

Cognitive Science & Psychology: Mind, Brain and Behavior

Paul F.M.J. Verschure
Giovanni Maffei

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SPECS synthetic perceptual, emotive and cognitive systems

Rationalism

Empiricism

JULIAN JAYNES

THE ORIGIN OF
CONSCIOUSNESS
IN THE BREAK
DOWN OF THE
BICAMERAL MIND



Julian Jaynes

1920-1997

Paul Verschure

MARINER BOOKS

Mind

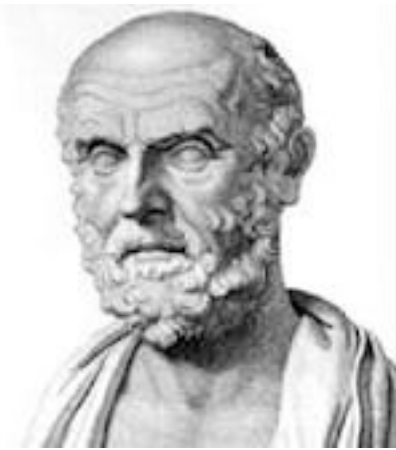
Brain



Skull with three arrow wounds, from a mass grave, battle of Visby, fought in July 1361 on the Swedish Baltic island of Gotland, between invading Danish troops and the local, Gutnish, forces. The Danish won a decisive victory. Due to the heat, the dead had to be disposed of quickly, and many were buried in their armour. The archaeological excavation of one of the mass graves, in the 1930s, revealed over 1000 skeletons.

“Men ought to know that from the brain, and from the brain only, arise our pleasures, joys, laughter and jests, as well as our sorrows, pains, griefs and tears. Through it, in particular, we think, see, hear, and distinguish the ugly from the beautiful, the bad from the good, the pleasant from the unpleasant.”

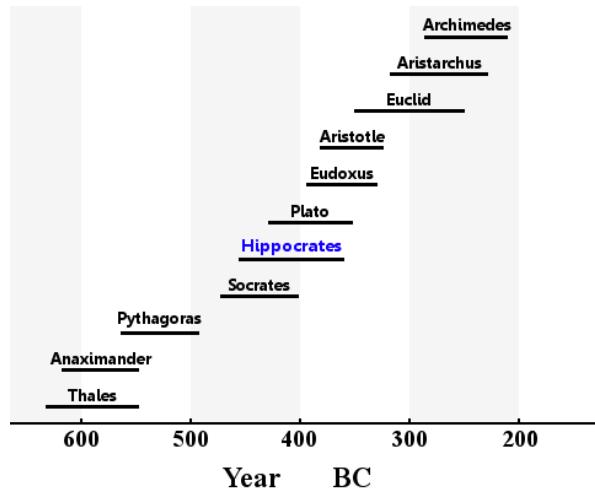
Hippocrates of Kos (460-37 BC)





Hippocrates: On the sacred disease (Πε λε νούσου) - 400 BC

“This disease is in my opinion no more divine than any other; it has the same nature as other diseases, and the cause that gives rise to individual diseases. It is also curable, no less than other illnesses, unless by long lapse of time it be so ingrained as to be more powerful than the remedies that are applied” (Hippocrates, 1849b)



- Attributes aetiology of epilepsy - the great disease (grand mal) - to brain disfunction describes unilateral nature and aura (Hippocrates, 1849a,d)
- Stresses the role of heredity in the disease: “its birth begins in the embryo while it is still in the womb” (Hippocrates, 1849h).
- Also describes symptoms of psychomotor epilepsy and temporal lobe fits (Hippocrates, 1849e).
- Factors that can lead to an epileptic fit are: (a) the changes of the winds and of temperature, (b) the exposition of the head to sun, (c) crying, and (d) fear.
- In his Injuries of the Head, Hippocrates notes that head injuries often lead to convulsions or traumatic epilepsy (Hippocrates, 1849i).

The 5 conceptual revolutions that put humans in their place

Copernicus

NICOLAI COPERNICI TORINENSIS DE REVOLUTIONIBUS ORBIUM COELESTIUM, Libri VI.

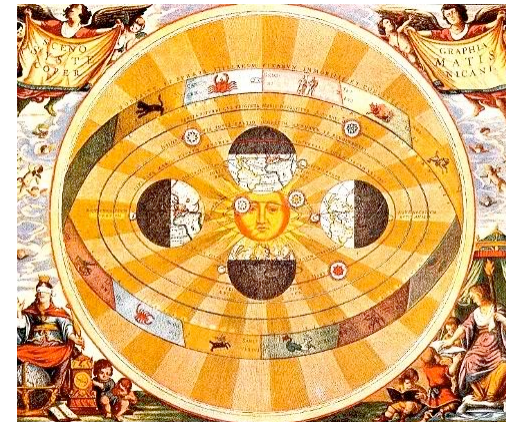
Habes in hoc opere iam recens nato, & adito, studiose lector, Motus stellarum, tam fixarum, quam erraticarum, cum ex veteribus, tum etiam ex recentibus observationibus restitutos; & novis insuper ac admirabilibus hypothesebus ornatos. Habes etiam Tabulas expeditissimas, ex quibus eisdem ad quodvis tempus quam facillime calculare poteris. Igitur eme, lege, frue.

Αναστήσθε θάλατταν.

Norimbergae apud Ioh. Petricium,
Anno M. D. XLIII.



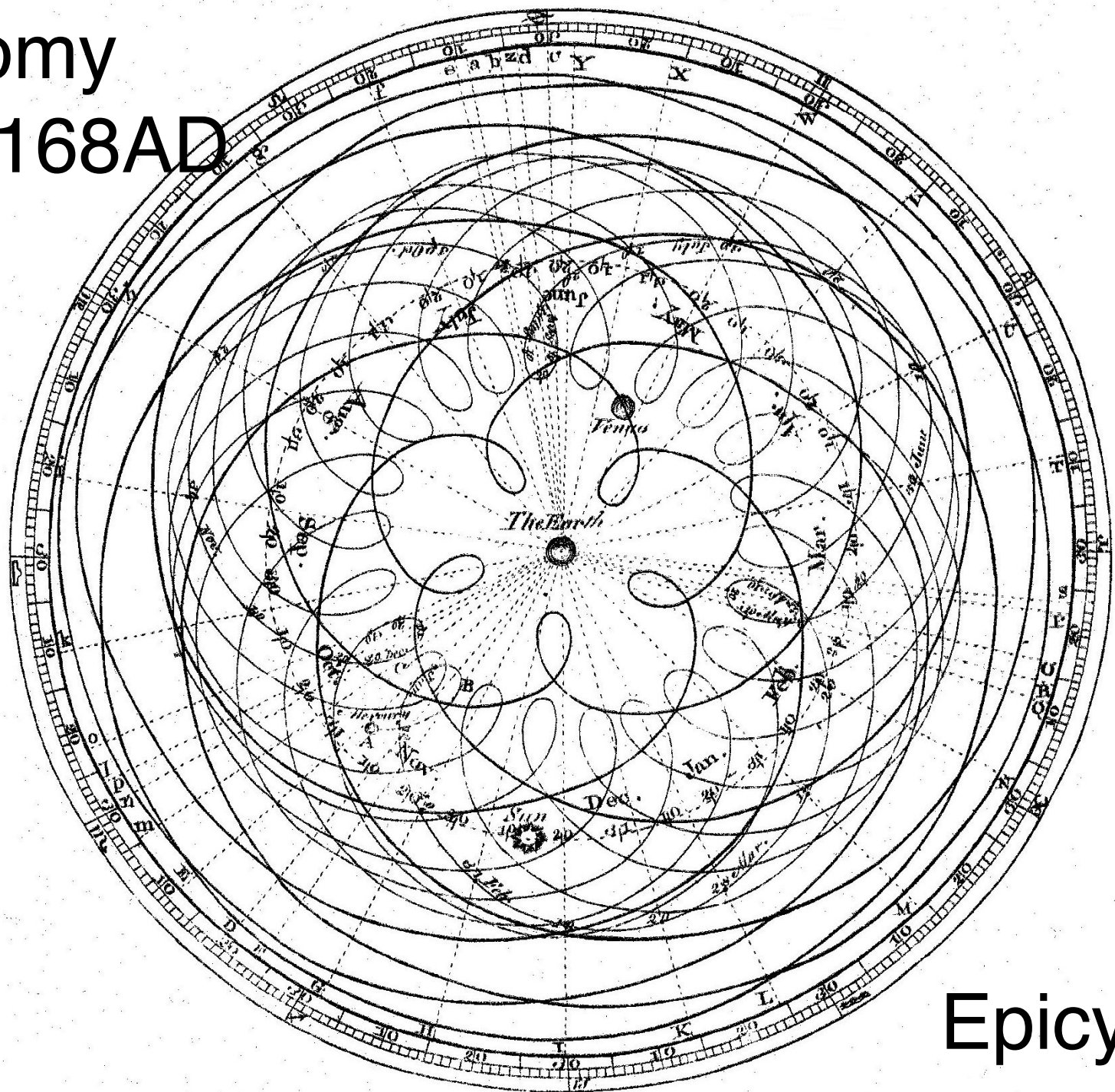
(19 February 1473 – 24 May 1543)



Nicolai Copernici Torinensis De revolutionibus orbium coelestium, Libri VI

(On the Revolutions of the Heavenly Spheres by Nicolaus Copernicus of Torin 6 Books), first printed in 1543 in [Nuremberg](#)

Ptolomy 100-168AD



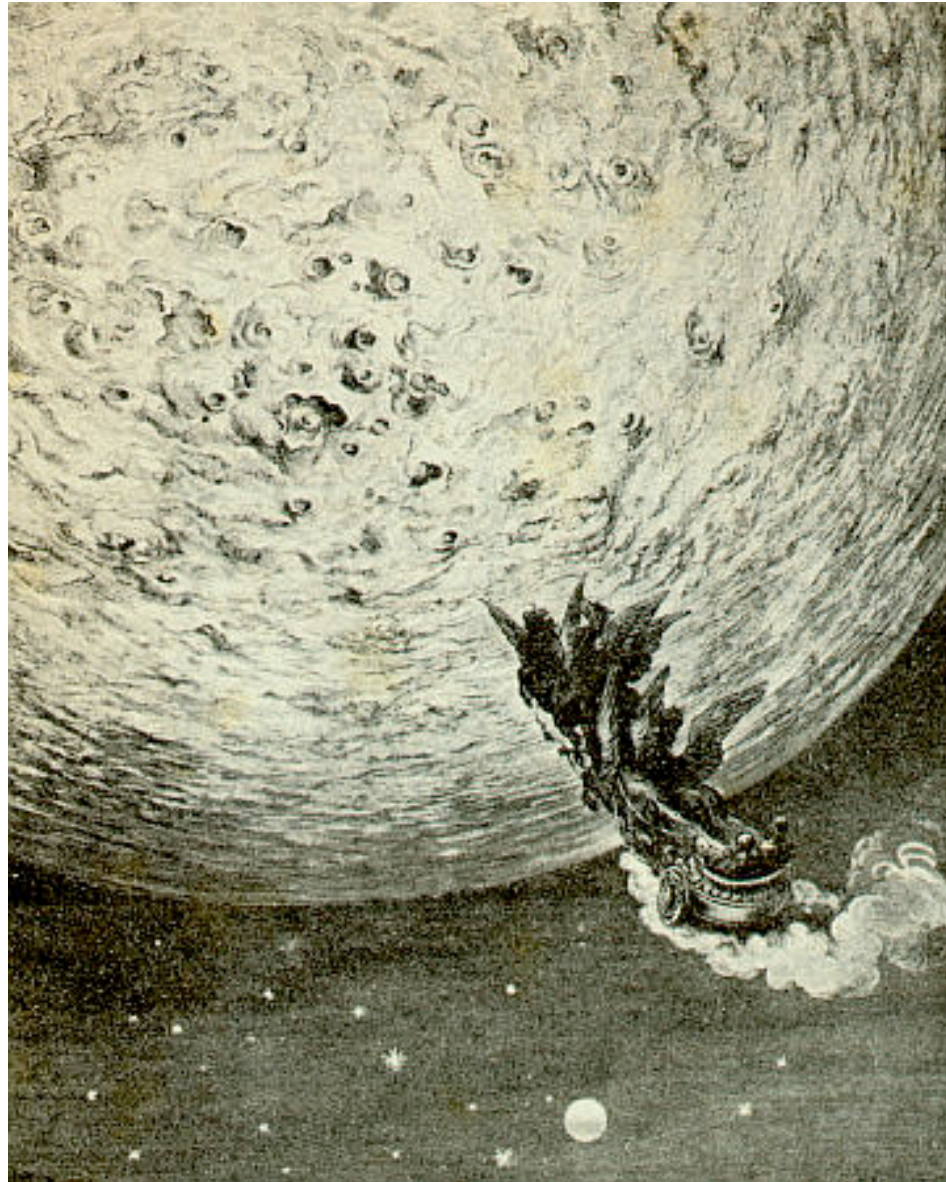
Epicycles

Paul Verschure



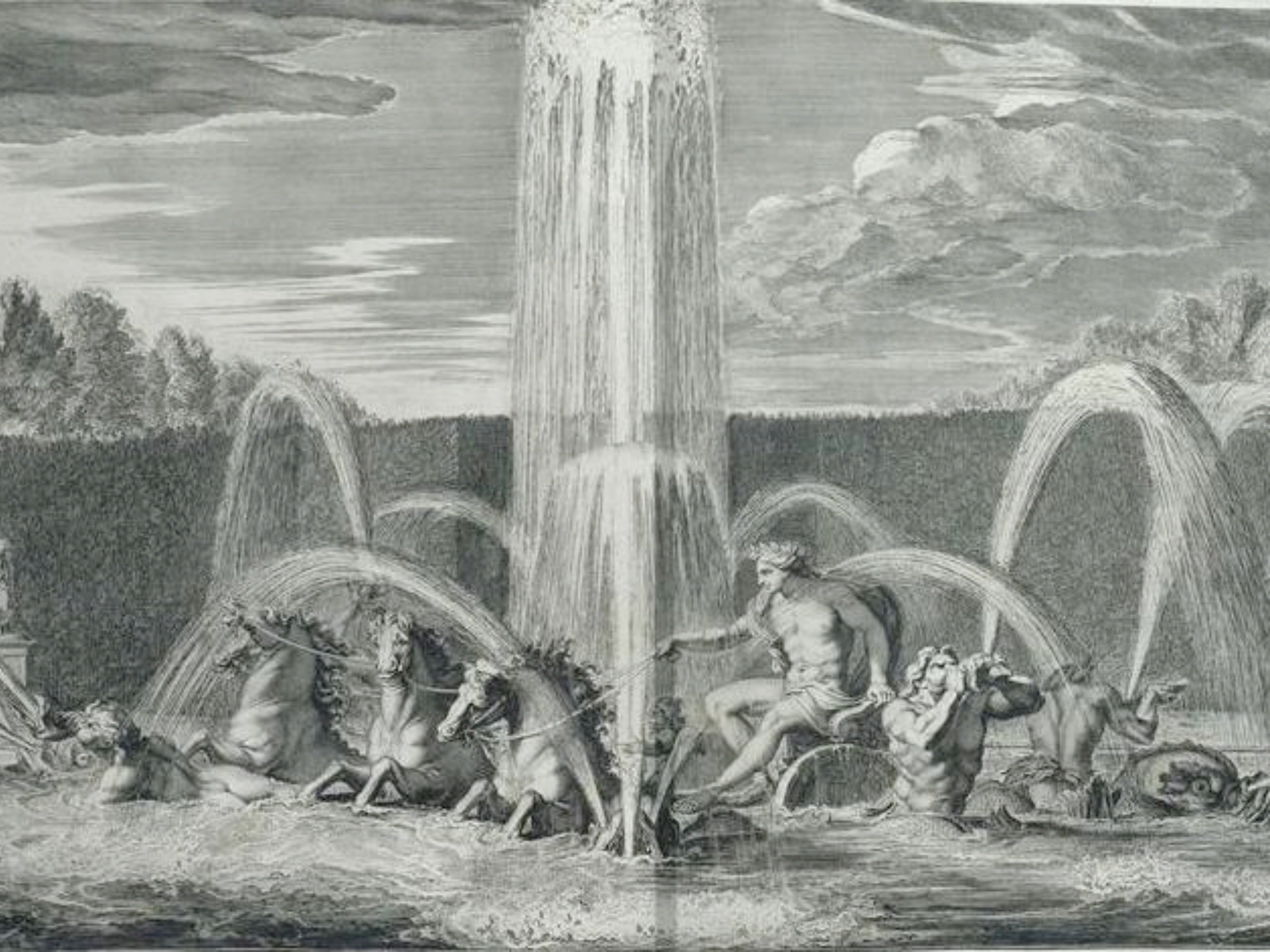
Orlando furioso ("The Frenzy of Orlando", more literally "Mad Orlando") - 1516

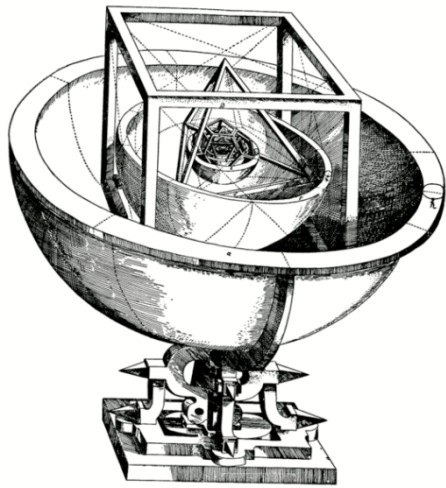
Ludovico Ariosto (8 September 1474 – 6 July 1533)



Astolfo sulla luna : illustrazione di Gustavo Dorè
per l'edizione francese del 1879 dell'« *Orlando furioso* ».

1 Humans (and their Gods) do
not constitute the centre of the
universe/reality





Cartesian Dualism



R. Descartes (1596-1650),
De Homini 1633

Kepler's physical astronomy

Galileo's mechanistic physics

- power of a mechanistic view on the universe
- the end of Aristotelean teleological explanation

Harvey: the heart is a pump

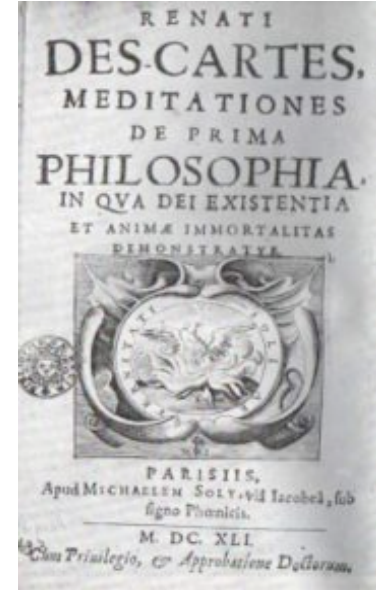
Descartes: Also physiology can be described in mechanistic terms

Fountains of Versailles
Hydrolic machines

“View of the Bassin d'Apollon” engraving by Louis de Chastillon, 1683

Descartes Meditations:

- “..never to accept anything as true that I did not know to be evidently so: that is to say, carefully to avoid precipitancy and prejudice, and to include in my judgments nothing more than what presented itself so clearly and so distinctly to my mind that I might have no occasion to place it in doubt.”
 - **Truth is derived from the mind**
- “..to divide each of the difficulties that I was examining into as many parts as might be possible and necessary in order to best solve it.”
 - **Rule of analysis: compose larger problems in smaller problems**
- “..to conduct my thoughts in an orderly way, beginning with the simplest objects and the easiest to know, in order to climb gradually, as by degrees, as far as the knowledge of the most complex, and even supposing some order among those objects which do not precede each other naturally.”
 - **Rule of synthesis**
- “..everywhere to make such complete enumerations and such general reviews that I would be sure to have omitted nothing.”
 - **Deductive logic: Ceteris paribus**



(1641) Meditations on First Philosophy: In which the existence of God and the immortality of the soul are demonstrated

How to ascertain truth?
Everything can be doubted except doubt itself
Cogito ergo Sum

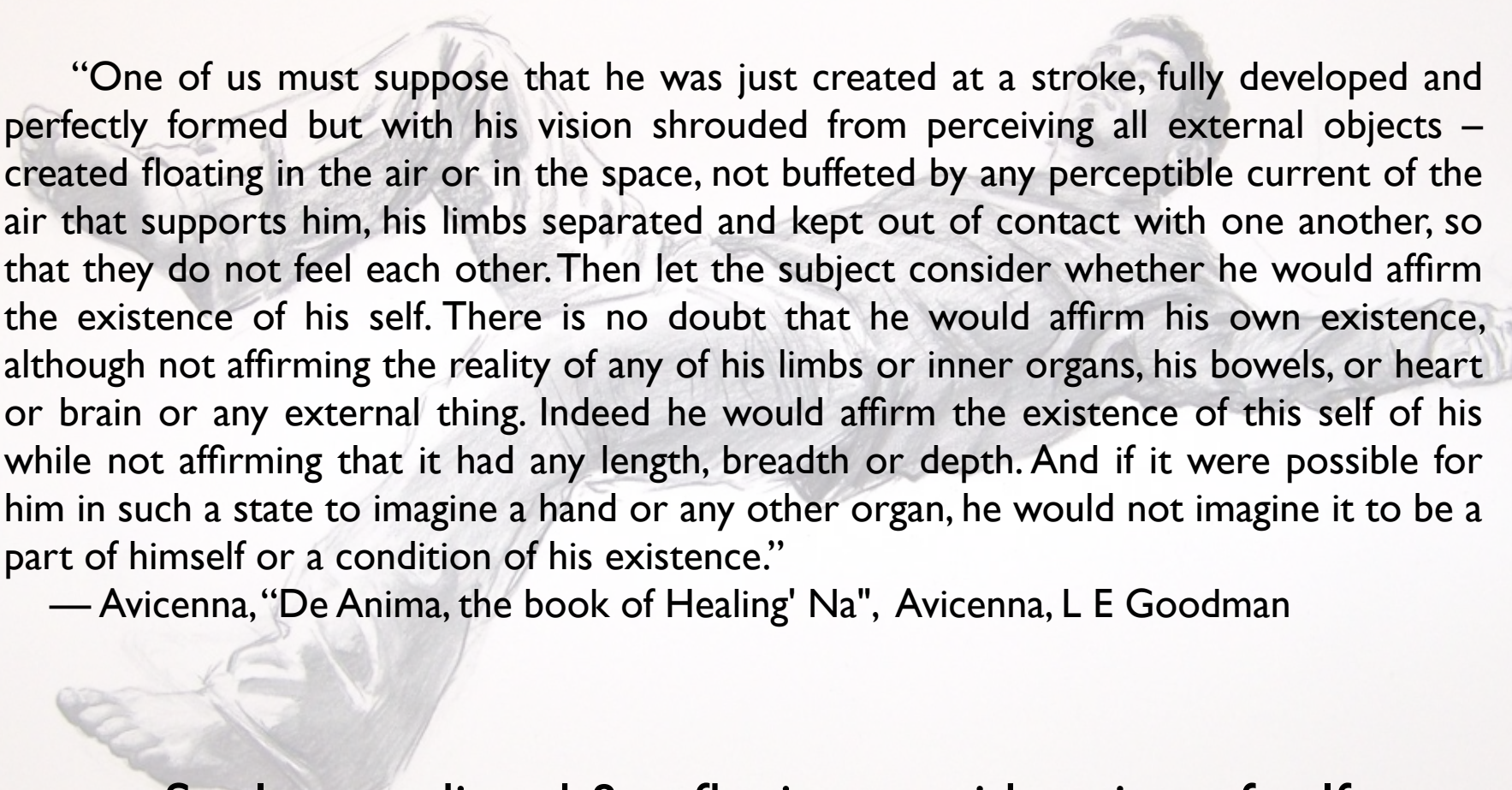
Antecedents to substance dualism: Avicenna (980-1037,



Floating man argument



Floating Man



“One of us must suppose that he was just created at a stroke, fully developed and perfectly formed but with his vision shrouded from perceiving all external objects – created floating in the air or in the space, not buffeted by any perceptible current of the air that supports him, his limbs separated and kept out of contact with one another, so that they do not feel each other. Then let the subject consider whether he would affirm the existence of his self. There is no doubt that he would affirm his own existence, although not affirming the reality of any of his limbs or inner organs, his bowels, or heart or brain or any external thing. Indeed he would affirm the existence of this self of his while not affirming that it had any length, breadth or depth. And if it were possible for him in such a state to imagine a hand or any other organ, he would not imagine it to be a part of himself or a condition of his existence.”

— Avicenna, “De Anima, the book of Healing' Na”, Avicenna, L E Goodman

Soul: unmediated & reflexive consideration of self

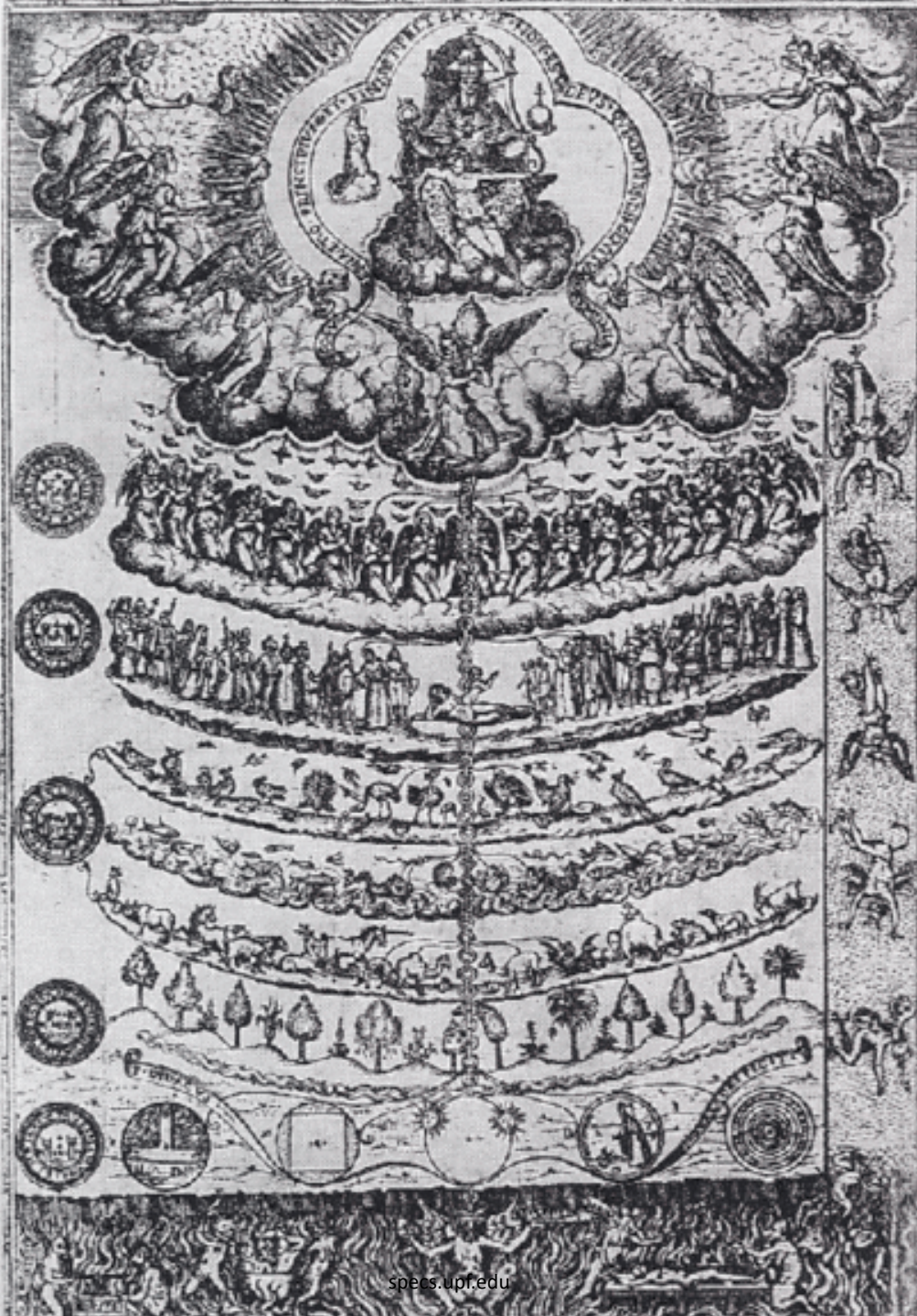
Dualism without interaction

- Psychophysical parallelism
 - interaction is an illusion
 - “God” is behind it
- Occasionalism
 - God supplies the link between body and mind
- Epiphenomenalism
 - Physical events cause mental states
 - mental events can NOT cause physical states

Physicalism

- Mental events can be explained by physical events
- Monism: only one substance
- Certainly makes a scientific program to study mind feasible
- Type-Identity theory
 - Mental events = physical events
 - The thought “blue camels” = a unique neuronal state of the brain

2 Mind in Reality: res cogitans vs res extensa

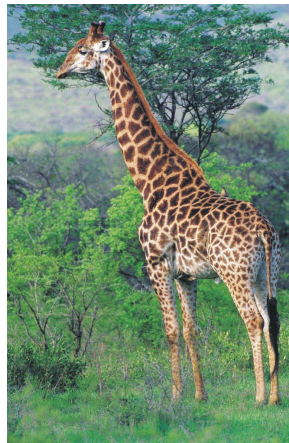


Lamarck proposes Lamarckianism (1800)

Jean-Baptiste Lamarck
August 1, 1744 - December 18, 1829



- The inheritance of acquired characters or *soft inheritance*
- The first truly cohesive theory of evolution.
- **2 principles:**
 - 1: the environment gives rise to changes in animals.
 - 2: life is structured in an orderly manner
- **2 forces** are at work:
 - *Le pouvoir de la vie*: The complexifying force drives animals from simple to complex forms.
 - *L'influence des circonstances*: a force adapting animals to their local environments and differentiating them from each other force adapted them to local environments through interaction with the environment and the *use and disuse* of characteristics, differentiating them from other organisms.
- These forces must be explained as a necessary consequence of basic physical principles, favoring a materialistic attitude toward biology.



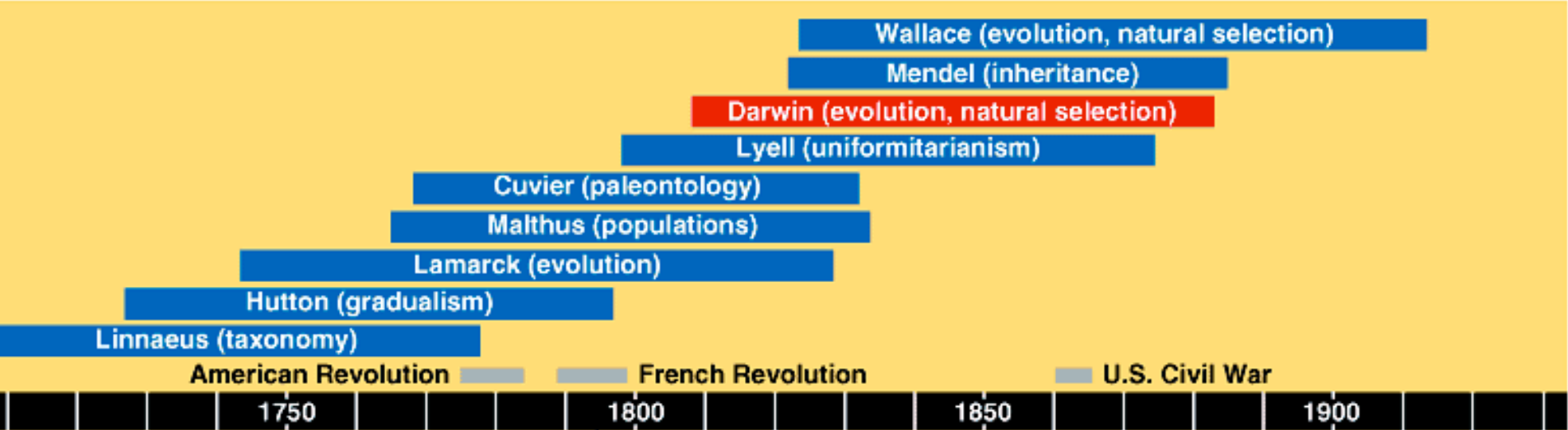
History of evolutionary thought is long

- Anaximander (c. 610–546 BC) proposed that life had originally developed in the sea and later moved onto land.
- Empedocles (c. 490–430 BC) wrote of a non-supernatural origin for living things where adaptation did not require an organizer or final cause. According to Aristotle: "Wherever then all the parts came about just what they would have been if they had come to be for an end, such things survived, being organized spontaneously in a fitting way; whereas those which grew otherwise perished and continue to perish..." although Aristotle himself rejected this view.
- In the late 19th century Erasmus Darwin proposed "that all warm-blooded animals have arisen from one living filament... with the power of acquiring new parts" in response to stimuli, with each round of "improvements" being inherited by successive generations (Zoonomia).
- An idea further elaborated by his grandson.



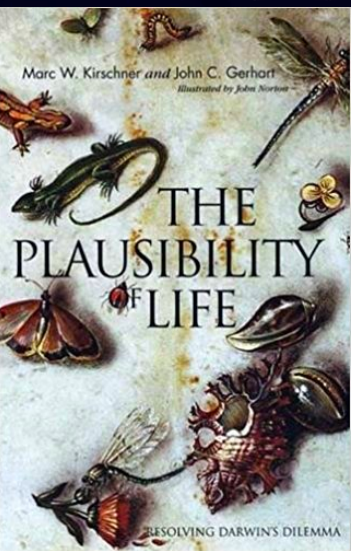
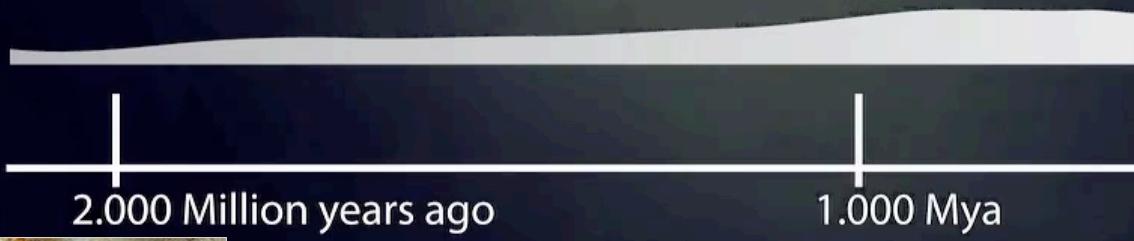
12 December 1731 - 18 April 1802

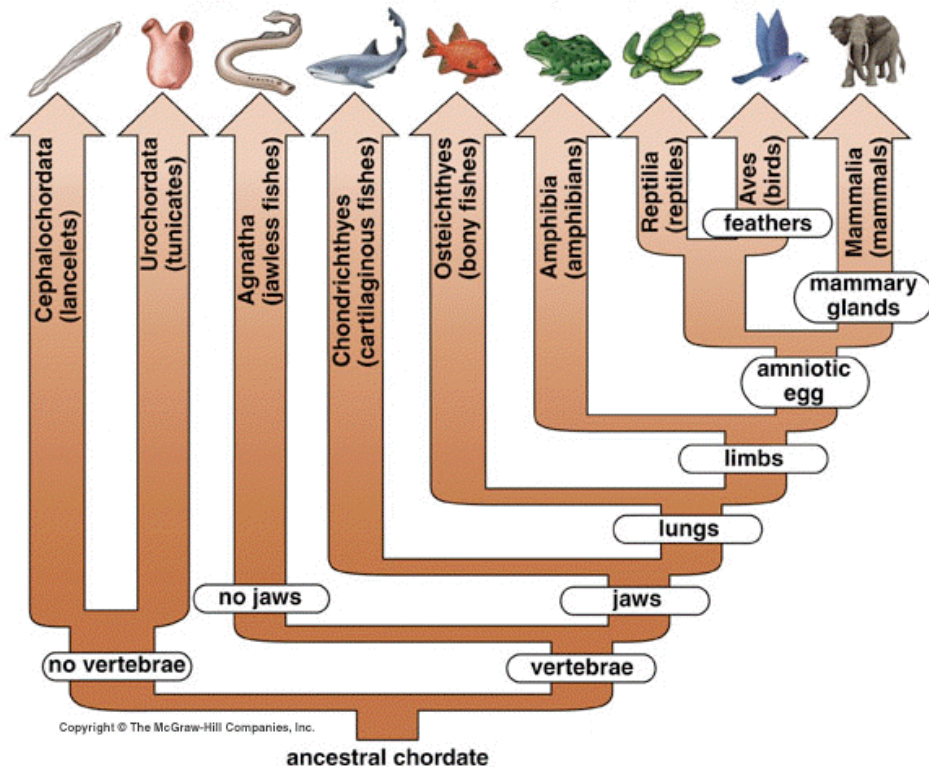
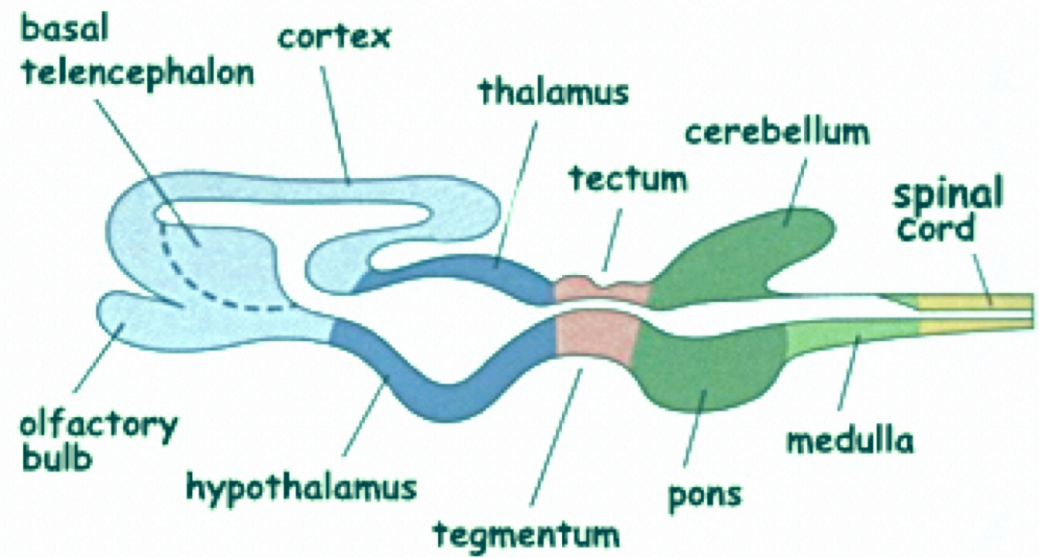
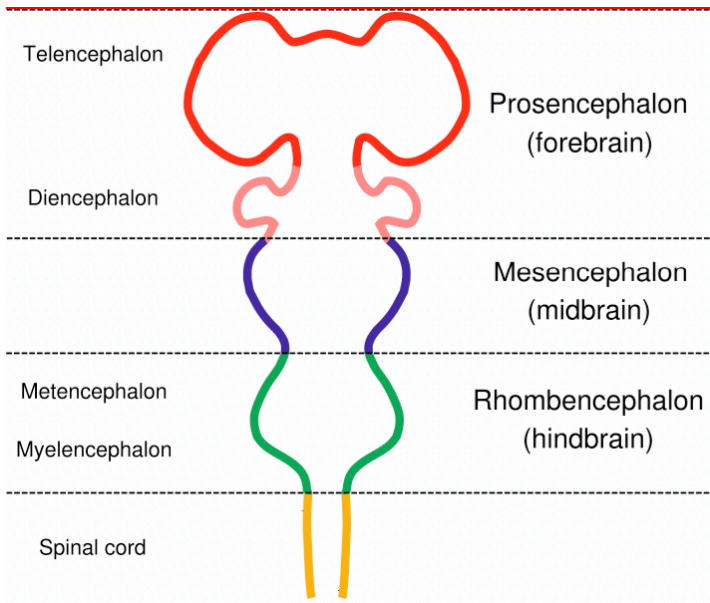
"Would it be too bold to imagine that, in the great length of time since the earth began to exist, perhaps millions of ages before the commencement of the history of mankind would it be too bold to imagine that all warm-blooded animals have arisen from one living filament, which the great First Cause endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions and associations, and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down these improvements by generation to its posterity, world without end!" ([Zoönomia](#))



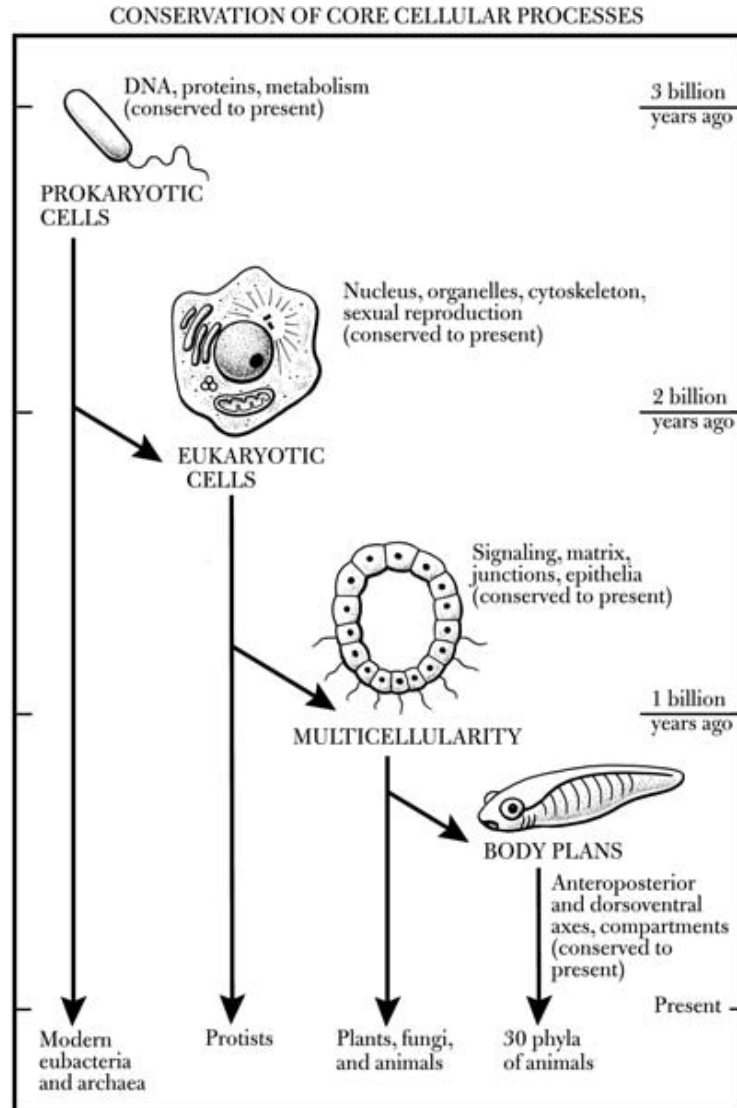
- 1791 Luigi Galvani publishes work on electrical stimulation of frog nerves
- 1800 Alessandro Volta invents the wet cell battery
Samuel von Sommering identifies the "substantia nigra" in the midbrain
- 1808 Franz Joseph Gall publishes work on phrenology
- 1817 James Parkinson publishes An Essay on the Shaking Palsy
- 1832 Sir Charles Wheatstone invents the stereoscope
Jan Purkyne (Purkinje) describes cerebellar cells;
- 1839 Theodor Schwann proposes the cell theory
- 1848 Phineas Gage has his brain pierced by an iron rod
- 1859 Charles Darwin publishes The Origin of Species
- 1870 Hitzig and Fritsch use electrical stimulation of motor cortex
- 1889 Ramon y Cajal argues on nerve doctrine

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Evolution conserves organizational principles



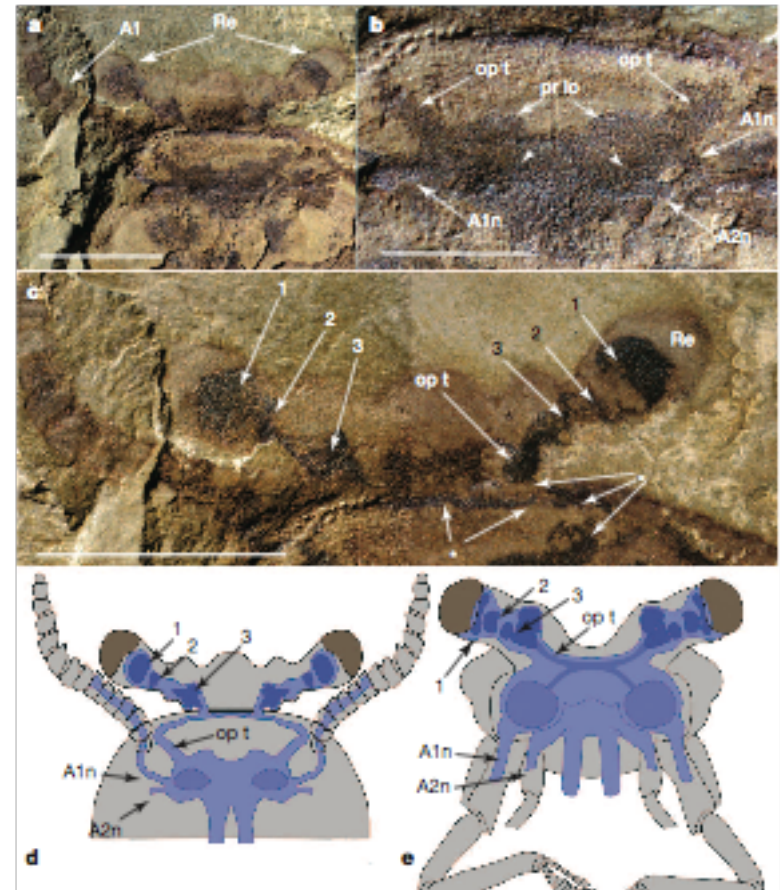
Kirschner & Gerhart (2007)
The Plausibility of Life

Conservation of design principles: *Fuxianhuia protensa* 520 Ma



Al, antenna; Ab, abdomen; Es, eye stalk; Ey, eye; Hs, head shield; Oc, optic capsule; Th, thorax. Scale bar, 1 cm.

Ma et al 2012 Nature

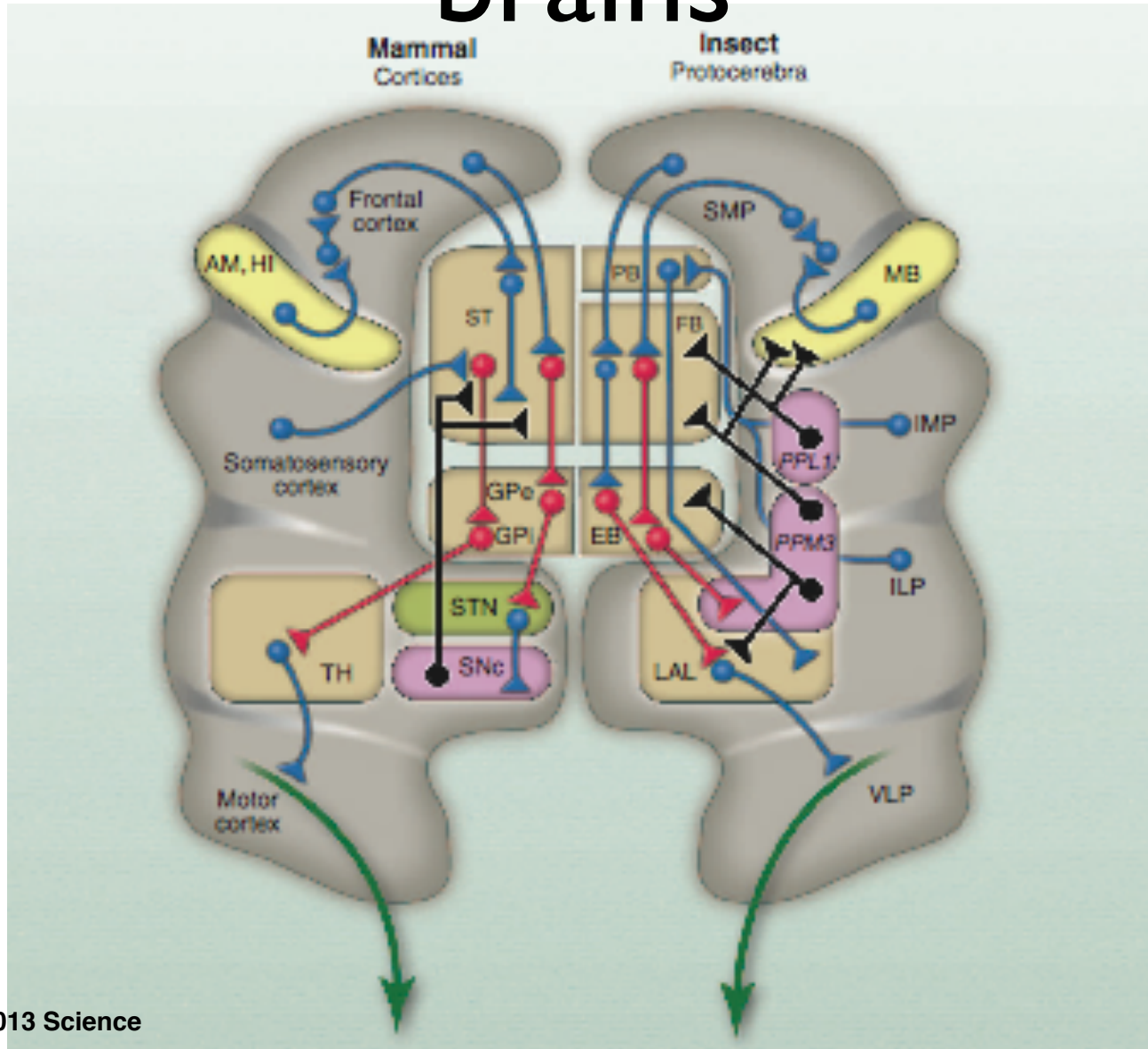


Fuxianhuia
520 Ma

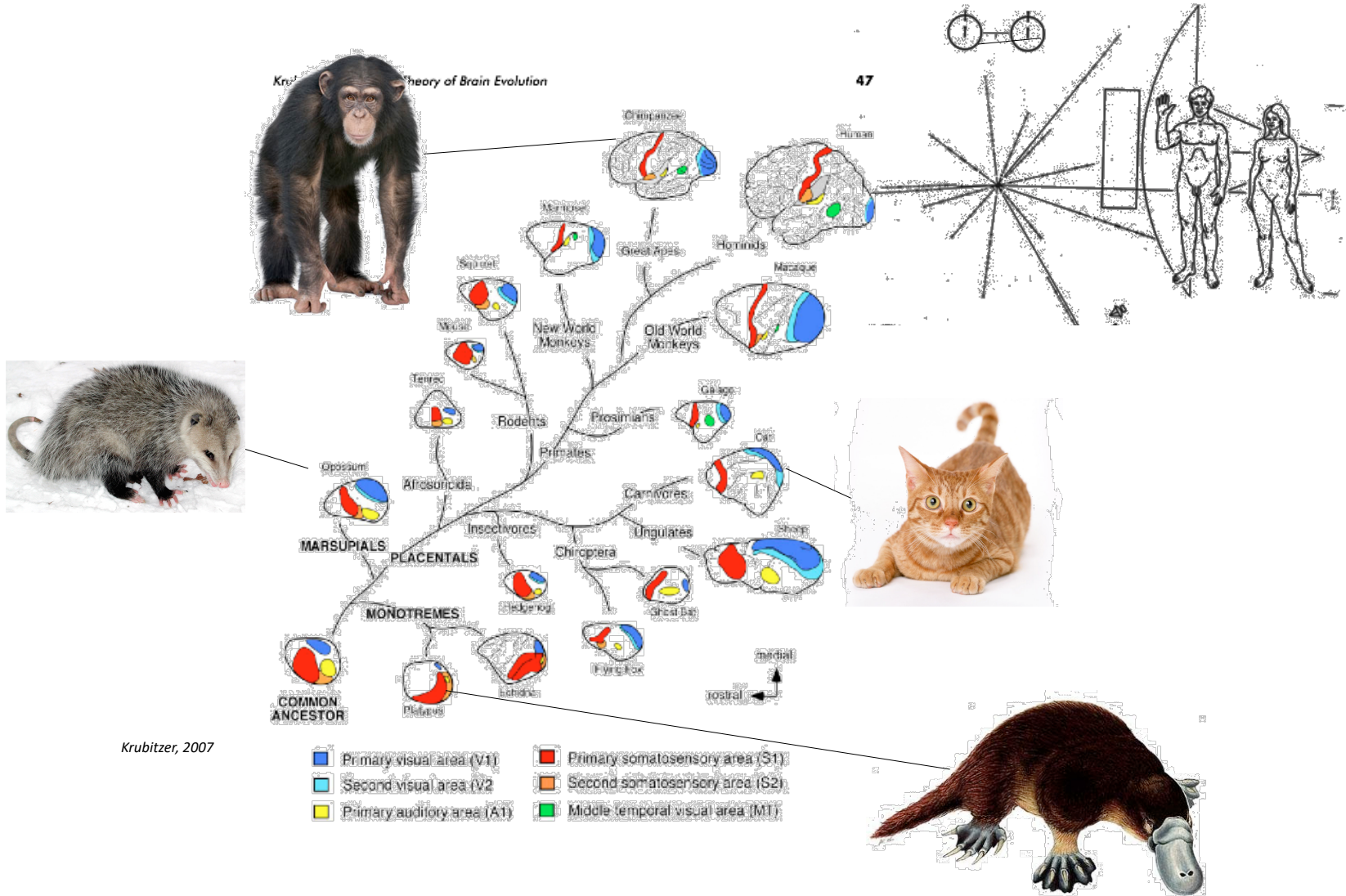
Coenobita clypeatus
Now



Mammalian versus Invertebrate brains



Pushing the envelope of complexity exploiting a small set of common design principles

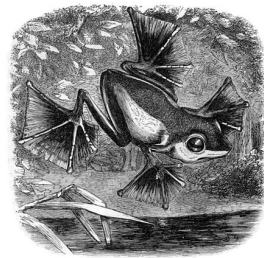


Krubitzer, 2007

Alfred Russel Wallace (1823-1913)

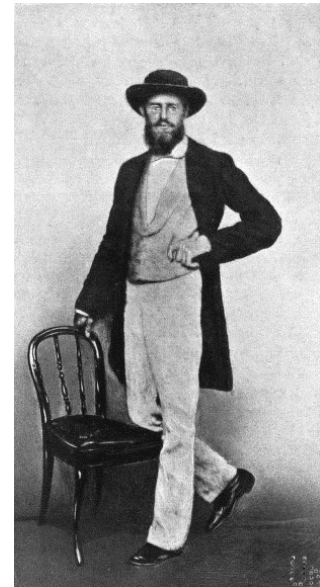
- Transmutation of species (Lamarck)

“The problem then was not only how and why do species change, but how and why do they change into new and well defined species, distinguished from each other in so many ways; why and how they become so exactly adapted to distinct modes of life; and why do all the intermediate grades die out (as geology shows they have died out) and leave only clearly defined and well marked species, genera, and higher groups of animals?”



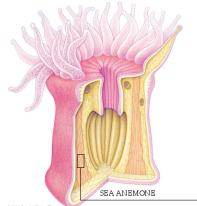
...these causes or their equivalents are continually acting in the case of animals also; ... Vaguely thinking over the enormous and constant destruction which this implied, it occurred to me to ask the question, why do some die and some live? And the answer was ... the best fitted live ... and considering the amount of individual variation ... then it followed that all the changes necessary for the adaptation of the species to the changing conditions would be brought about ... In this way every part of an animals organization could be modified exactly as required, and in the very process of this modification the unmodified would die out, and thus the definite characters and the clear isolation of each new species would be explained.” (Wallace, My Life)

- Natural selection

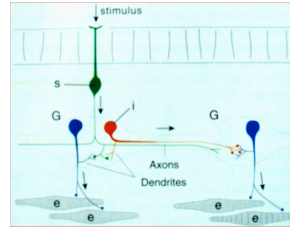
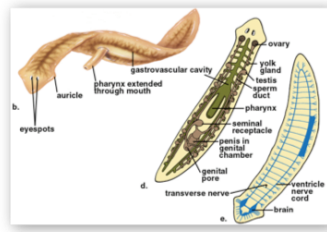


Evolution has no goal

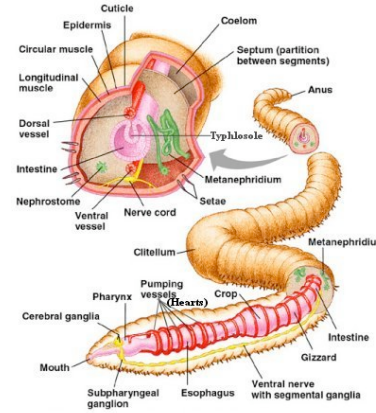
3 Humans are animals



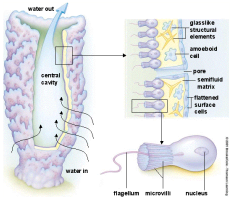
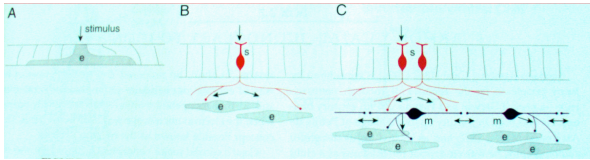
Nerve nets



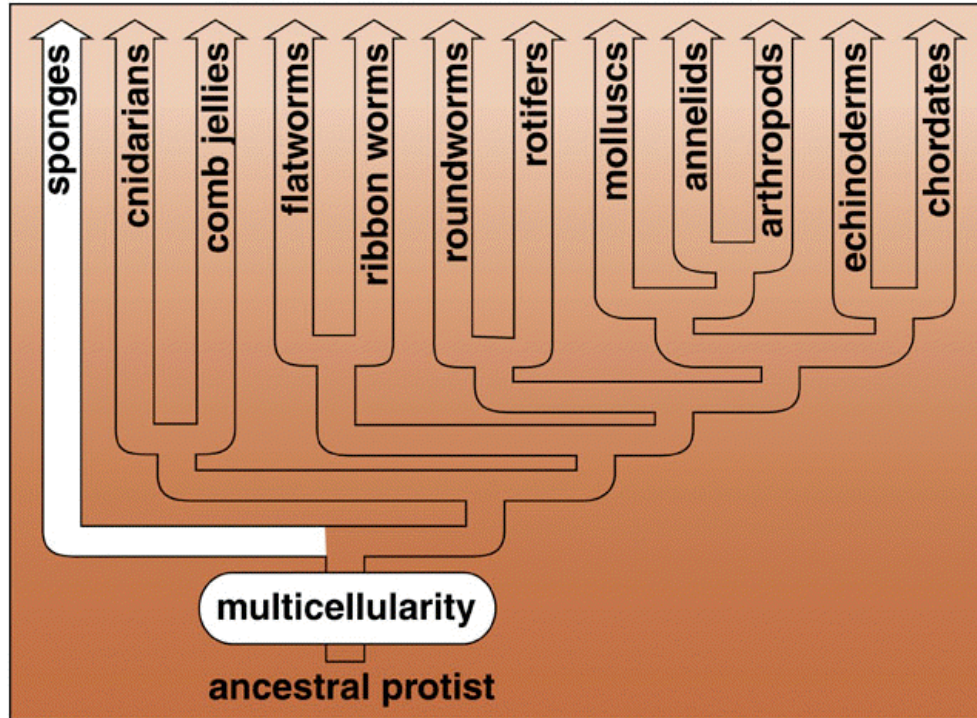
Segmented Cephalization



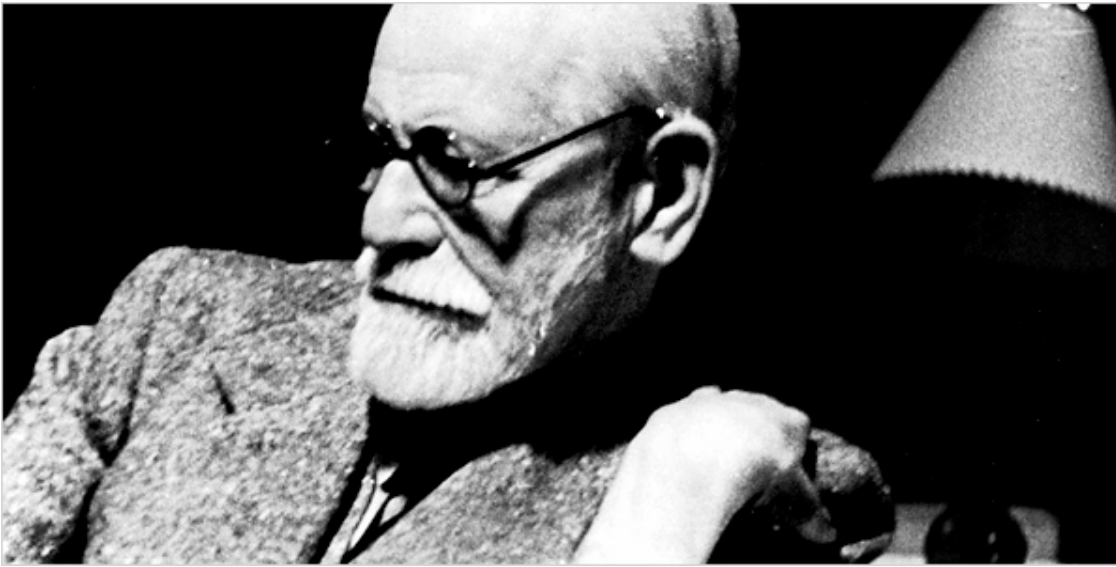
Segmented Ventral CNS



Cells



Freud

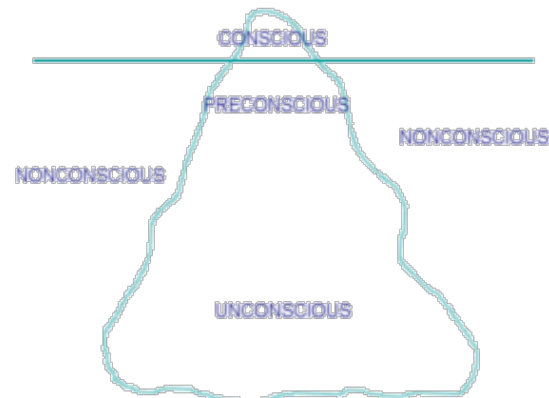


Behavior and experience is motivated by sex

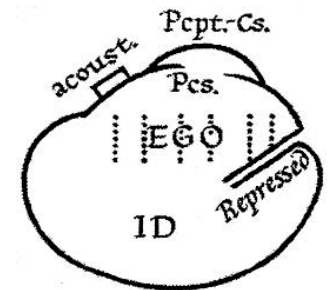
We are not aware of most of our the mental states that influence our personality and experience

The Ego comprises that part of personality that includes defensive, perceptual, intellectual-cognitive, and executive functions. Conscious awareness resides in the ego, although not all of the operations of the ego are conscious. The ego separates what is real and organises thoughts and makes sense of them and the world around us.

(May 6, 1856 – September 23, 1939)



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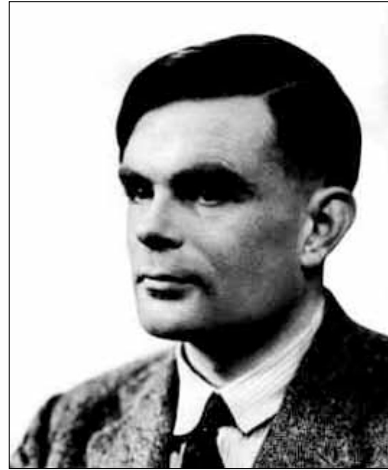
Freud, 1923

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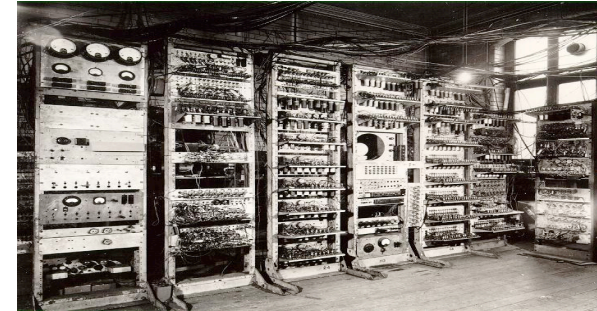
Paul Verschure

Computing machinery

Breaking the enigma code



Alan M. Turing (1912–1954)



Manchester Mark 1

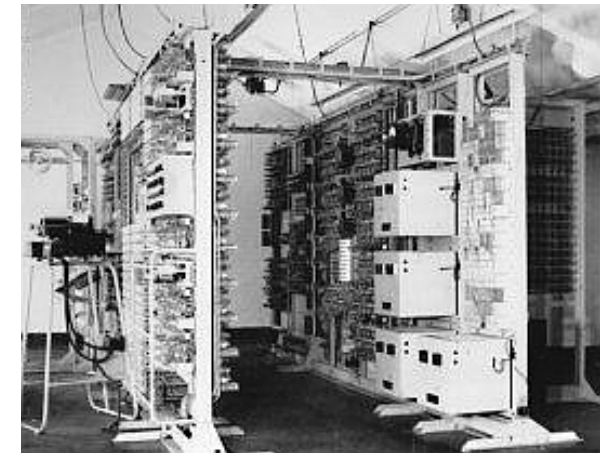


Enigma: 1918 Arthur Scherbius



Bletchley park

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“Bombs”

Paul Verschure

Mind/Brain/Behavior Cycle

