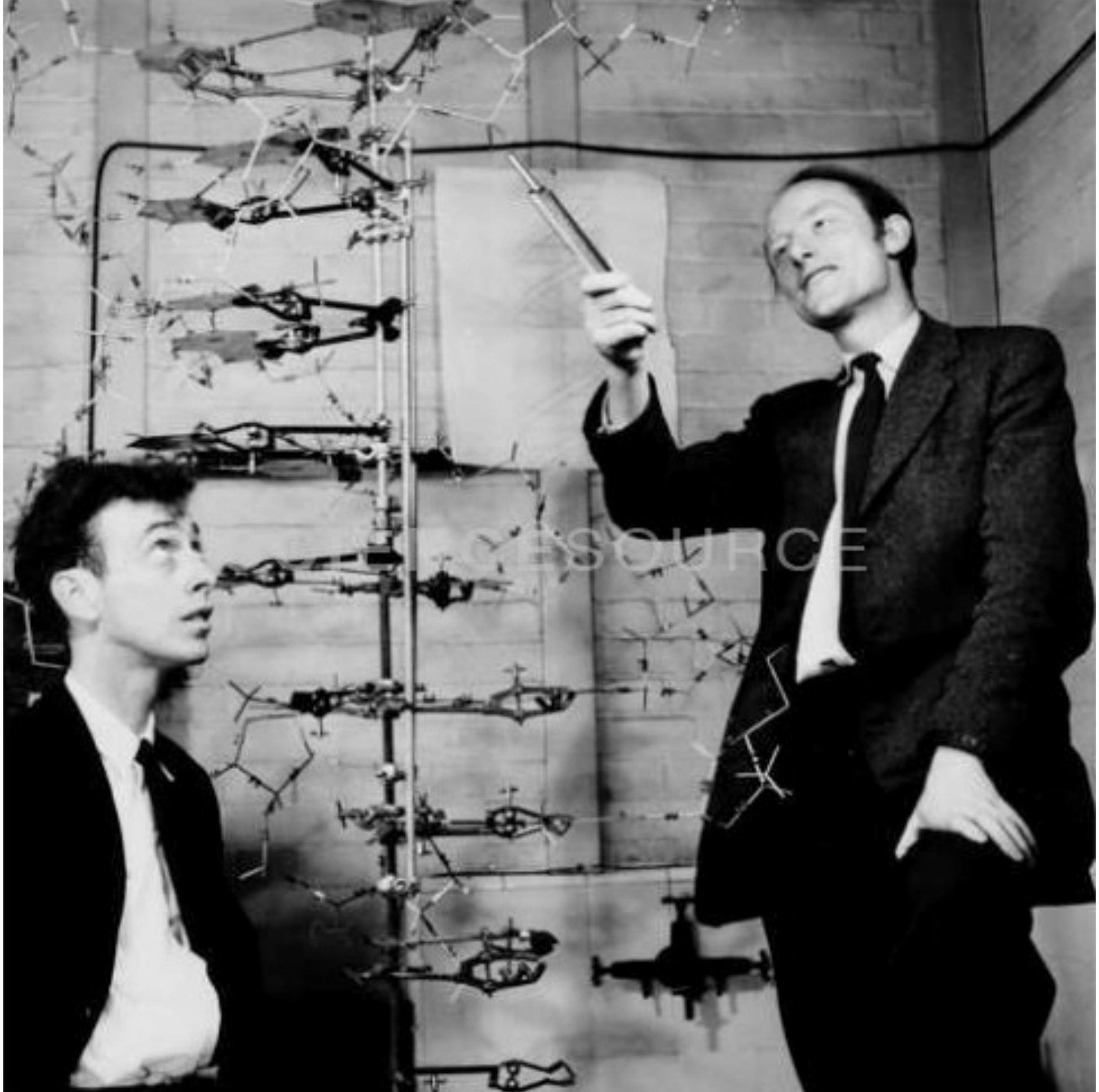
-> in **1924** publishes a classic example of evolution, the case of the **<u>peppered moth</u>** (Amphidasys betularia)

-> shows the **power** of **natural selection**

[-> frequency of **melanic** form **< 1%** in **1848**, until **1901 ~ 99%**
-> calculates that melanic form must have had **50% selective advantage**]

-Main conclusion of population geneticists:
-> **even a small genetic difference could spread quickly through the population**

-> many <u>neo-Lamarckians</u> are convinced (e.g. Ernst Mayr, Bernhard Rensch)



equipment, and to Dr. G. E. R. Deacon and the captain and officers of R.R.S. *Discovery II* for their part in making the observations.

[1] Young, F. B., Gerrard, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).
[2] Longuet-Higgins, M. S., *Mon. Not. Roy. Astro. Soc., Geophys. Supp.*, **5**, 285 (1949).
[3] Von Arx, W. S., Woods Hole Papers in Phys. Oceanog. Meteor., **11** (3) (1950).
[4] Ekman, V. W., *Arkiv. Mat. Astron. Fysik.* (Stockholm), **2** (11) (1905).

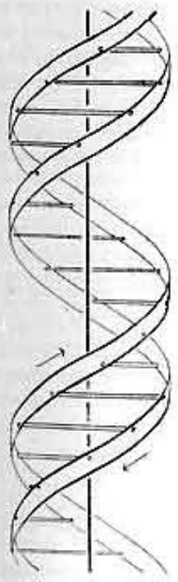
MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey[1]. They kindly made their manuscript available to us in advance of publication. Their model consists of three intertwined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons: (1) We believe that the material which gives the X-ray diagrams is the salt, not the free acid. Without the acidic hydrogen atoms it is not clear what forces would hold the structure together, especially as the negatively charged phosphates near the axis will repel each other. (2) Some of the van der Waals distances appear to be too small.

Another three-chain structure has also been suggested by Fraser (in the press). In his model the phosphates are on the outside and the bases on the inside, linked together by hydrogen bonds. This structure as described is rather ill-defined, and for this reason we shall not comment on it.



This figure is purely diagrammatic. The two ribbons symbolize the two phosphate—sugar chains, and the horizontal rods the pairs of bases holding the chains together. The vertical line marks the fibre axis

We wish to put forward a radically different structure for the salt of deoxyribose nucleic acid. This structure has two helical chains each coiled round the same axis (see diagram). We have made the usual chemical assumptions, namely, that each chain consists of phosphate diester groups joining β-D-deoxyribofuranose residues with 3′,5′ linkages. The two chains (but not their bases) are related by a dyad perpendicular to the fibre axis. Both chains follow right-handed helices, but owing to the dyad the sequences of the atoms in the two chains run in opposite directions. Each chain loosely resembles Furberg's[2] model No. 1; that is, the bases are on the inside of the helix and the phosphates on the outside. The configuration of the sugar and the atoms near it is close to Furberg's 'standard configuration', the sugar being roughly perpendicular to the attached base. There is a residue on each chain every 3·4 A. in the *z*-direction. We have assumed an angle of 36° between adjacent residues in the same chain, so that the structure repeats after 10 residues on each chain, that is, after 34 A. The distance of a phosphorus atom from the fibre axis is 10 A. As the phosphates are on the outside, cations have easy access to them.

The structure is an open one, and its water content is rather high. At lower water contents we would expect the bases to tilt so that the structure could become more compact.

The novel feature of the structure is the manner in which the two chains are held together by the purine and pyrimidine bases. The planes of the bases are perpendicular to the fibre axis. They are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other chain, so that the two lie side by side with identical *z*-co-ordinates. One of the pair must be a purine and the other a pyrimidine for bonding to occur. The hydrogen bonds are made as follows: purine position 1 to pyrimidine position 1; purine position 6 to pyrimidine position 6.

If it is assumed that the bases only occur in the structure in the most plausible tautomeric forms (that is, with the keto rather than the enol configurations) it is found that only specific pairs of bases can bond together. These pairs are: adenine (purine) with thymine (pyrimidine), and guanine (purine) with cytosine (pyrimidine).

In other words, if an adenine forms one member of a pair, on either chain, then on these assumptions the other member must be thymine; similarly for guanine and cytosine. The sequence of bases on a single chain does not appear to be restricted in any way. However, if only specific pairs of bases can be formed, it follows that if the sequence of bases on one chain is given, then the sequence on the other chain is automatically determined.

It has been found experimentally[3,4] that the ratio of the amounts of adenine to thymine, and the ratio of guanine to cytosine, are always very close to unity for deoxyribose nucleic acid.

It is probably impossible to build this structure with a ribose sugar in place of the deoxyribose, as the extra oxygen atom would make too close a van der Waals contact.

The previously published X-ray data[5,6] on deoxyribose nucleic acid are insufficient for a rigorous test of our structure. So far as we can tell, it is roughly compatible with the experimental data, but it must be regarded as unproved until it has been checked against more exact results. Some of these are given in the following communications. We were not aware of the details of the results presented there when we devised our structure, which rests mainly though not entirely on published experimental data and stereochemical arguments.

It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.

Full details of the structure, including the conditions assumed in building it, together with a set of co-ordinates for the atoms, will be published elsewhere.

We are much indebted to Dr. Jerry Donohue for constant advice and criticism, especially on interatomic distances. We have also been stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M. H. F. Wilkins, Dr. R. E. Franklin and their co-workers at

Nobel Prize in Physiology or Medicine (1962) -Crick, Watson & Wilkins

"for their discoveries concerning the **molecular structure of nucleic acids** and its significance for **information transfer in living material**"

Structure of the course

The course consists of **5 thematic units**:

1 <u>Philosophical issues in evolutionary biology</u>
Weeks 2-5 (evolution, natural selection, adaptation, adaptationism, niche construction, teleology, units of selection)

2 <u>The ontology of evolution</u>
Weeks 6-7 (organisms, biological individuals, biological species, higher taxa)

3 <u>Philosophical issues in genetic and molecular biology</u>
Weeks 8-10 (reductionism, gene, genetic causation, genetic information)

4 <u>Biology as a science</u>
Week 11 (biological laws and mechanisms, complexity, evolutionary progress, life)

5 <u>Evolution and human nature</u>
Weeks 12-13 (sociobiology, evolutionary psychology, cultural evolution, human nature, evolutionary ethics)

	Topic	PB	DG
1	Introduction	PB ch. 1	
2	Evolution and natural selection	PB 28-42	
3	Adaptationism and niche construction	PB 50-59	
4	Teleological concepts in biology	PB 59-65	
5	The units of selection and the gene's-eye view of evolution	PB 42-49 93-99	DG part 2
6	Organisms and biological individuals	PB 66-80	
7	Biological species and higher taxa	PB 100-119	
8	The concept of the gene	PB 81-93	
9	Reductionism in biology		
10	Genetic information	PB 144-157	
11	Biological laws and mechanisms	PB 11-27	DG part 3
12	Evolutionary explanations of social behaviour	PB 120-136	
13	Cultural evolution and human nature	PB 45-49 PB 136-143	

- Richard Dawkins , 1nine76 The selfish gene
- Quine Epistemology naturalised
- taxonomy classification
- rank
- naturalists
- Buffon
- Lamarck
- saltationists
- finches / mockingbirds / turtle
- evolutionary lineage
- LUCA
- life experiment - genetic code

- patterns - process in evolution
- vestiges - vestigial traits

- trait = feature / characteristic