

Ιστορία της Βιολογίας

Τρίτη 9:30 - 12:00, Αίθουσα Β

Διδάσκων: Σταύρος Ιωαννίδης

Email: stavros.ioannidis.phil@gmail.com

Ώρες γραφείου: μετά από συνεννόηση
(κτήριο γραμματείας, ισόγειο, πρώτο γραφείο αριστερά)

<http://eclass.uoa.gr/courses/PHS249/>

Προτεινόμενα συγγράμματα

Mayr (2008) *Η ανάπτυξη της βιολογικής σκέψης*, ΜΙΕΤ <- κλασικό έργο στην ιστορία της βιολογίας, πολύ λεπτομερές

Morange (2017) *Ιστορία της βιολογίας*, Utopia <- πολύ πιο σύντομο από τον Mayr, γενική επισκόπηση, χρήσιμο για το μάθημα

Βασική Βιβλιογραφία

<- εδώ αναφέρονται τα βιβλία που ιδανικά κανείς θα πρέπει να διαβάσει κατά τη διάρκεια του μαθήματος

- **Bowler & Morus (2012)** *Η ιστορία της νεότερης επιστήμης: μια επισκόπηση*, Πανεπιστημιακές Εκδόσεις Κρήτης

(κεφάλαια **5**: Η ηλικία της γης, **6**: Δαρβινική επανάσταση, **7**: Νέα βιολογία, **8**: Γενετική, **18**: Βιολογία και Ιδεολογία)

- **Morange (2017)** *Ιστορία της βιολογίας*, Utopia
- **Δαρβίνος (2007)** *Αυτοβιογραφία*, Εκδόσεις Γκοβόστη
- **Watson (1990)** *Η διπλή έλικα*, Τροχαλία

Άλλα σημαντικά συγγράμματα

[βιβλία για πιο λεπτομερή μελέτη: βλ. κυρίως τα **Darwin** (1859), **Κριμπάς** (2009), **Mayr** (1991), **Ridley** (2007)]

Δαρβίνος (1998) *Ταξιδεύοντας με το Μπιγκλ στη Γη του Πυρός & τα νησιά Γκαλαπάγκος*, Στοχαστής

Darwin (1859) *On the Origin of Species (1st ed)* (εισαγωγή, κεφ. 1-4, 6, 14)

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

Κριμπάς (2009) *Δαρβινισμός και η ιστορία του έως τις μέρες μας*, Ωκεανίδα

Mayr (1991) *Ο Δαρβίνος και η γένεση της σύγχρονης εξελικτικής σκέψης*, Σύναλμα

Mayr (2008) *Η ανάπτυξη της βιολογικής σκέψης*, MIET

Mukherjee (2017) *The Gene: An Intimate History*, Vintage

Ridley (2007) *Δαρβίνος*, Εκδόσεις Πατάκη

Sapp (2003) *Genesis: the evolution of biology*, Oxford University Press

Sturtevant (2001) *A History of Genetics*, Cold Spring Harbor Press

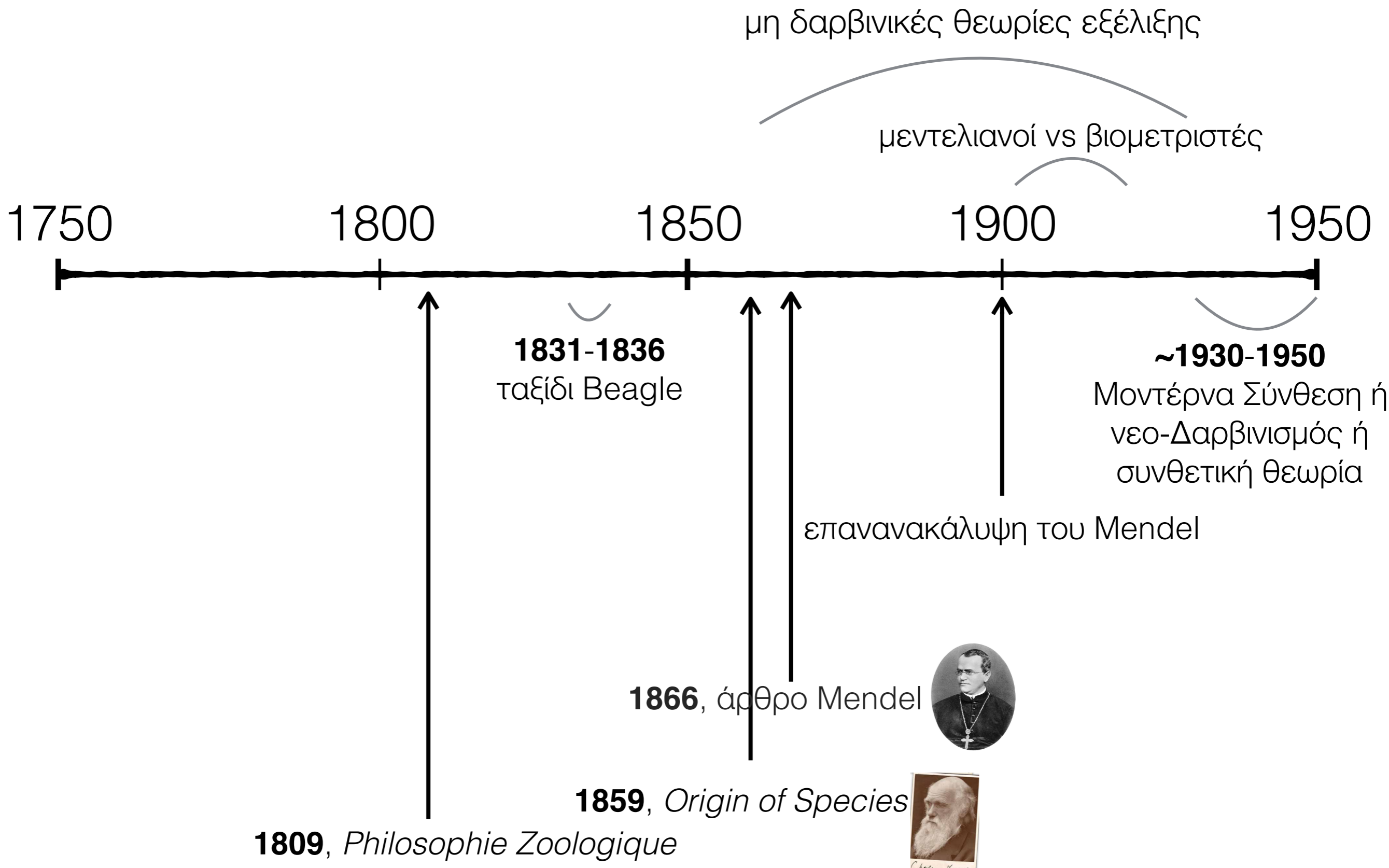
Διαδικτυακές πηγές

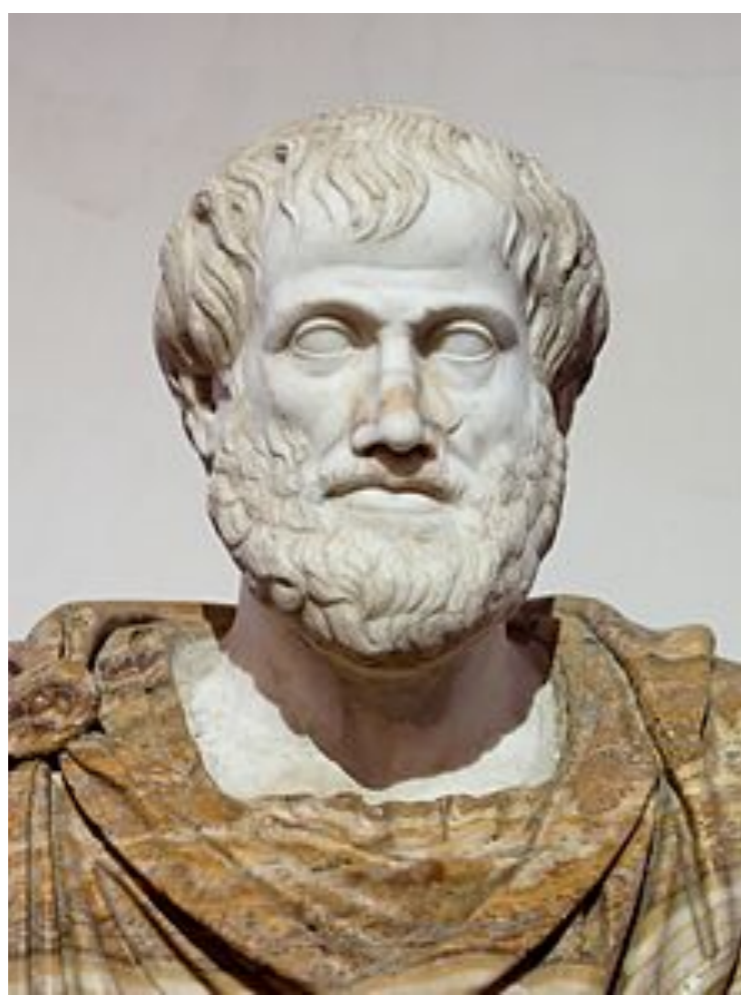
<http://darwin-online.org.uk>

<https://www.darwinproject.ac.uk>

<http://wallace-online.org>

<http://www.mendelweb.org/home.html>

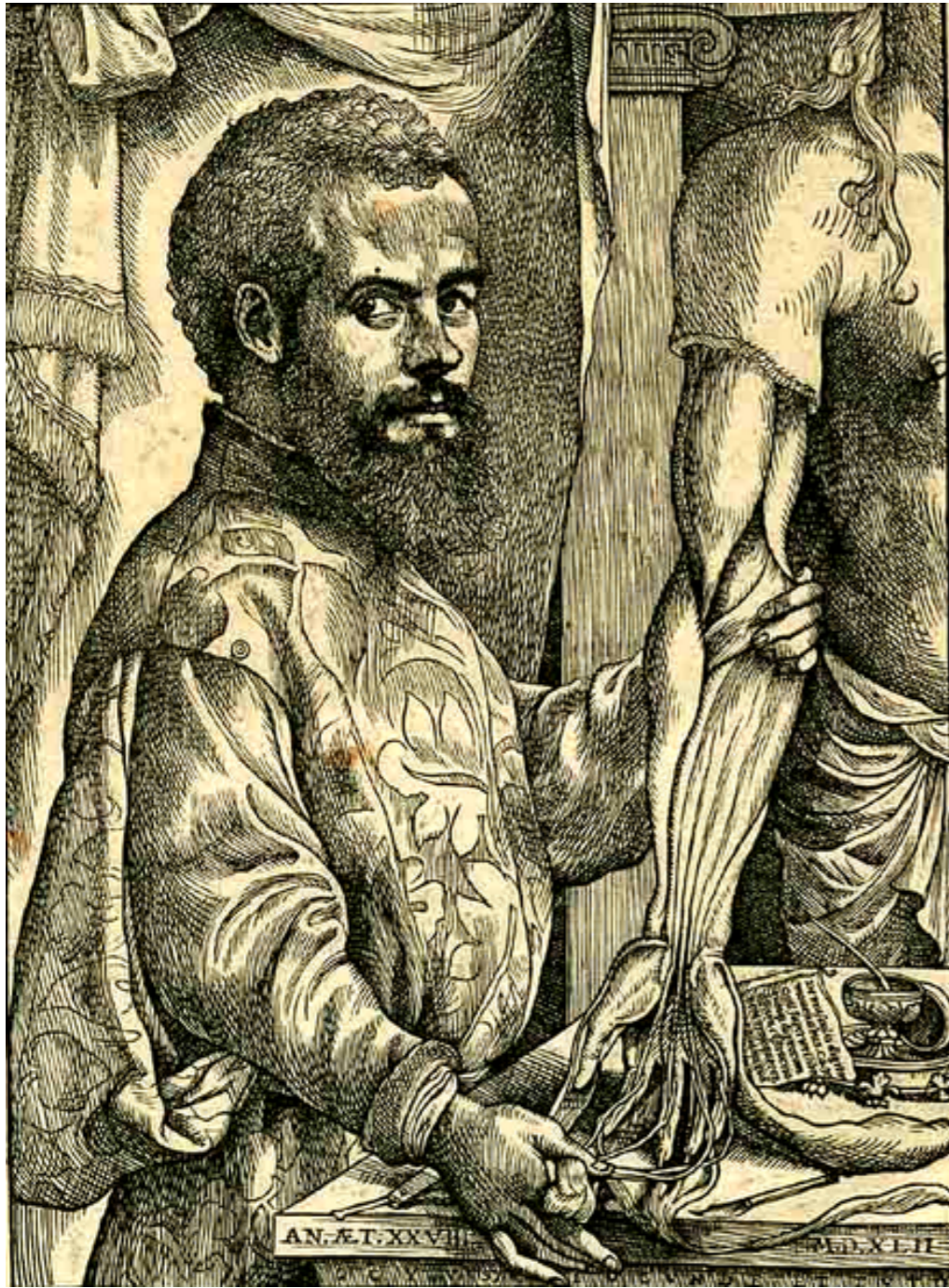




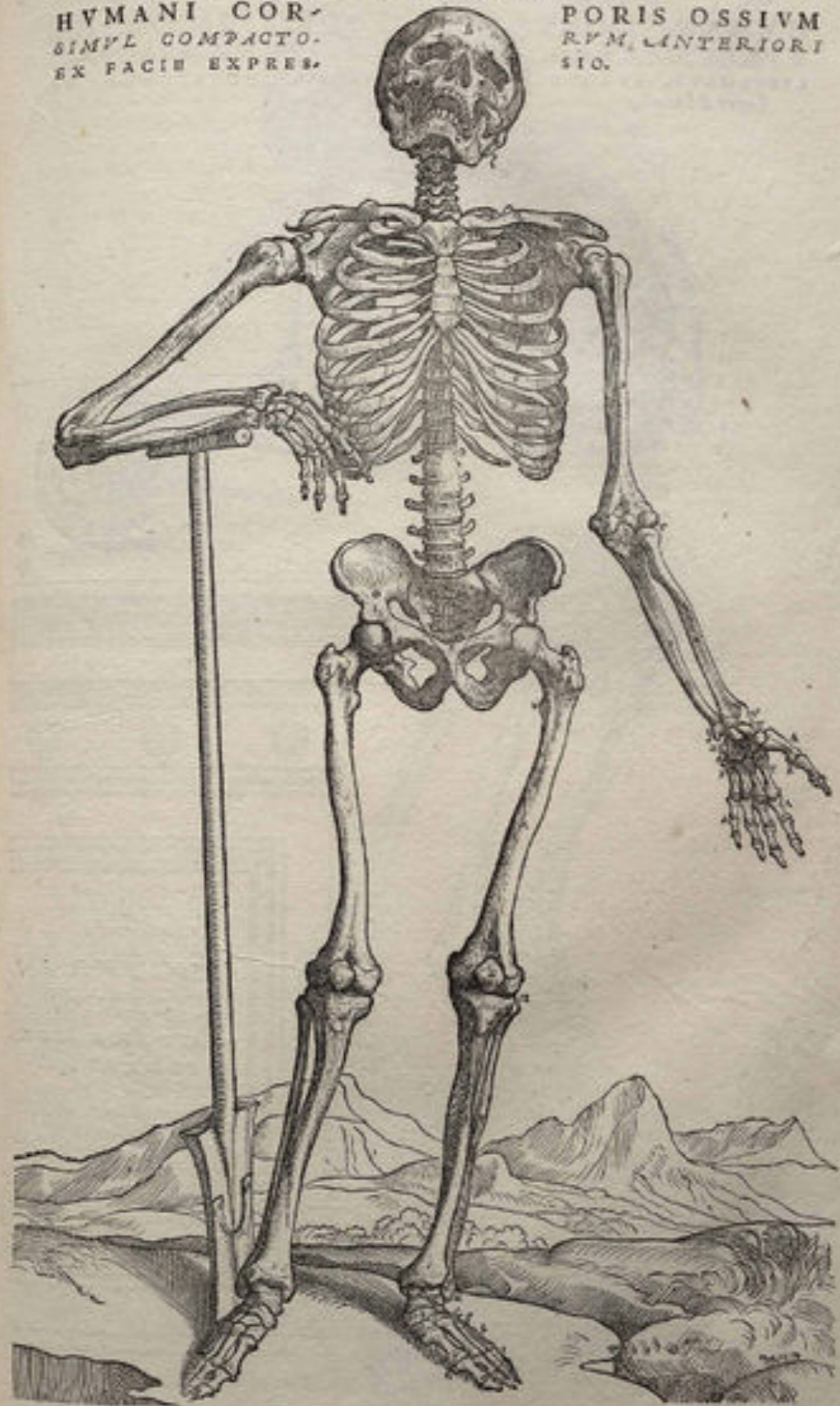
The **octopus** is a **stupid creature**, for it will approach a man's hand if it be lowered in the water; but it is **neat and thrifty** in its habits: that is, it lays up stores in its nest, and, after eating up all that is eatable, it ejects the shells and sheaths of crabs and shell-fish, and the skeletons of little fishes. It seeks its prey by so changing its colour as to render it like the colour of the stones adjacent to it; it does so also when alarmed. ... The octopus as a rule **does not live the year out**. It has a natural tendency to run off into liquid; for, if beaten and squeezed, it keeps losing substance and at last disappears. ... As a **proof** that they do not live into a second year there is the fact that, after the birth of the little octopuses in the late summer or beginning of autumn, it is seldom that a large-sized octopus is visible, whereas a little before this time of year the creature is at its largest. ... The octopus is the only mollusc that ventures on to dry land; it walks by preference on rough ground; it is firm all over when you squeeze it, excepting in the neck.

(Aristotle, History of Animals)

Andreas Vesalius (1514 – 1564), *De humani corporis fabrica*, 1543 (On the fabric of the human body)



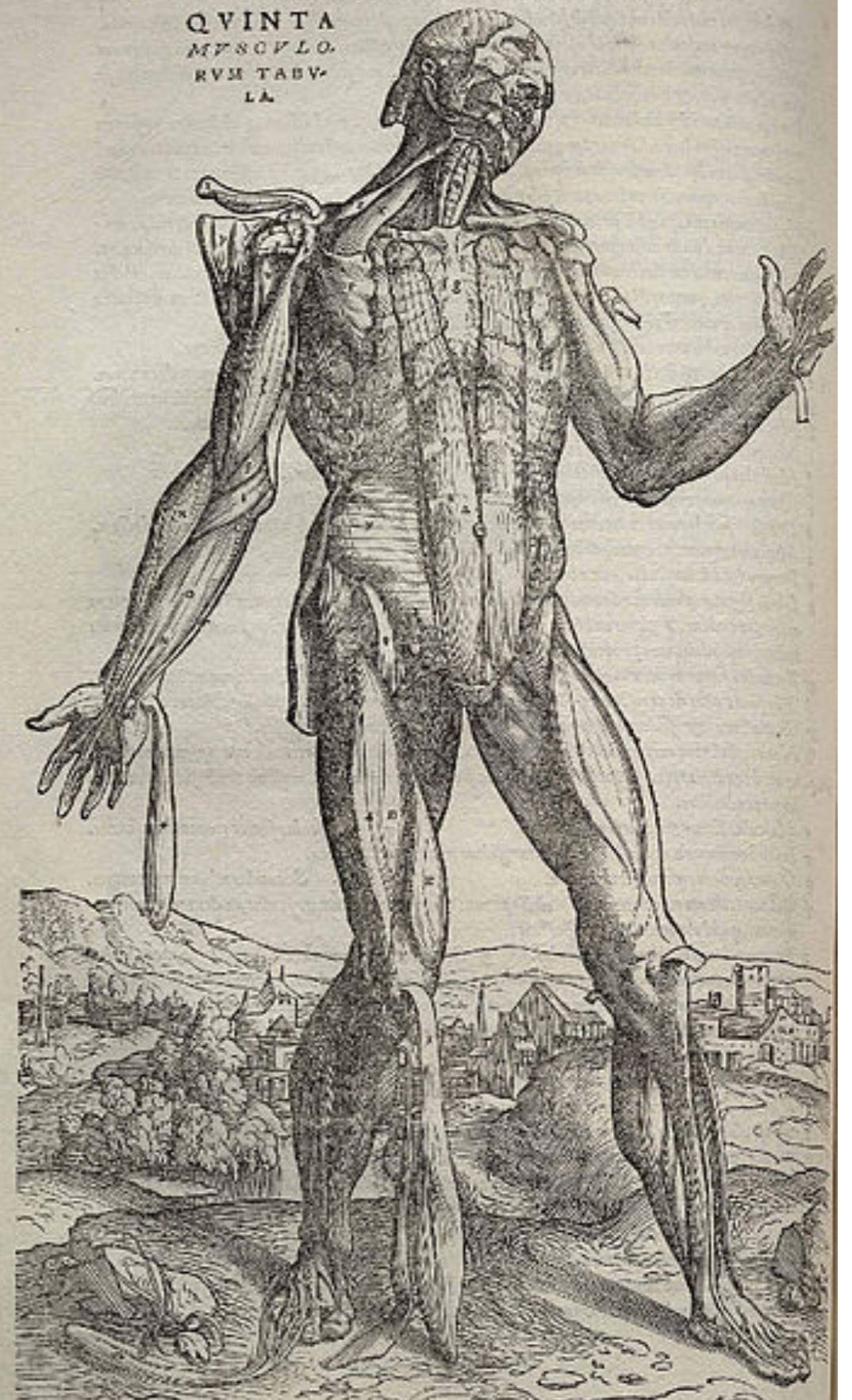
DE HVMANI CORPORIS FABRICA LIBER I. 153
HVMANI COR-
SIMPL COMPACTO-
EX FACIE EXPRES-
PORIS OSSIVM
RVM ANTERIORI
SIO.



184

ANDREAE VESALII BRVXELLENSIS

QVINTA
MVSQVLO-
RVM TABV-
LA



VIGESIMASECVNDA QVINTI LIBRI FIGVRA.

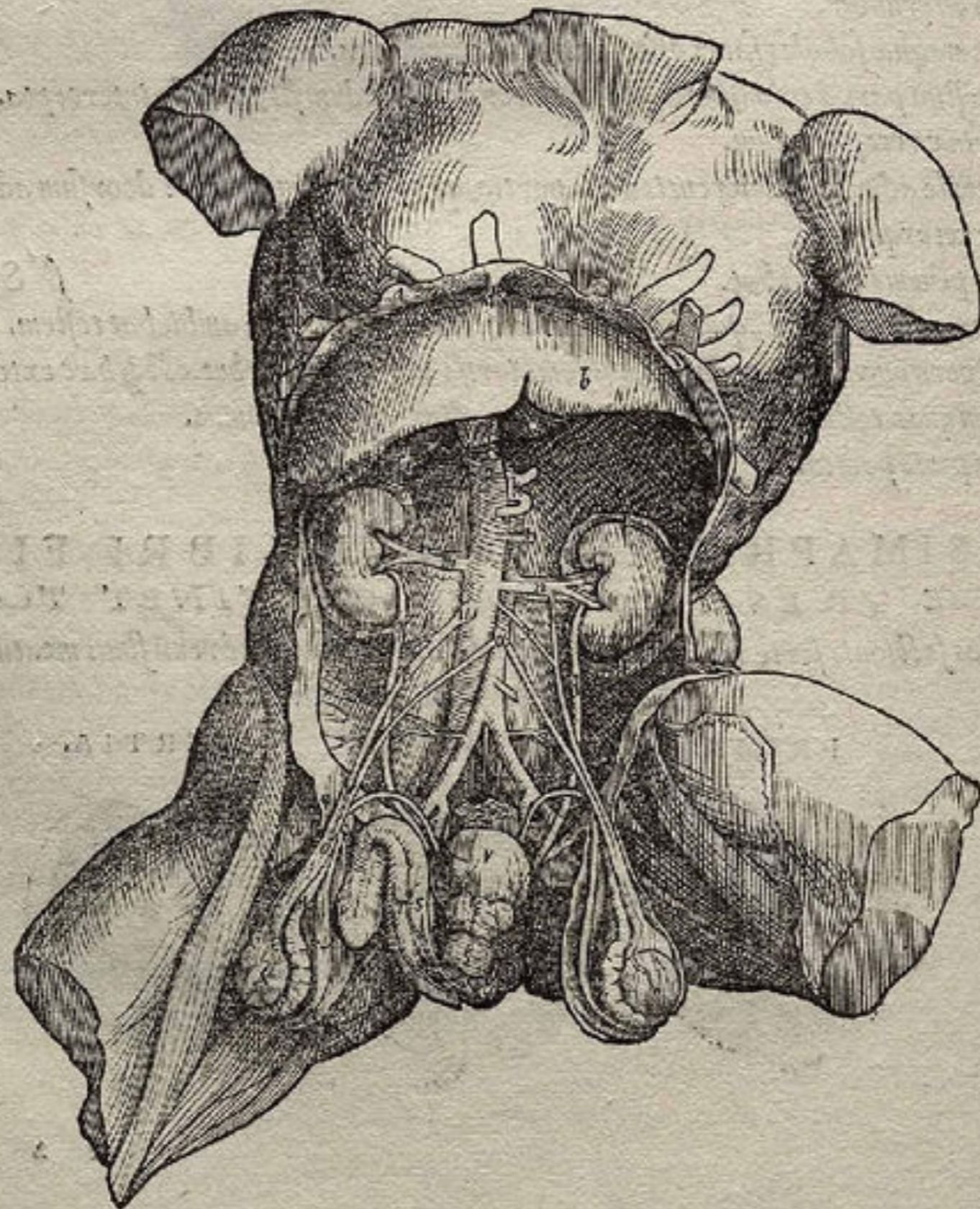


PLATE 2

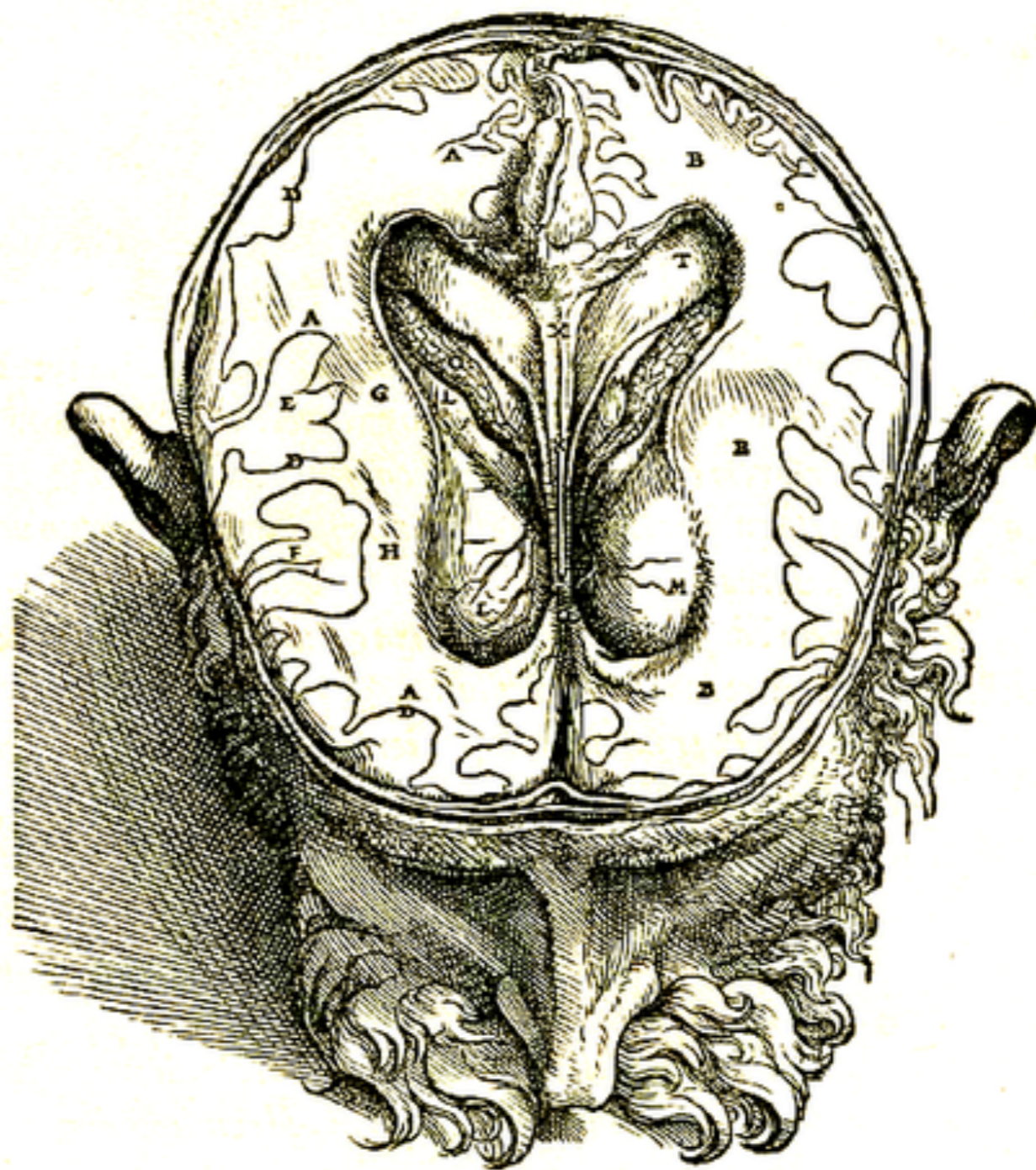
VIGES

QVINTA SEPTIMI LIBRI FIGVRA.

PRÆSENS figura quòd ad relictam in caluaria cerebri portionē attinet, nulla ex parte uariat: atq; id solū habet proprium, quod callosum corpus hic anteriori sua sede à cerebro primū liberauimus, ac dein eleuatum in posteriora refleximus, septum dextrī ac sinistri uentriculorum diuellentes, & corporis instar testudinis extructi superiorem superficiem ob oculos ponētes.

Ab A A, A, A itaq; & B, B, ad Q. B, ac dein D, D, D, & E & F, & G & H eadem hic indicant, quæ in quarta figura. Sic quoque & L, L, & M, M, & O & P & Q eadem insinuant.

R, R, R Notatur inferior callosi corporis superficies. est enim id à sua sede motum, atque in posteriora reflexum.



S, T, V Supe

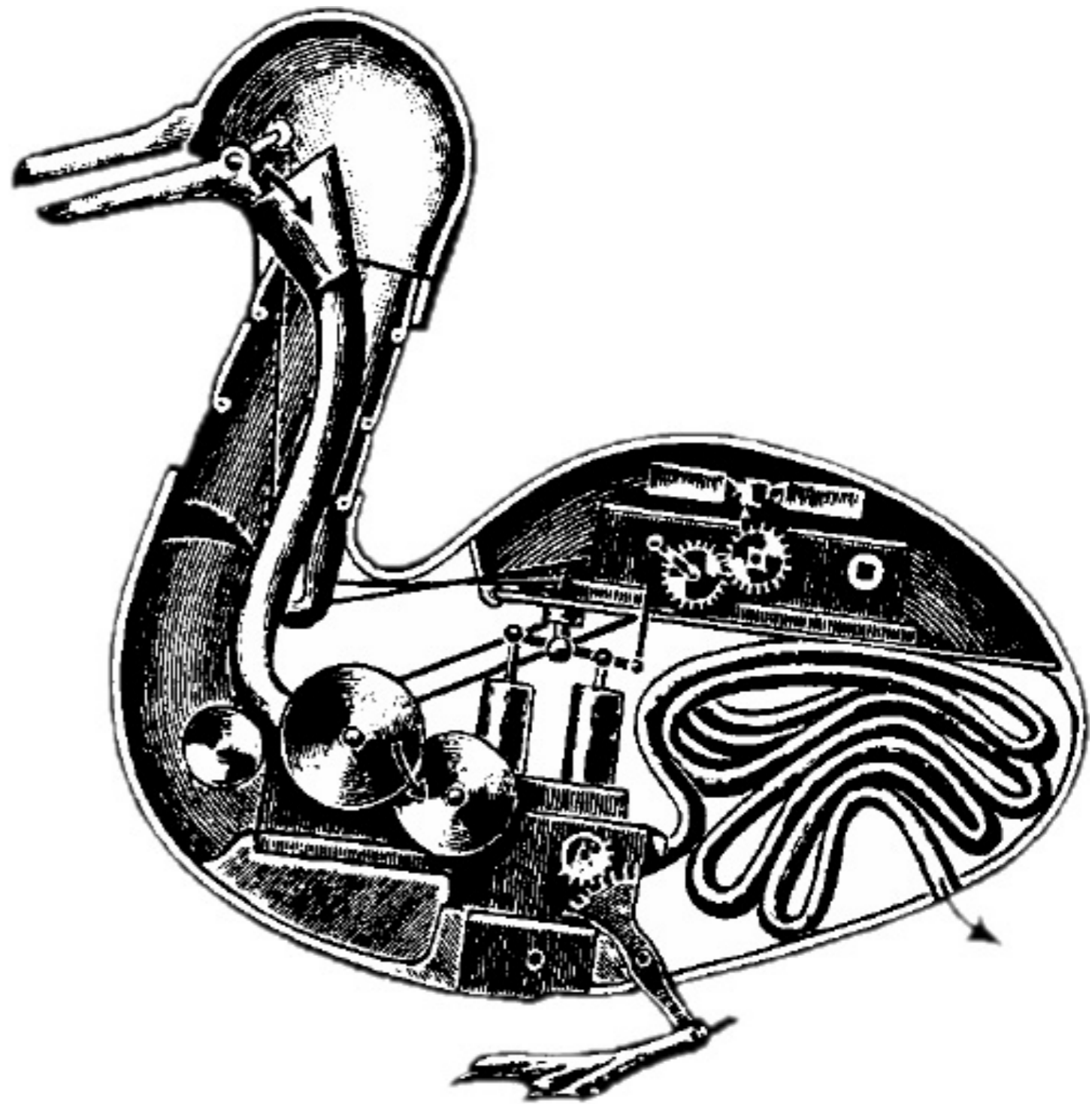
Περὶ Ψυχῆς

ἐστὶν ἡ **ψυχὴ** τῶν εἰρημένων τούτων **ἀρχή** καὶ τούτοις ὠρίζεται,
θρεπτικῶ, αἰσθητικῶ, διανοητικῶ, κινήσει

a **soul** is a **principle** of the aforesaid powers and is defined by them,
namely by **nutrition, perception, thought, movement**

διὸ καὶ οὐ δεῖ ζητεῖν εἰ ἓν ἡ **ψυχὴ** καὶ τὸ **σῶμα**, ὥσπερ οὐδὲ τὸν **κηρὸν**
καὶ τὸ **σχῆμα**, οὐδ' ὄλως τὴν ἐκάστου **ὑλὴν** καὶ τὸ **οὐ** ἢ **ὑλὴ**

one should not ask if the **soul** and the **body** are one, any more than one
should ask such a question of a piece of **wax** and its **shape** or in general of
the **matter** of anything and **that of which it is the matter**



L'HOMME
DE RENE
DESCARTES.
ET VN TRAITTE
DE LA FORMATION DV FOETVS
DV MESME AVTHEVR.

*Avec les Remarques de LOVYS DE LA FORGE,
Docteur en Medecine, demeurant à la Fleche,
Sur le Traitté de l'Homme de RENE' DESCARTES;
& sur les Figures par luy inuentées.*

Stanisls MEUNIER



A PARIS,
Chez CHARLES ANGOT, Libraire Iuré, rue
S. Jacques, au Lion d'Or.

M. DC. LXIV.
AVEC PRIVILEGE DV ROY.

Tab. XXXII



MICROGRAPHIA:

OR SOME

Physiological Descriptions

OF

MINUTE BODIES

MADE BY

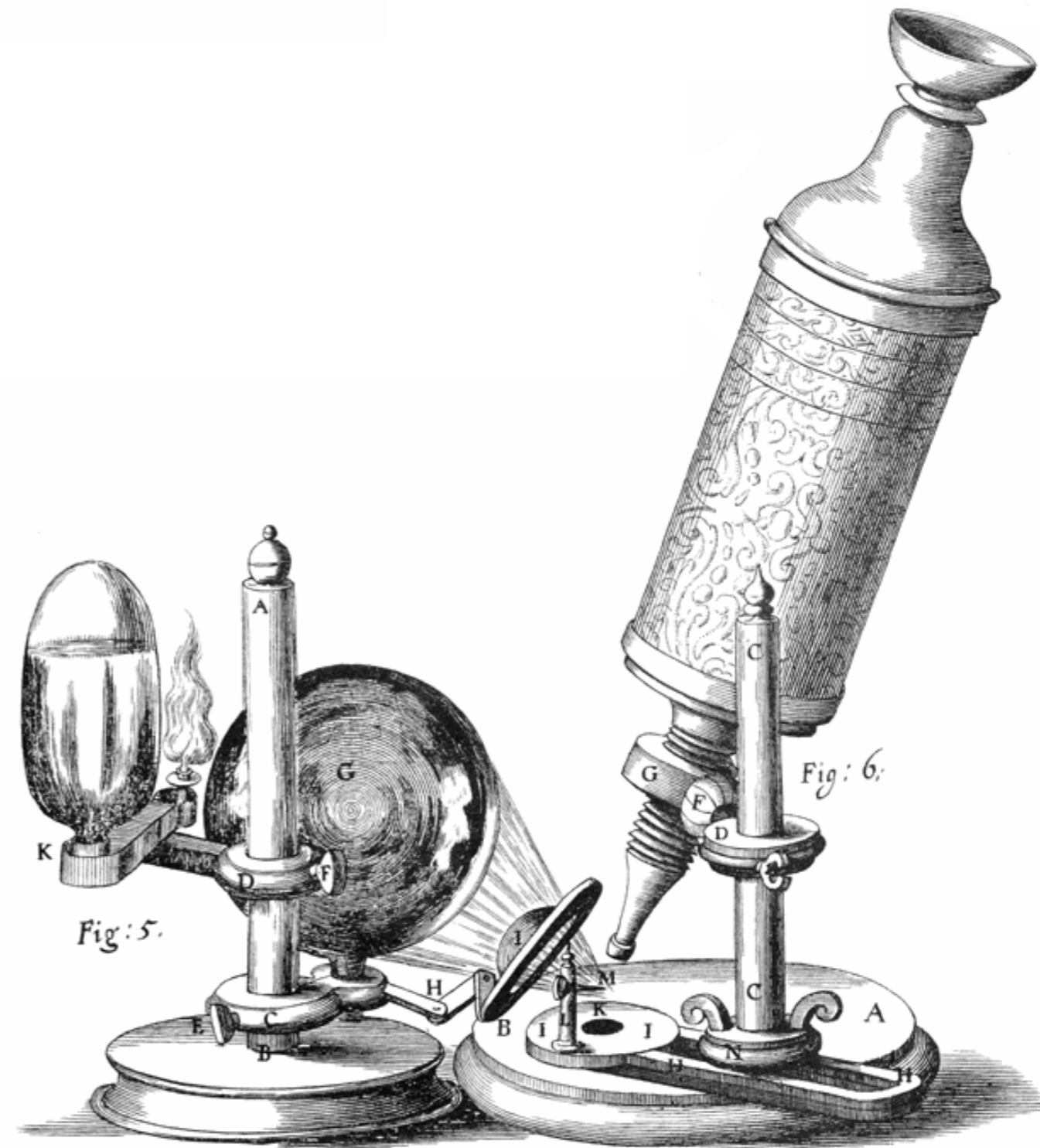
MAGNIFYING GLASSES

WITH

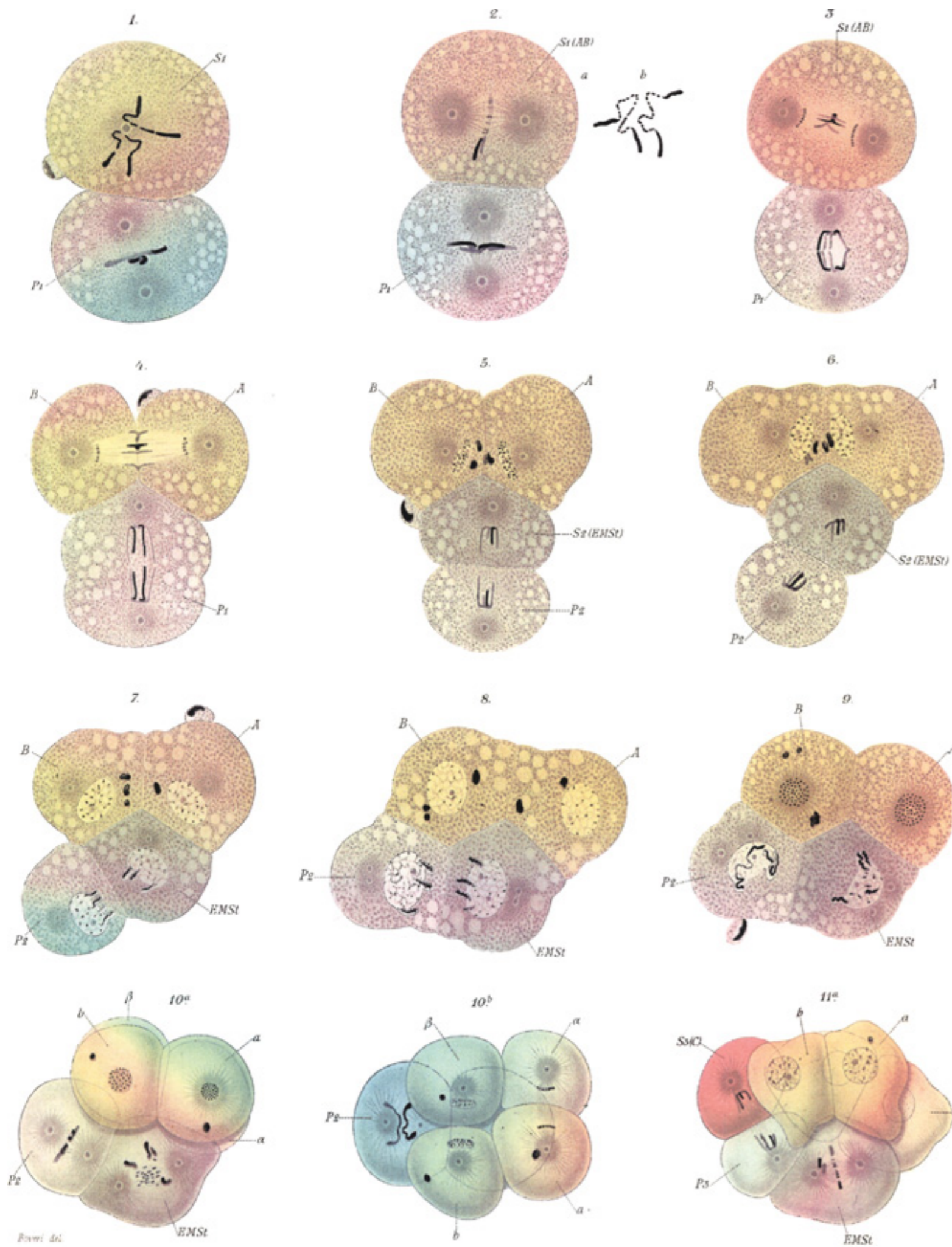
OBSERVATIONS and INQUIRIES thereupon.

By R. HOOKE, Fellow of the ROYAL SOCIETY.

*Non possis oculo quantum contendere Linceis,
Non tamen idcirco contempnas Lippus inungi.* Horat. Ep. lib. 1.

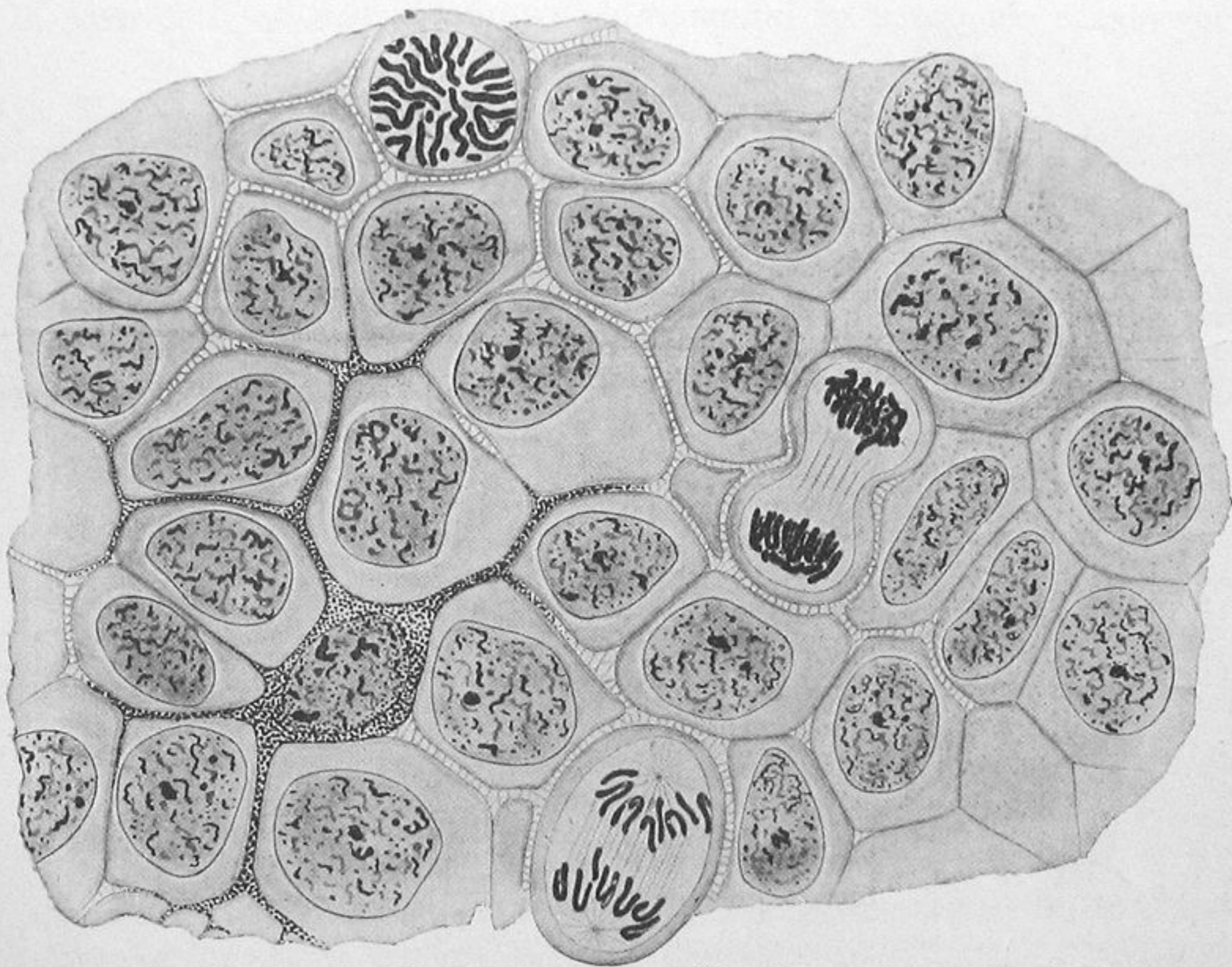


LONDON, Printed by Jo. Martyn, and Ja. Allestry, Printers to the
ROYAL SOCIETY, and are to be sold at their Shop at the Bell in
S. Paul's Church-yard. M DC LX V.



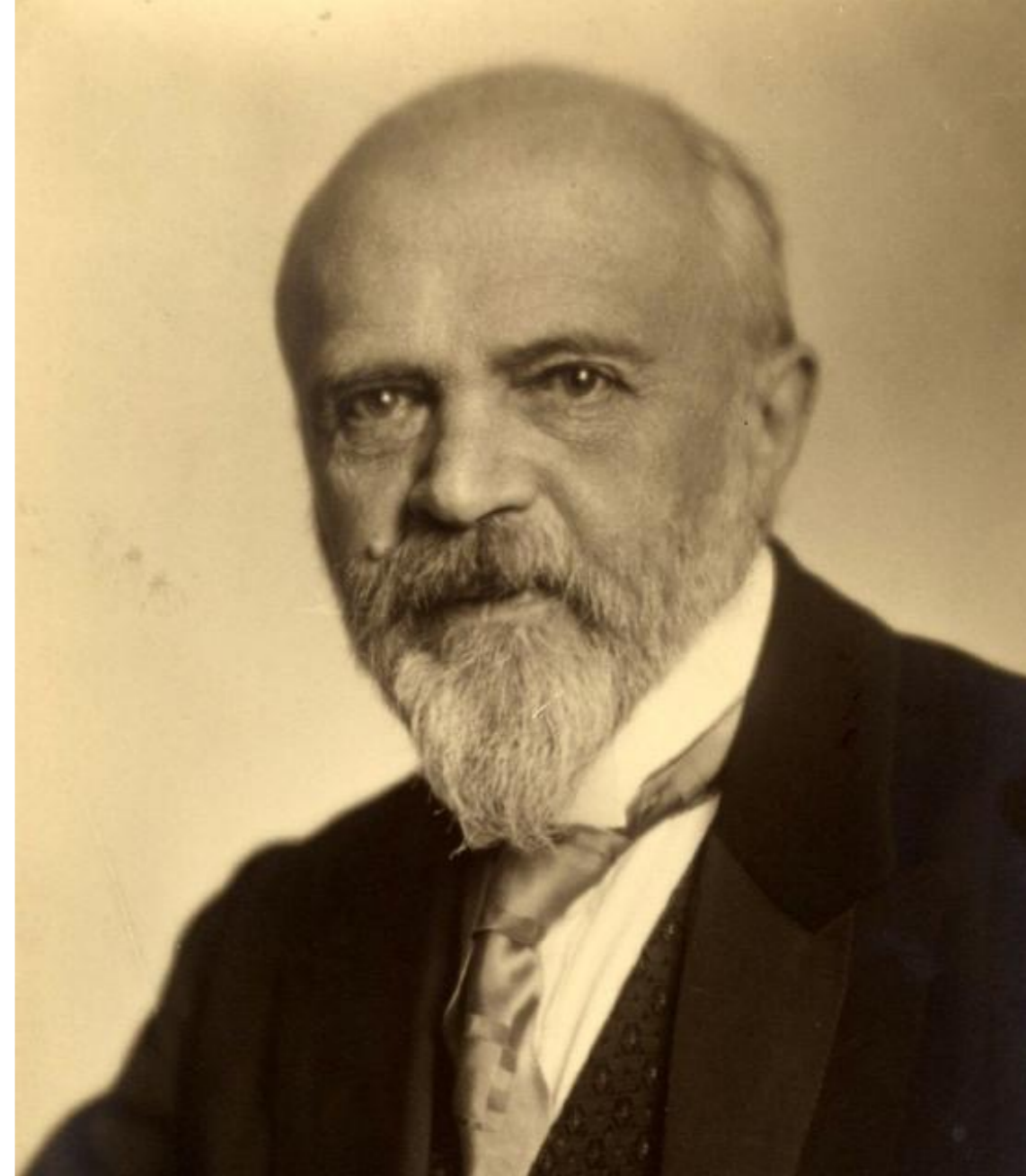
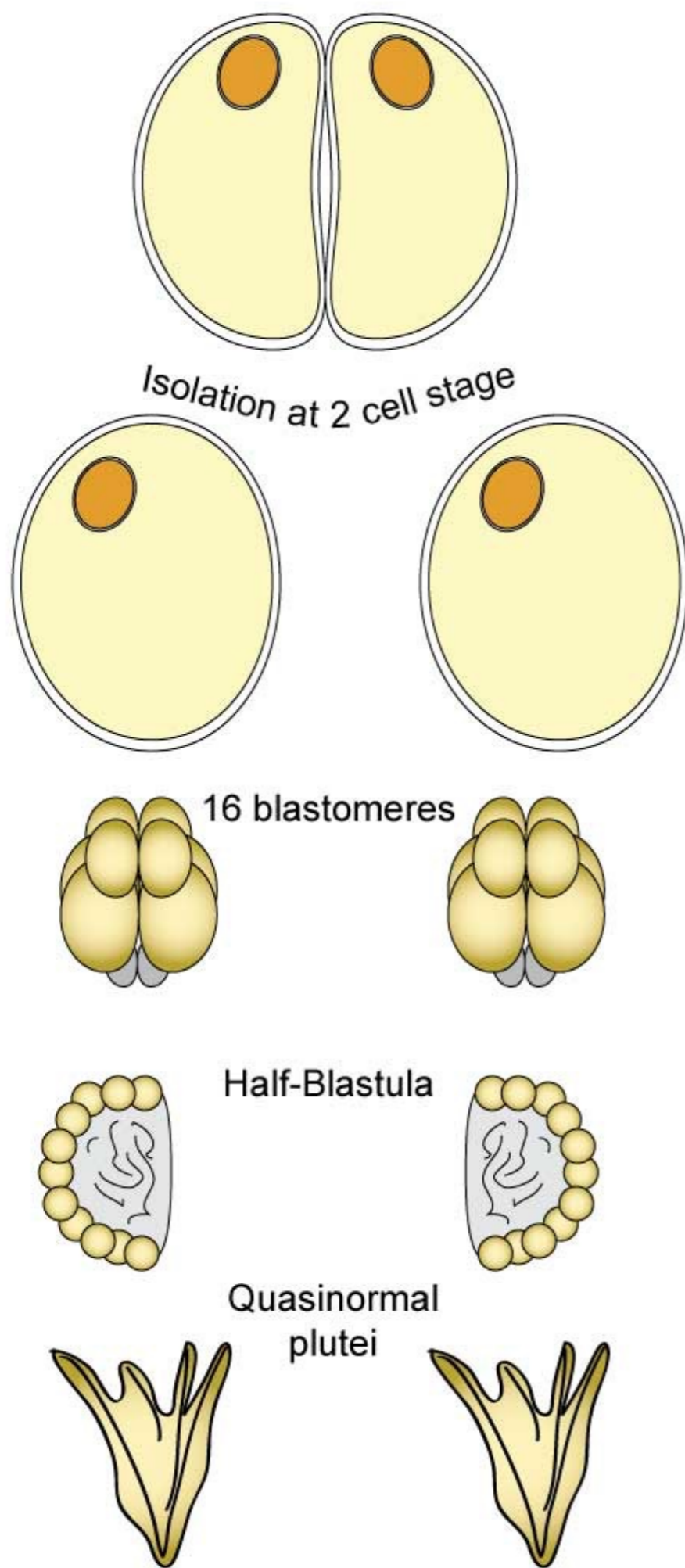
Ανάπτυξη
(από το στάδιο 2
κυττάρων έως το
στάδιο των 7
κυττάρων) στο
Ascaris
(Theodor and
Marcella **Boveri**)

a



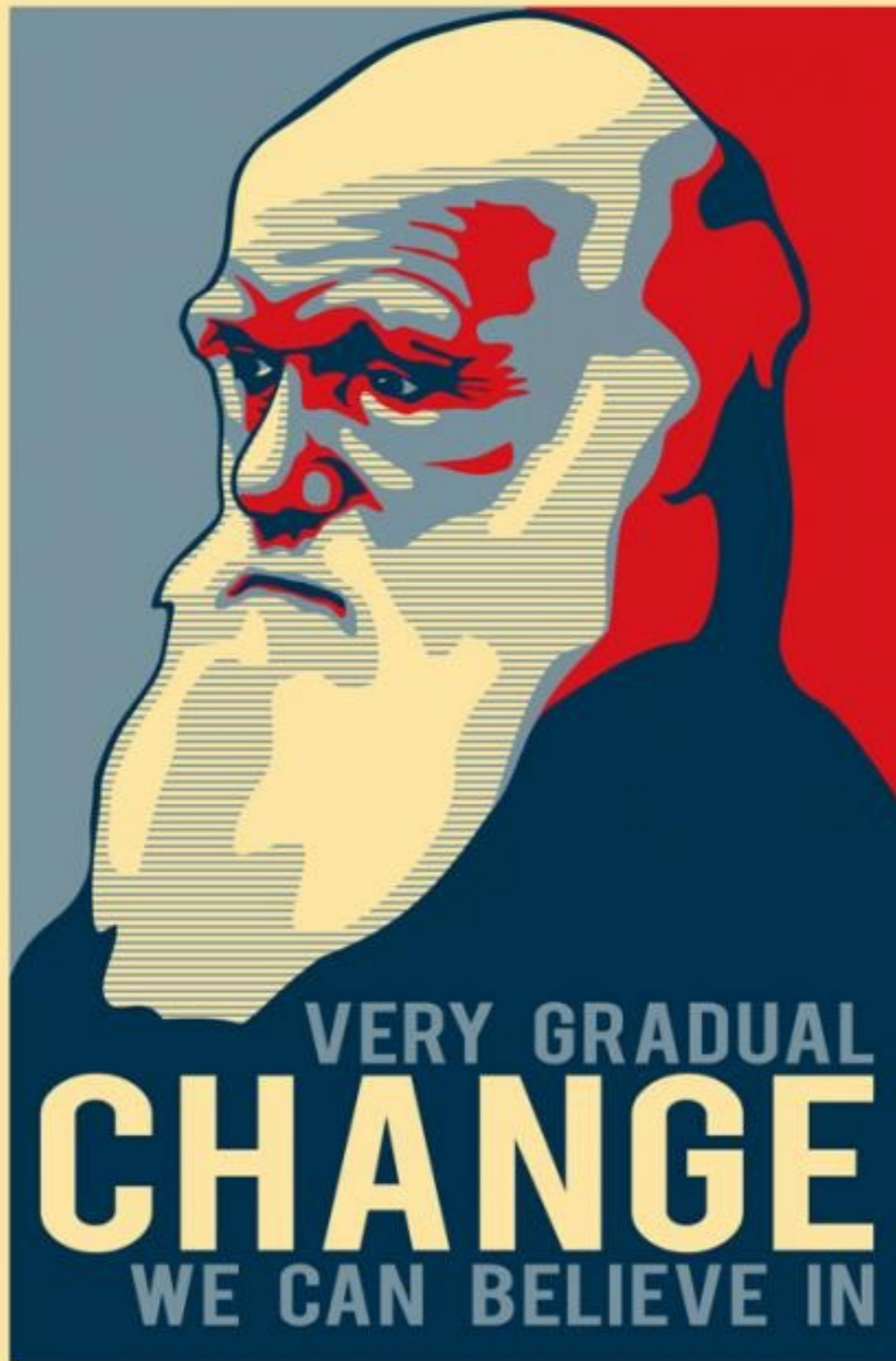
x

b



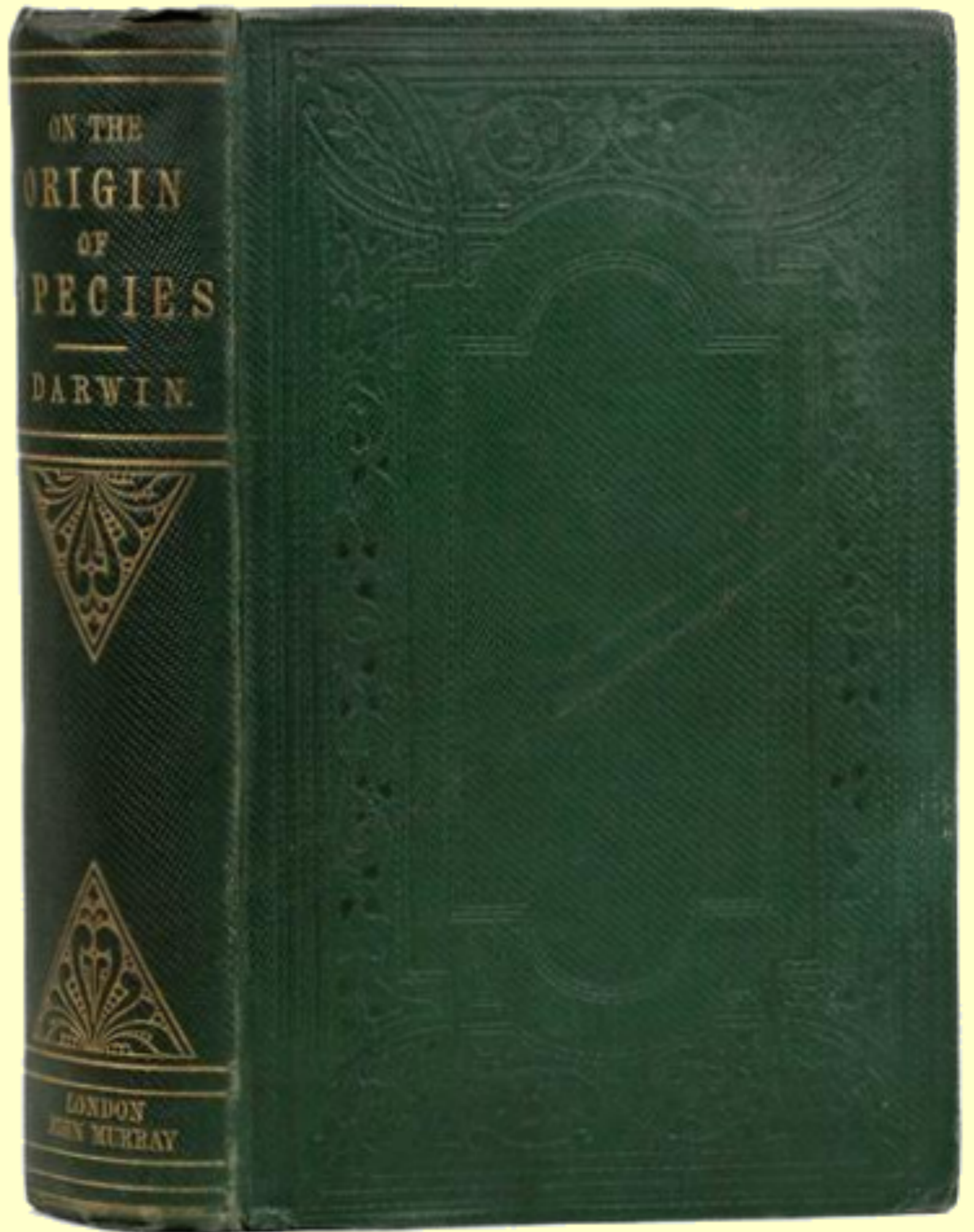
Πάνω: Hans **Driesch** (1867–1941)

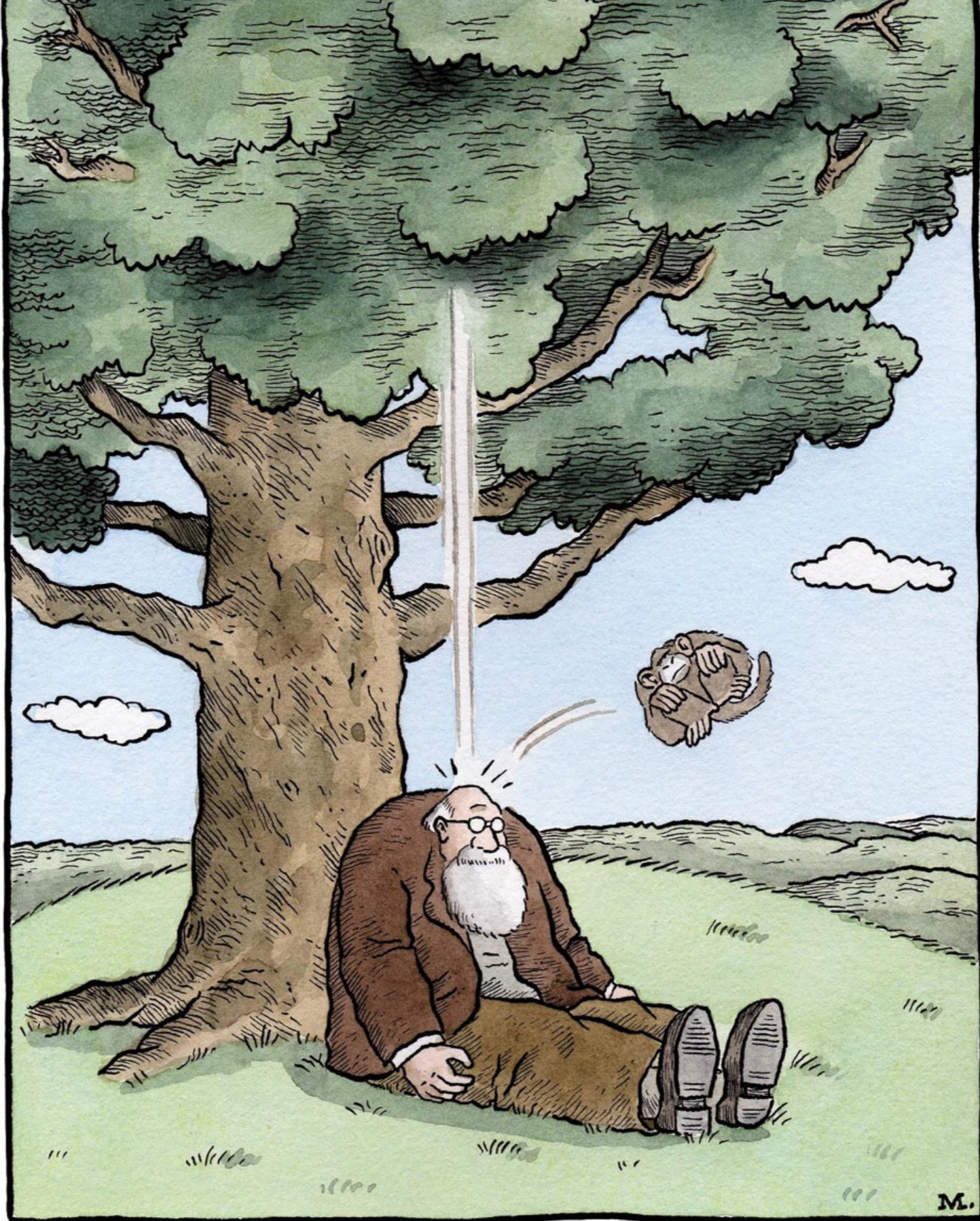
Αριστερά: το πείραμα του Driesch με το έμβryo αχινού (**1891**)



VERY GRADUAL
CHANGE
WE CAN BELIEVE IN

1859
Η Καταγωγή
των Ειδών



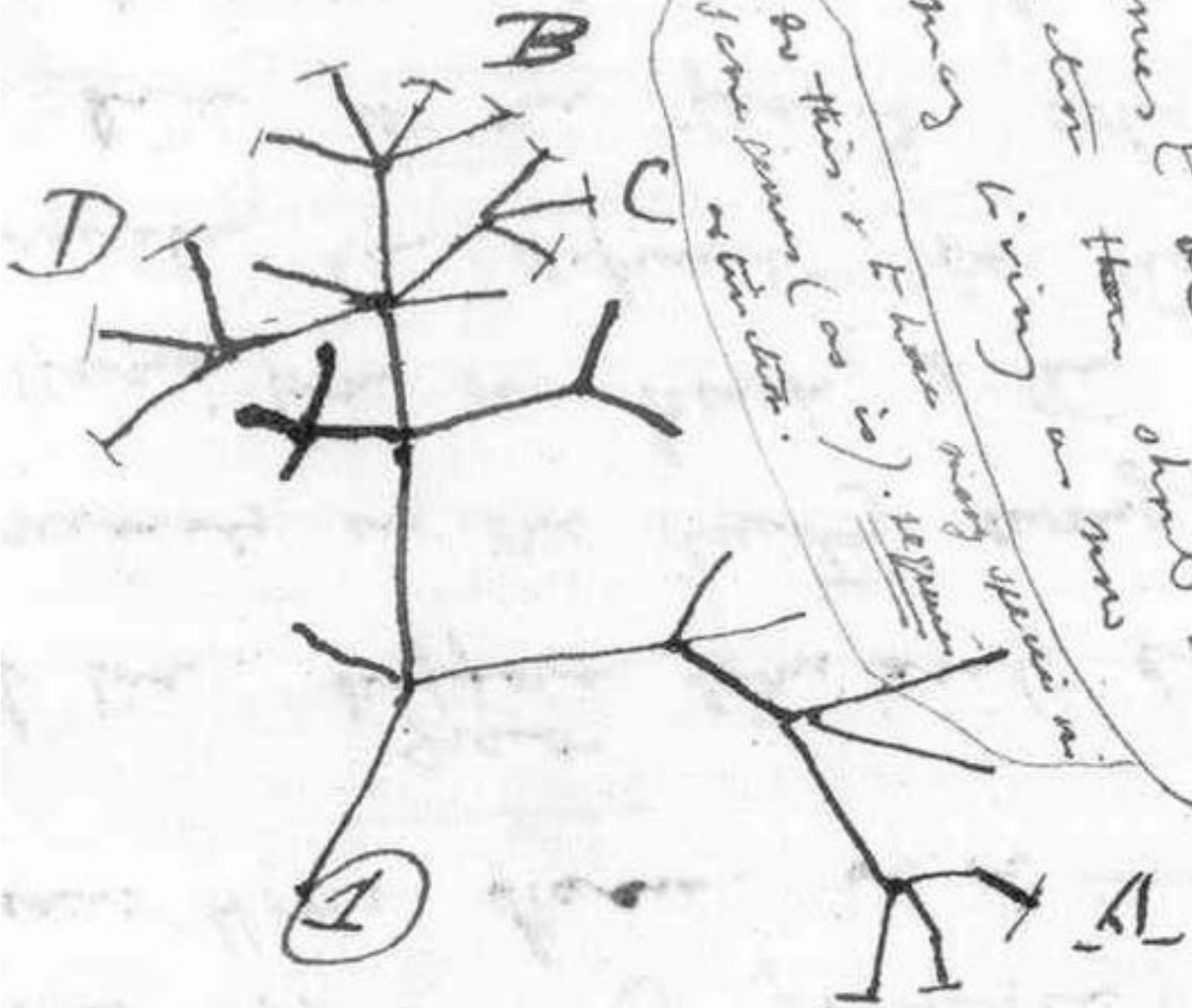


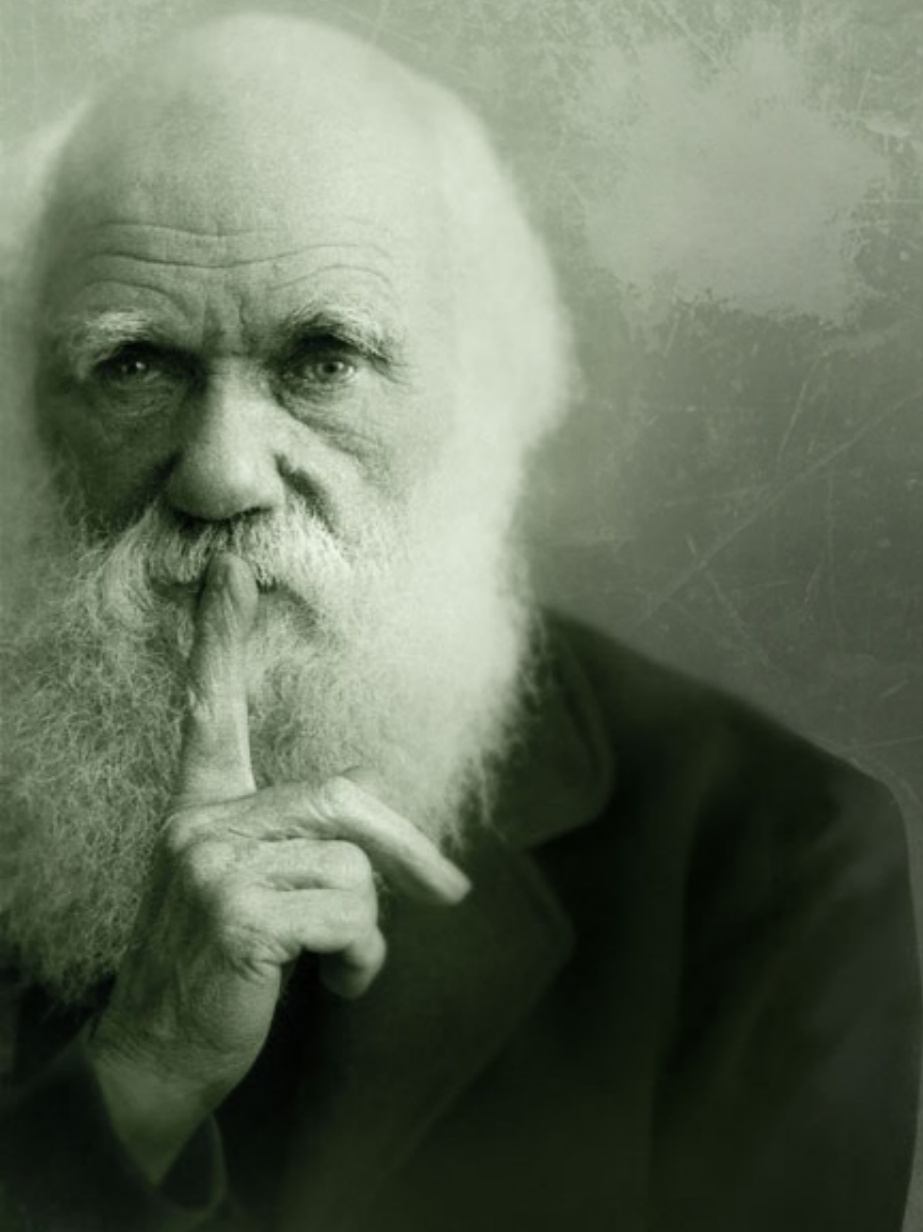
**How Darwin really came upon his
theory of evolution**

I think

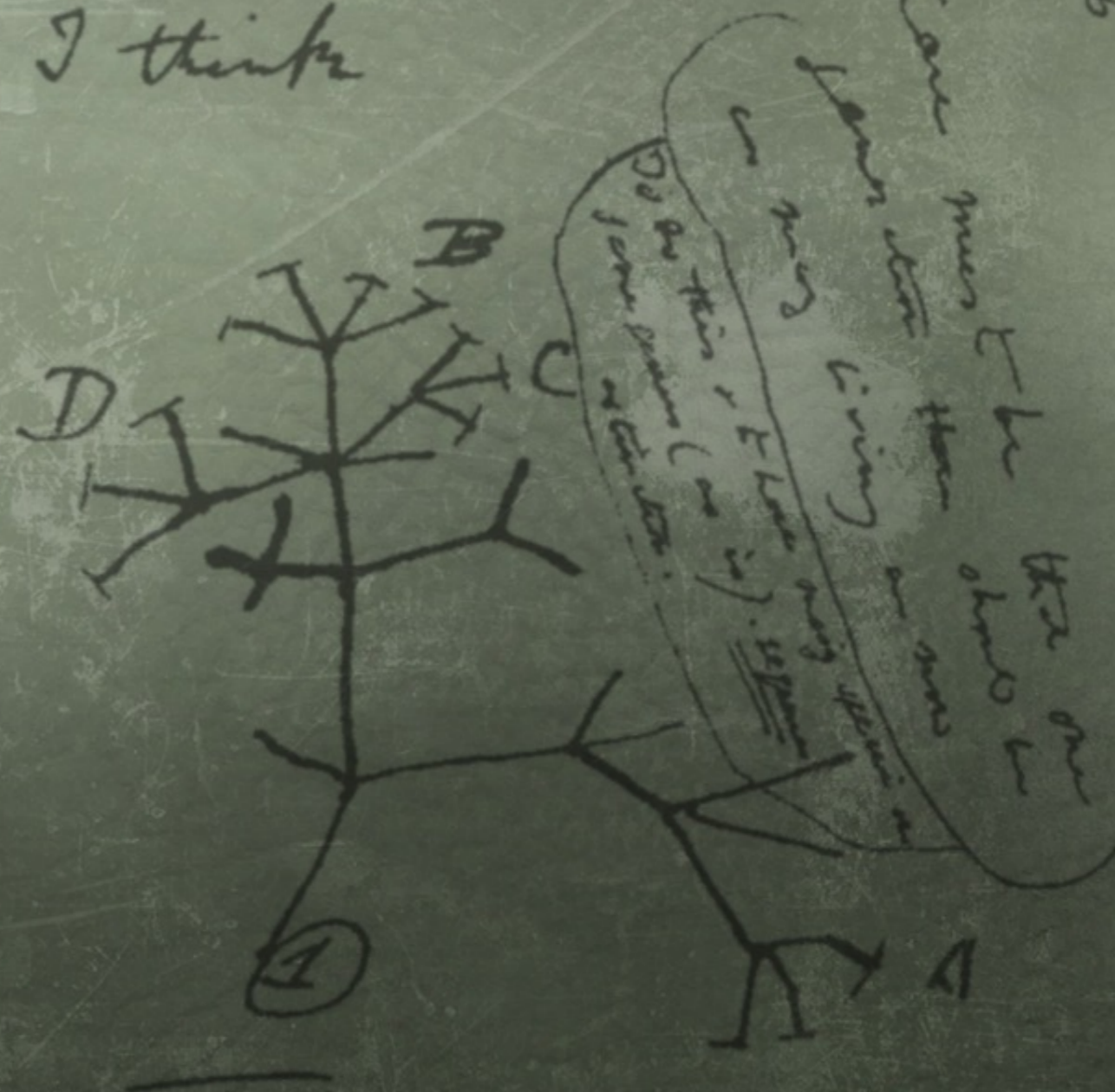
can
press E be
then
living
as
others
obvious
as

Do you think E has many species?
Do you know how many species there are?



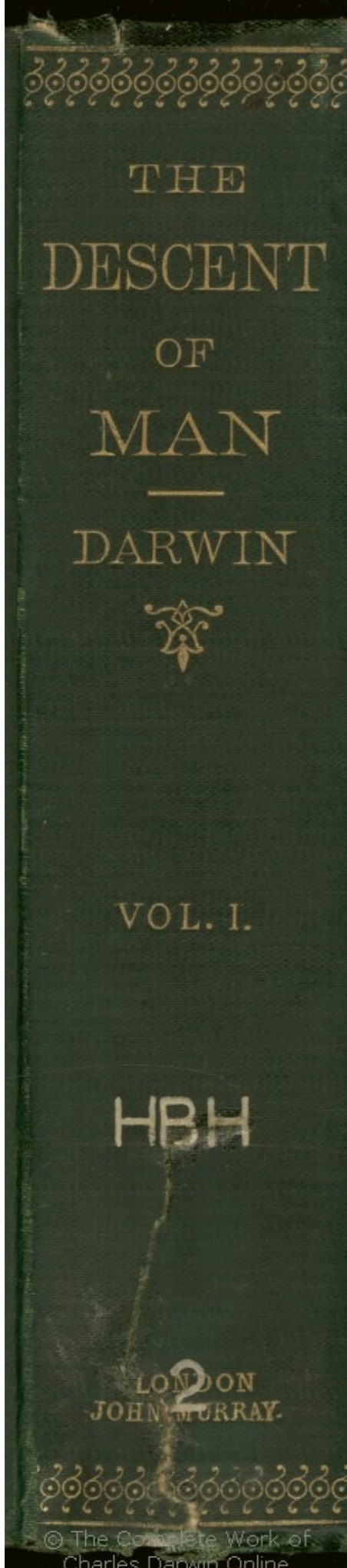


I think



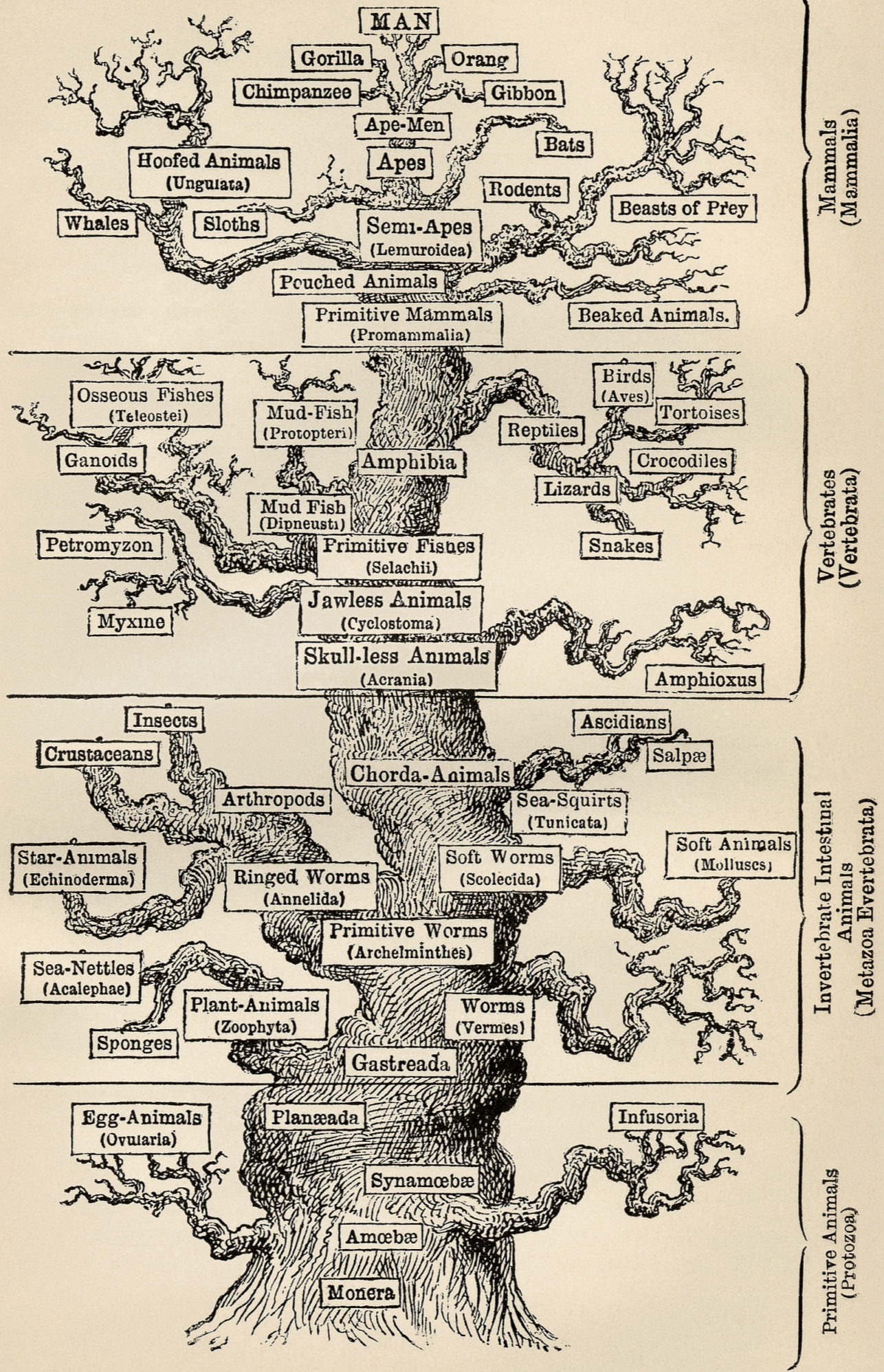
There between A & B. various
sort of relation C & D. E

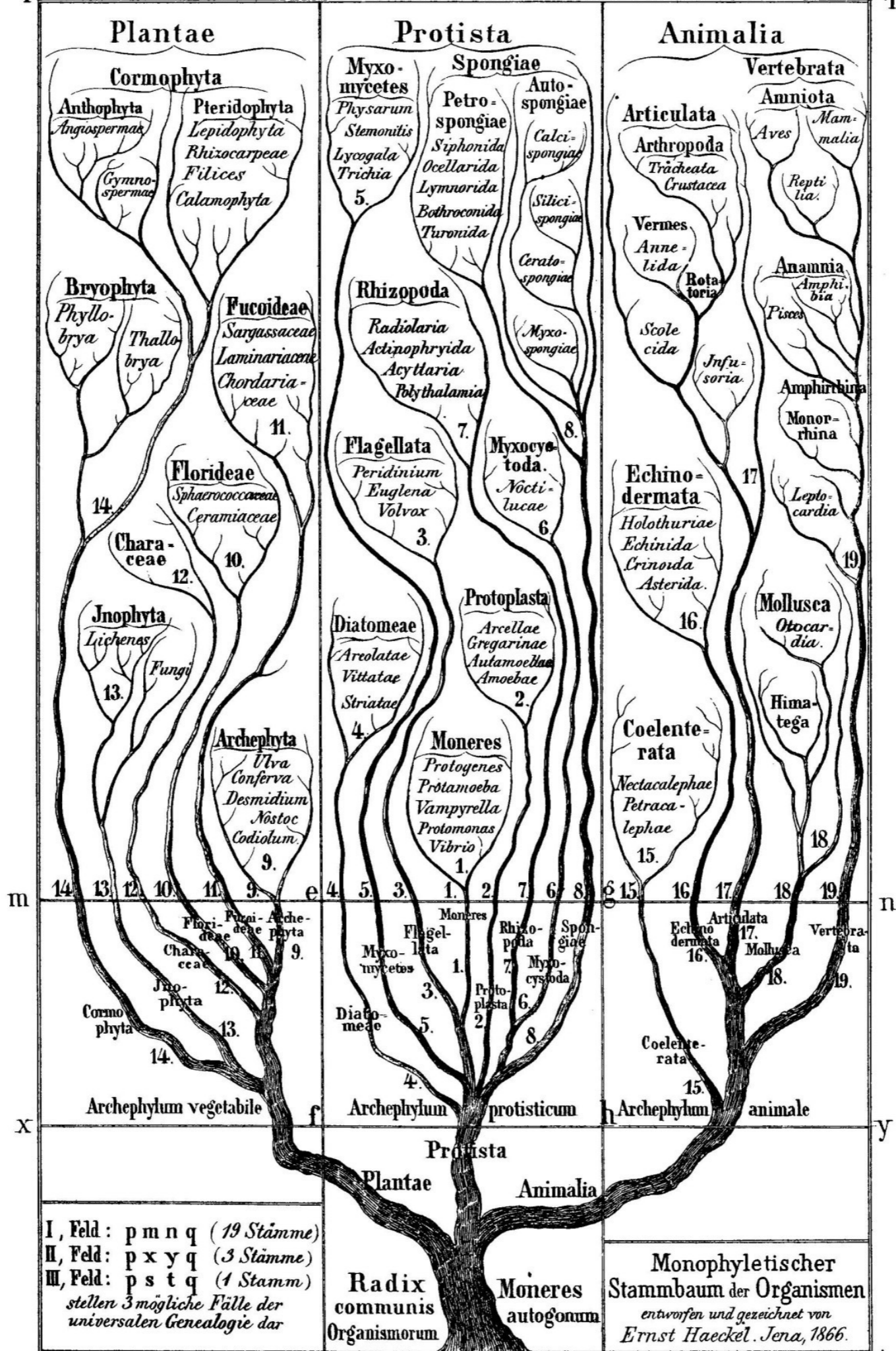
1871 Η Καταγωγή του Ανθρώπου



Πάνω, 'A Venerable Orang-outang', γελοιογραφία του Δαρβίνου που δημοσιεύτηκε στο σατιρικό περιοδικό *The Hornet* το **1871**.



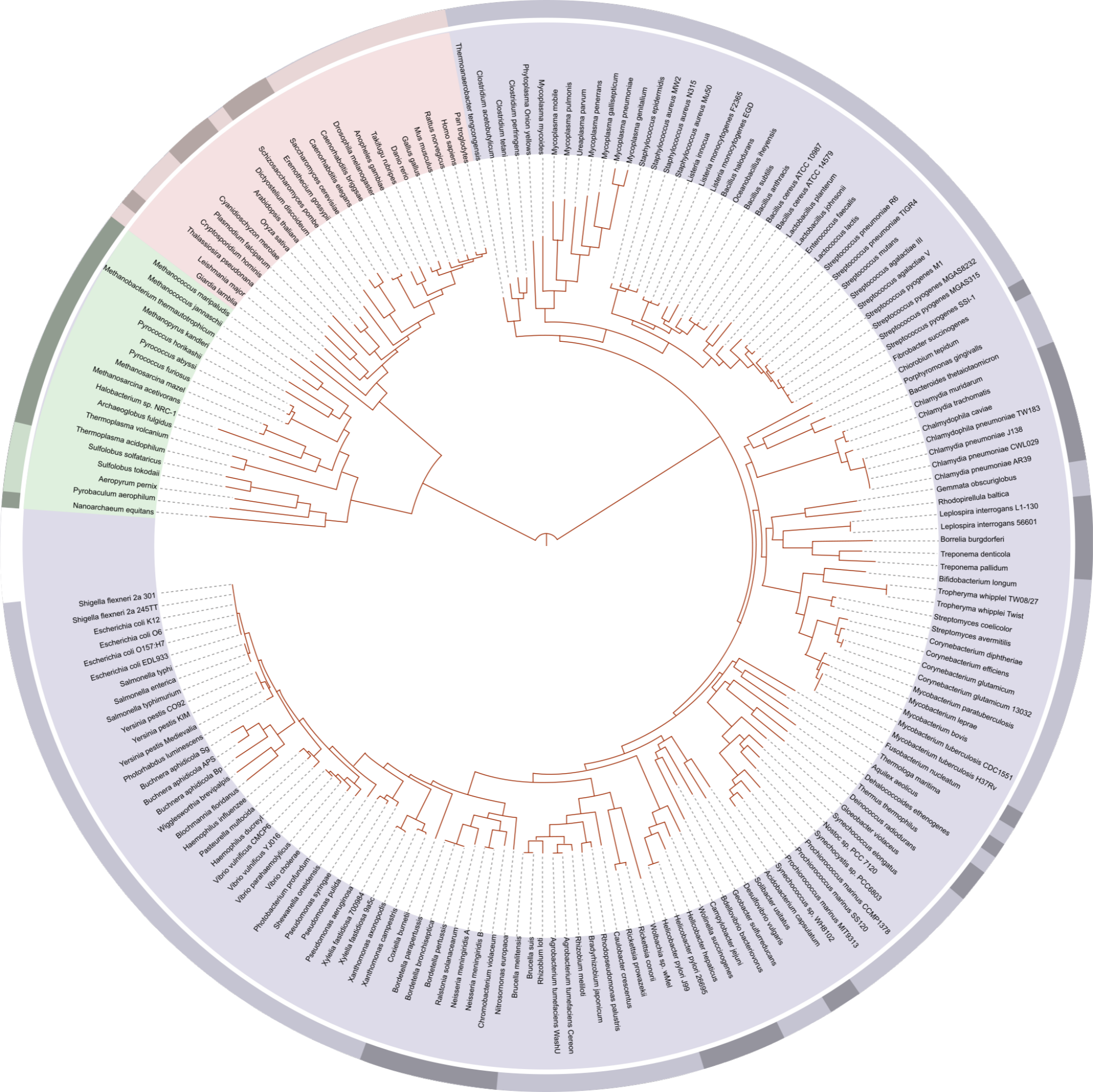




I, Feld: p m n q (19 Stämme)
 II, Feld: p x y q (3 Stämme)
 III, Feld: p s t q (1 Stamm)
 stellen 3 mögliche Fälle der
 universalen Genealogie dar

Radix
 communis
 Organismorum

Monophyletischer
 Stammbaum der Organismen
 entworfen und gezeichnet von
 Ernst Haeckel. Jena, 1866.

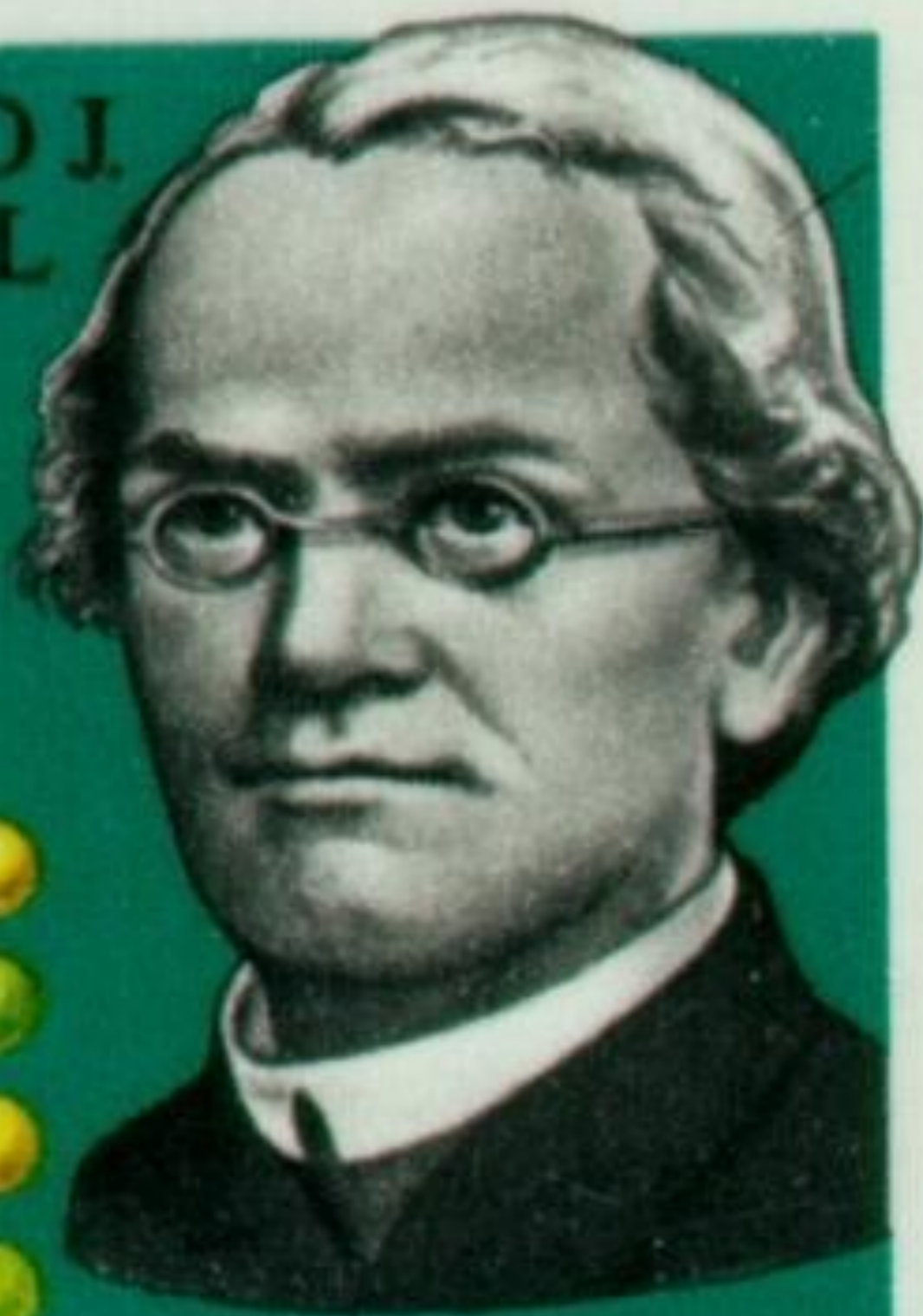




GREGORIO J.
MENDEL

1884

1984



450

POSTE VATICANE

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

M. CODONI

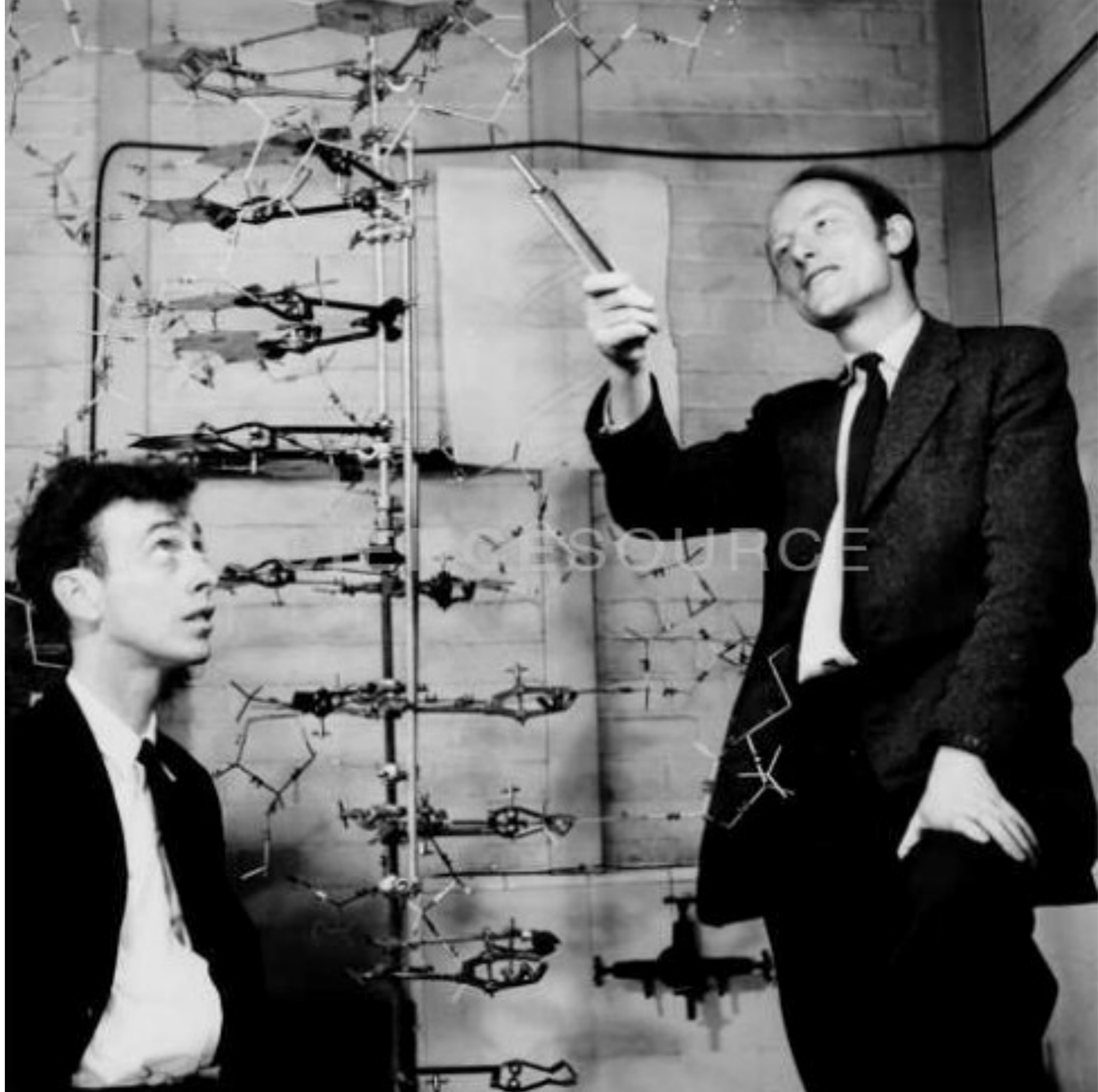




White-eyed mutant fly



Red-eyed wild-type fly



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.

¹Young, F. B., Gerrard, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).

²Longuet-Higgins, M. S., *Mon. Not. Roy. Astro. Soc., Geophys. Supp.*, **5**, 285 (1949).

³Von Arx, W. S., *Woods Hole Papers in Phys. Oceanog. Meteor.*, **11** (3) (1950).

⁴Ekman, V. W., *Arkiv. Mat. Astron. Fysik. (Stockholm)*, **2** (11) (1905).

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

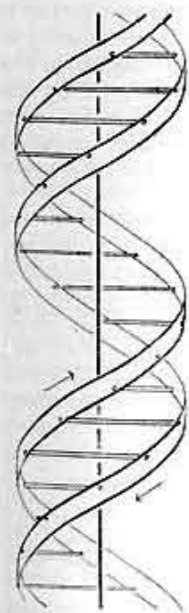
A Structure for Deoxyribose Nucleic Acid

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 Corey¹. 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.

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-deoxy-ribofuranose 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's² 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



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.

is a residue on each chain every 3.4 Å. 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 Å. The distance of a phosphorus atom from the fibre axis is 10 Å. 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"



-To Oxford English Dictionary περιέχει τη λέξη

‘anatiferous’:

“producing **ducks or geese**, that is producing **barnacles**, formerly supposed to grow on trees and dropping off into the water below, to turn into **tree-geese**”

(Hacking 1983 : 70)

-O **Scaliger** (16ος αιώνας) αναφέρει “as a thing he himself has seen” the stories “falsely told of the Phoenix but veraciously of the Barnacle [sic] Goose”

(Raven 1953 : 204)



‘I have often seen **with my own eyes** more than a thousand **minute embryos of birds** of this species on the seashore, hanging from one piece of timber, **covered with shells, and, already formed**’.

[*Topographia Hibernica* **1188**, Giraldus Cambrensis
(Welsh monk)]



Ο Francis **Bacon** (1561 - 1626) πίστευε ότι:

“not only that one species might pass into another, but that it was a matter of **chance** what the **transmutation** would be”

(Poulton 1908: 54).

-Το κλίμα μπορεί να αλλάξει το είδος του φυτού
μόνιμα:

Ο John **Ray** ισχυρίζεται το **1687** ότι “Wheat . . .

degenerates into tares, rape into radish . . . maize into

wheat” (quoted in Crombie 1994 v.2: 1270).

“Peter Crescentius, the great 14th century agriculturist, devoted 3 chapters to sudden species changes . . . and for the next 200 years the sudden mutation of species was recorded in practically every work on natural history”

(Zirkle 1951: 48)



Erasmus Darwin



Lamarck

Nurs'd by warm sun-beams in primeval caves /
Organic Life began beneath the waves. /
Hence without parent by spontaneous birth /
Rise the first specks of animated earth;

