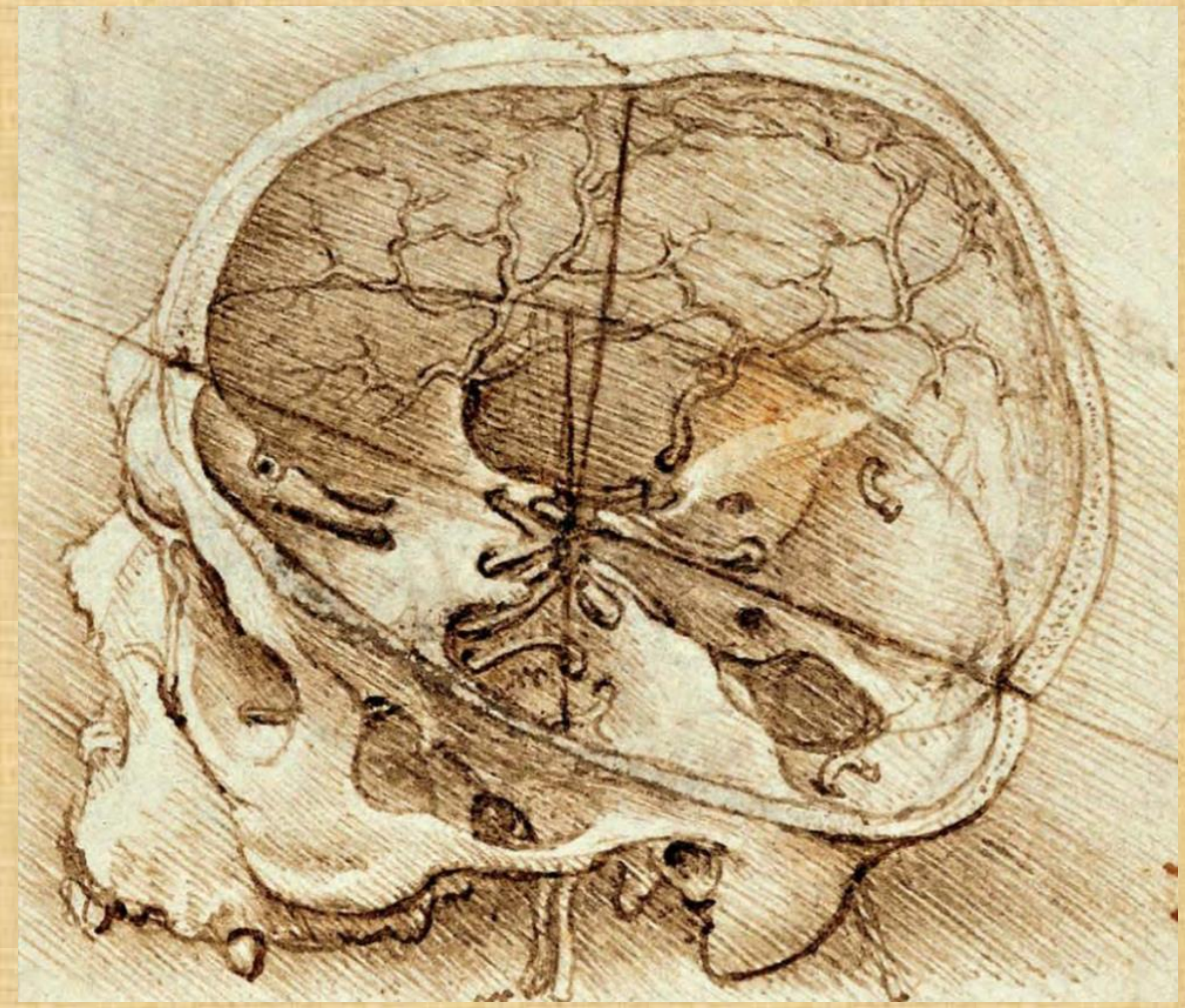
History of the Brain

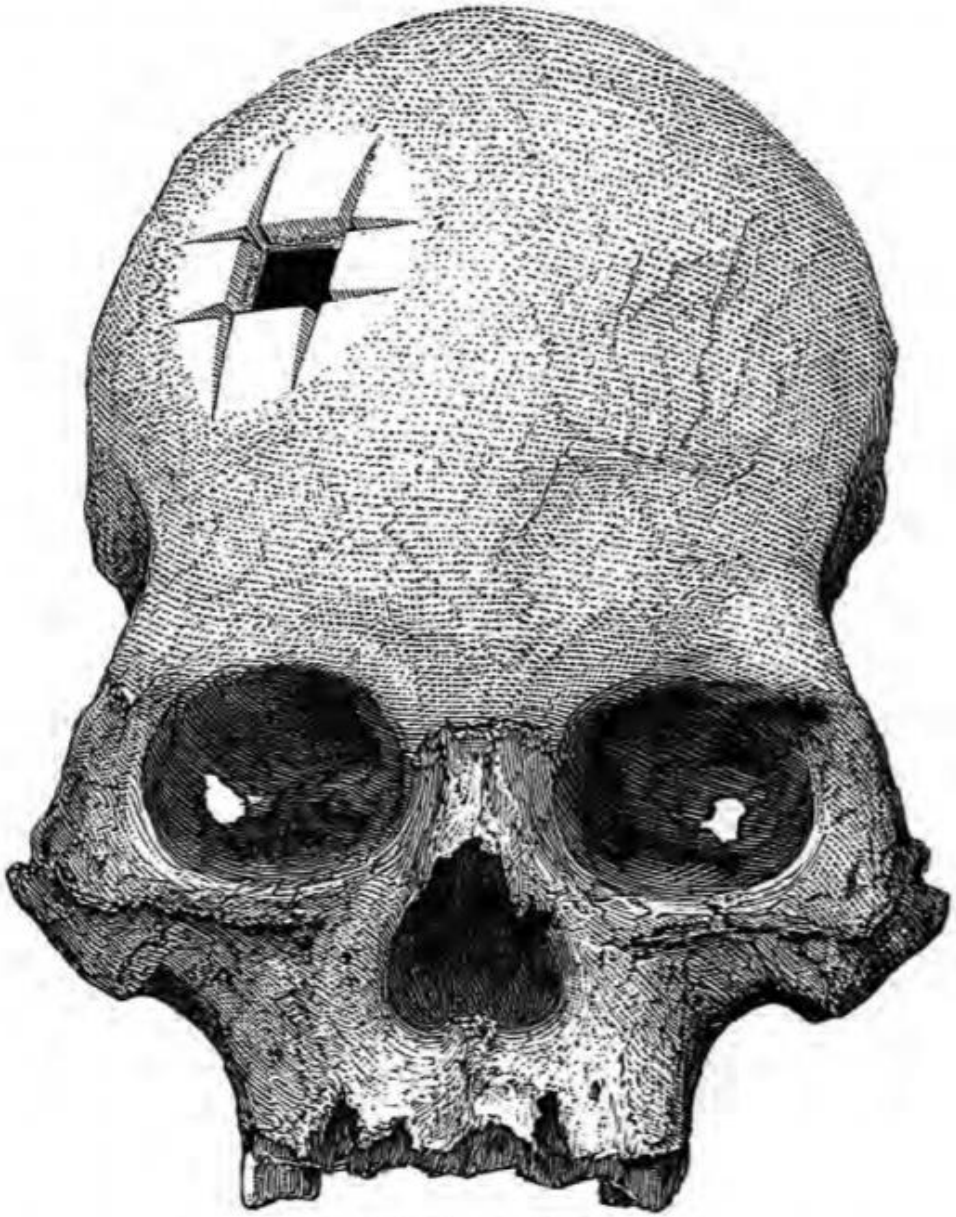


Main periods in the history of Neuroscience

- Prehistoric period
- beliefs about the brain in ancient Egypt, Greece and Rome
- the Medieval
- the 19th century
- the most important advances in the 21st century and future directions in neuroscience

Prehistoric Neurosurgeons

- It was proved that it is possible to bore a hole in a child's skull in just four minutes, 50 minutes - adult one.
- Trepanation was practiced throughout Europe during Neolithic times and was surprisingly common in certain locations. Skulls have been found in France (where the highest numbers occur) along with those in Spain, Denmark, Germany, England, Italy, Russia and the Balkans.
- Ukrainian skulls are from **7300–6200 BC**, and others from France date from **5100–4900 BC**. Most trepanations, however, appear to have been performed between **3000 and 2000 BC**.



TREPANNED SKULL.

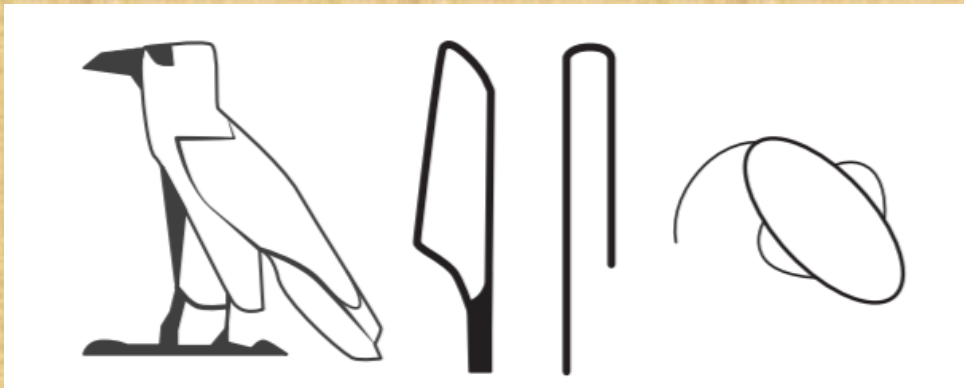
FIGURE 1.1 The Peruvian skull showing evidence of trepanation presented to the New York Academy of Medicine by Ephraim George Squier in 1865 and later sent to Paul Broca. Actually, this skull is relatively recent and dates from between 1400 and 1530 AD. It now resides in the American Museum of Natural History.

Ancient Egypt

- Egypt's history begins around **3100 BC** when Menes became the first Pharaoh to rule a land dominated by the tides of the Nile
- How the Egyptians treated the various parts of the body during this process tells us a great deal about their beliefs.
- thoughts, desires and actions arising not from the brain, but the heart.
- ancient Egyptians attributed little importance to the brain, other than seeing it as a vesicle for passing wet mucus or snot to the nose

The first word for the brain

- Edwin Smith papyrus (purchased by an American of that name in Luxor in 1862, and translated by James Henry Brested during the 1920s) – written around 1700 BC, a copy of a much older text, possibly a manual for military surgeons, dating from around 3000 BC

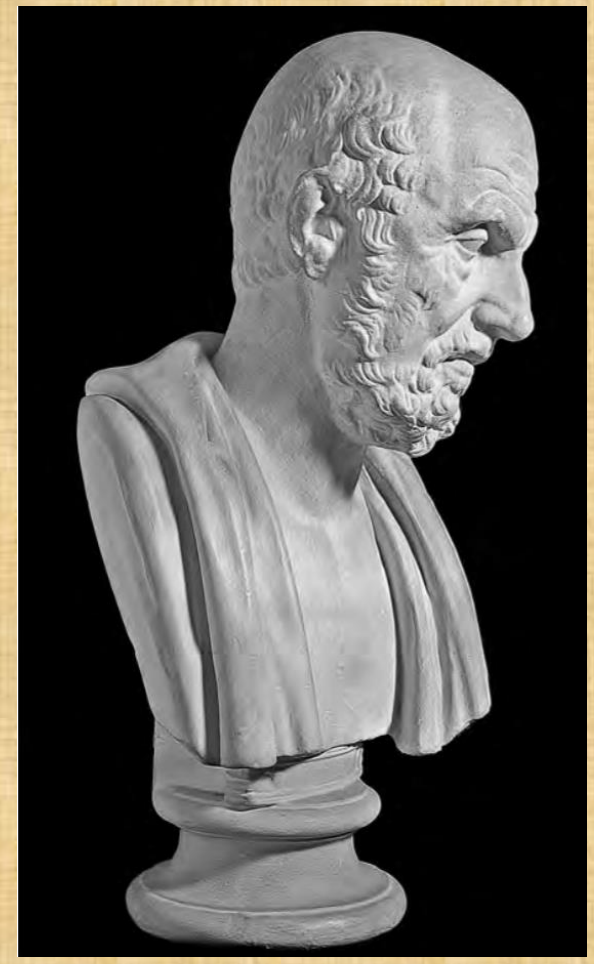


- It is represented by a four-part hieroglyph, composed of a **‘vulture’, ‘reed’, ‘folded cloth’** and a final suffix which means **‘little’**.
- The first three of these hieroglyphs are actually phonemes making a sound, which is believed to have resembled ‘ ah-i-s’. This is also translatable as ‘skull-offal’ or ‘skull-marrow’.
- Interestingly, the origin of our modern word ‘brain’ has a similar derivation for it is believed to come from ‘braegen’, an Old English word (c. 1000) that appears to be related to a yet older French word ‘bran’ meaning refuse.

Ancient Greece: Homer's Illiad

- Psyche, thymos, noos – vital forces. All reside in the chest.
- More than 150 anatomical terms are found in Illiad, although only three relate to the brain.
  - enkephalos, which literally refers to the material inside our head (i.e. the brain) and is the source of our words 'encephalon' and 'cerebrum';
  - muelos referring to the marrow inside the spine, from where we get the word 'medulla';
  - sinew describing a ligament or tendon.

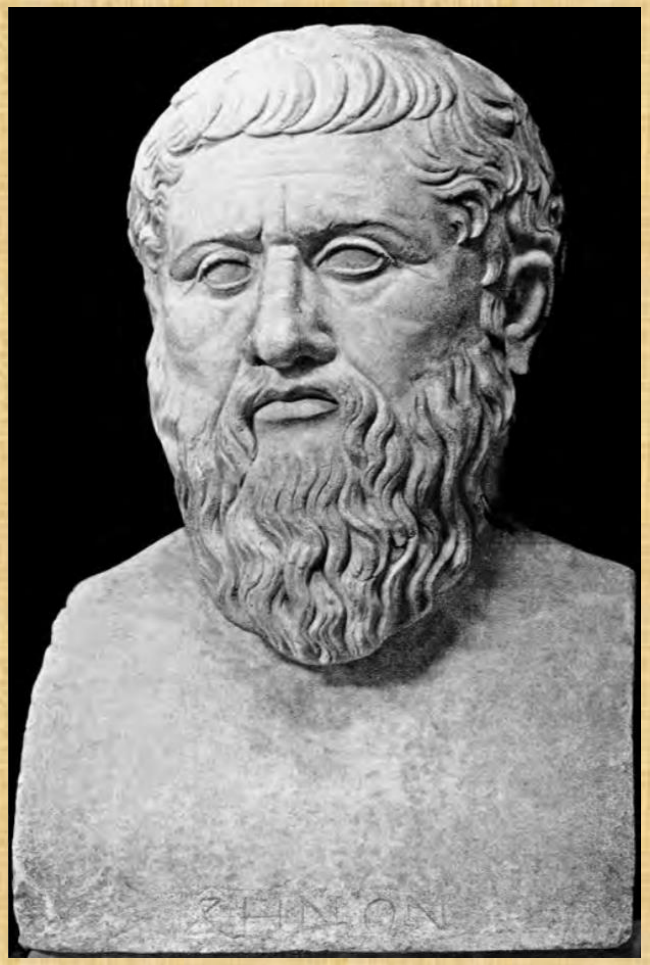
c. 460 to 370 BC



- more than any other individual in antiquity freed medical practice from mysticism and superstition by replacing it with the idea that health is a physical process amenable to understanding through observation and reasoning.
- his writings were collected by scholars at the Library of Alexandria after his death, where they would form a body of work known as the Corpus H.
- Part “On the Sacred Disease” provides an excellent anatomical description of the human brain.

Plato (424–347 BC)

- he would attribute it with three distinct parts:
  - the epithymetikon – liver-based, dasal needs
  - the thymos – heart – emotions
  - the logistikon – brain – unique to humans. Intelligence.



Herophilus (c. 335–280 BC) and Erasistratus (c. 310–250 BC).

- Herophilus made his greatest contribution to anatomy by discovering the true nature of the nervous system
- Herophilus described seven pairs of nerves arising from the brain (now known as cranial nerves) and established six of their destinations: these were apparently the optic, oculomotor, trigeminal, facial, auditory and hypoglossal nerves.
- Herophilus localised the soul in the ventricles of the brain(the ventricular theory).
- Erasistratus paid close attention to the brain, and improved upon the observations of Herophilus by providing a more thorough account of the ventricular system by describing four main cavities.
- Erasistratus' greatest legacy was his explanation of the way blood and pneuma are generated in the body.

Claudius Galen (AD 129–200)

- Galen was a prolific author who wrote on a surprisingly wide variety of topics, including medicine (of course), but also logic, philosophy and literary criticism.
- Galen's true greatness, however, lay in his determination to supplement what was already known with his own facts, discoveries and theories.

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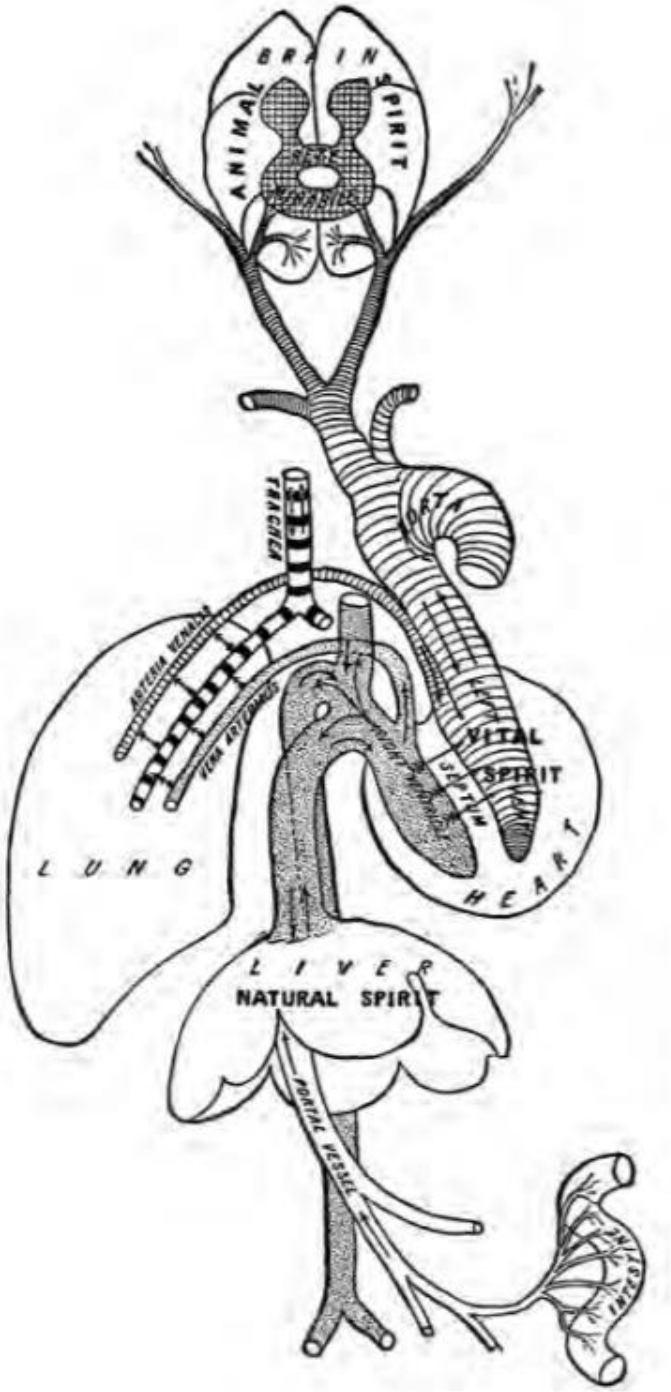
- authority of Galen, and the quality of his empirical work, that his influence reigned supreme over medicine for 15 centuries after his death.
- Laryngeal nerve was found



VENETIIS APVD IVNTAS. M D LXV.

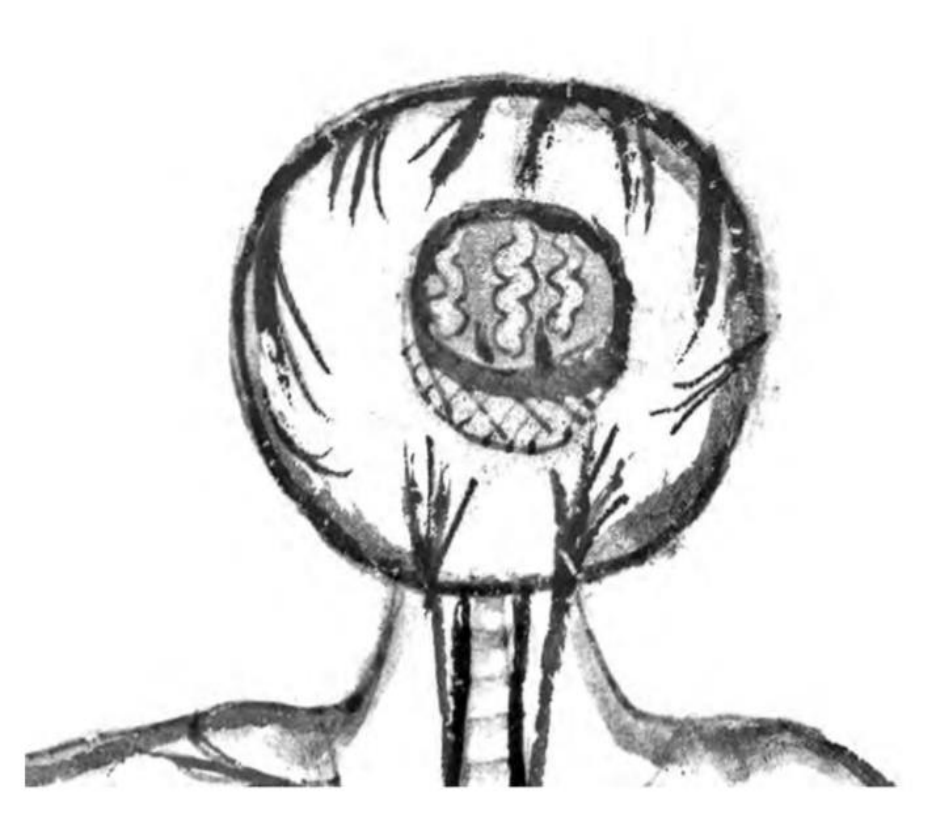
The death of Galen at the end of the second century AD, and Rome's fall some 200 years later, marks a point where new anatomical and physiological research was put on hold for more than 1200 years…

- The Muslims who occupied many of the surrounding lands during this period also had a strong desire for knowledge, and they too helped preserve Greek knowledge by translating it into Arabic.
- The Eastern scholars preserved the writings of the great Greek philosophers, incorporated their own beliefs and knowledge into the work.
- Eventually symbiosis of antique teachings with Eastern phylosophy turned into Cell doctrine(presumably 370 AD).
- Intellectual stagnation of the West would only begin change in the thirteenth and fourteenth centuries. An important development was the return of travellers back from places such as Byzantine with copies of ancient texts for translation into Latin, resulting in a renewed respect for Greek values and thinking.

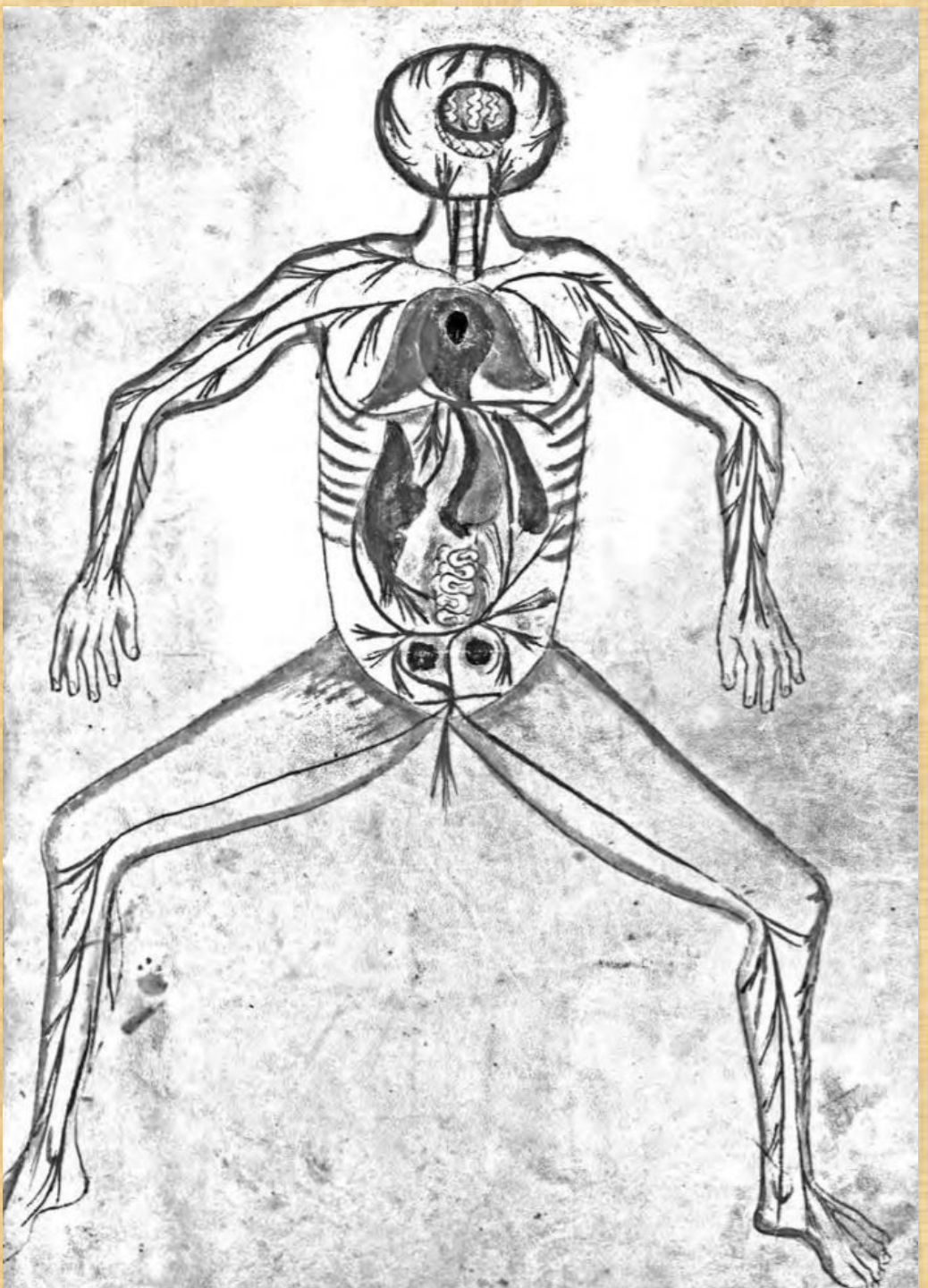
Ibn Sina (ابن سينا),**Abu Ali Sina** (ابن سينا) ,often known in the west as **Avicenna** (c. 980 – June 1037)

- monumental 14 volume Canon of Medicine first written in 1025
- Wrote a set of books which served as the standard text in university medical education in Europe for the next 600 years
- Advocated a five-cell doctrine
- First used term *VERMIS*

Brain?



- One of a series of five drawings found in a number of Eastern and Western medical manuscripts which are believed to be copied from a much earlier source – possibly in Alexandria circa 300 BC. The insert shows possibly the earliest depiction of the brain



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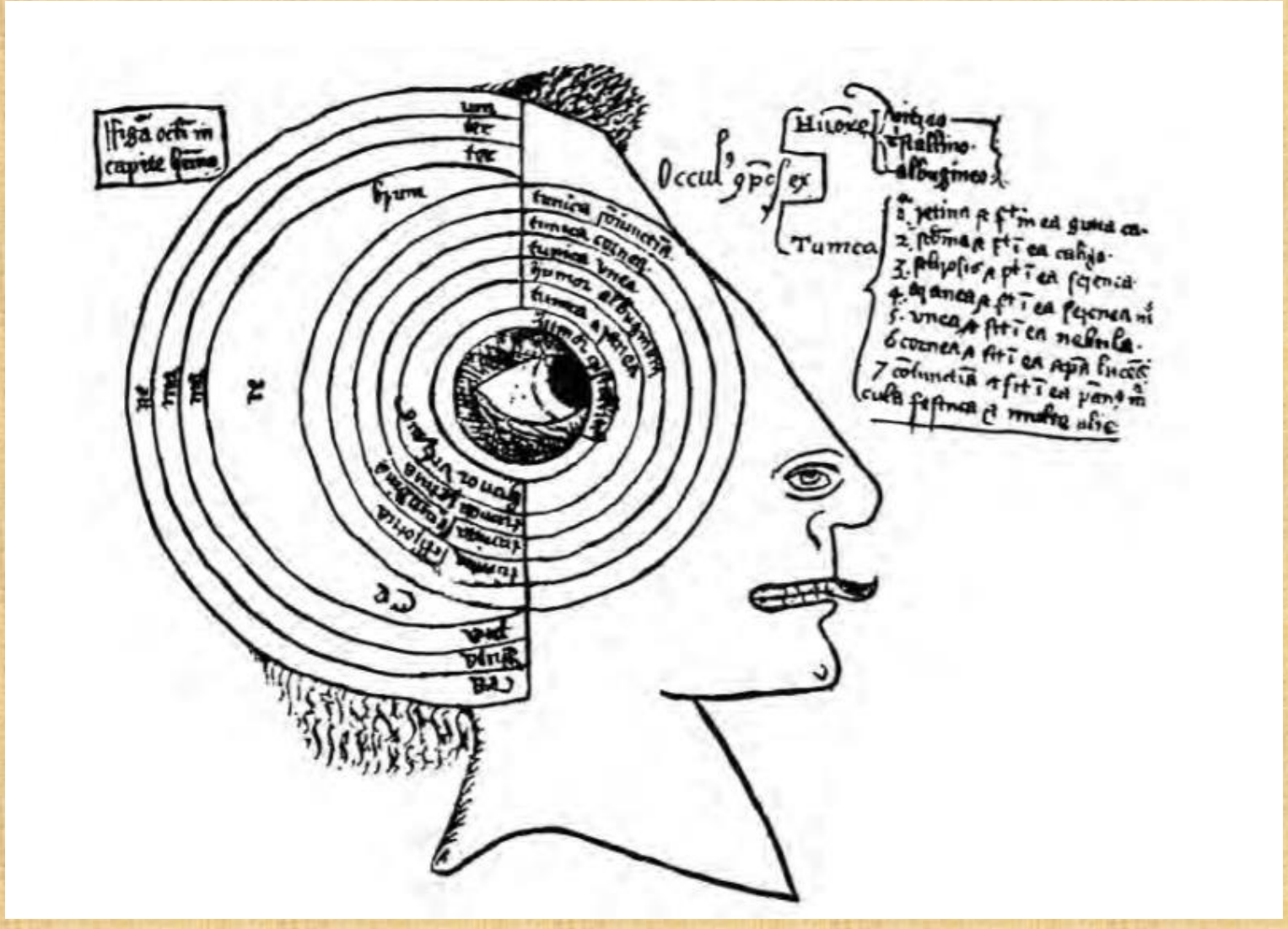
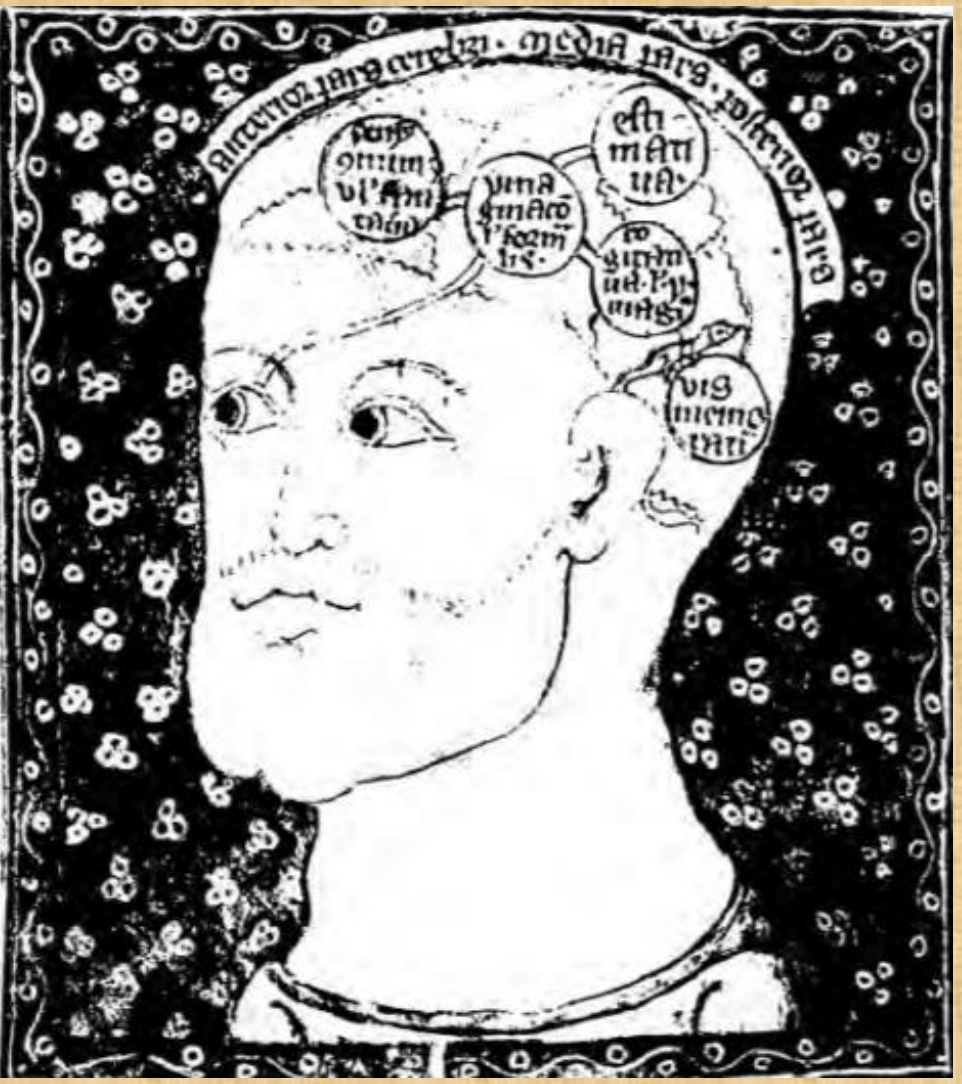


- The anatomy of the eye from a late fourteenth century manuscript held in the British Museum which depicts seven layers, including the retina (1) and cornea (6). On the left, the cranium, dura mater, pia mater and cerebellum are also named.

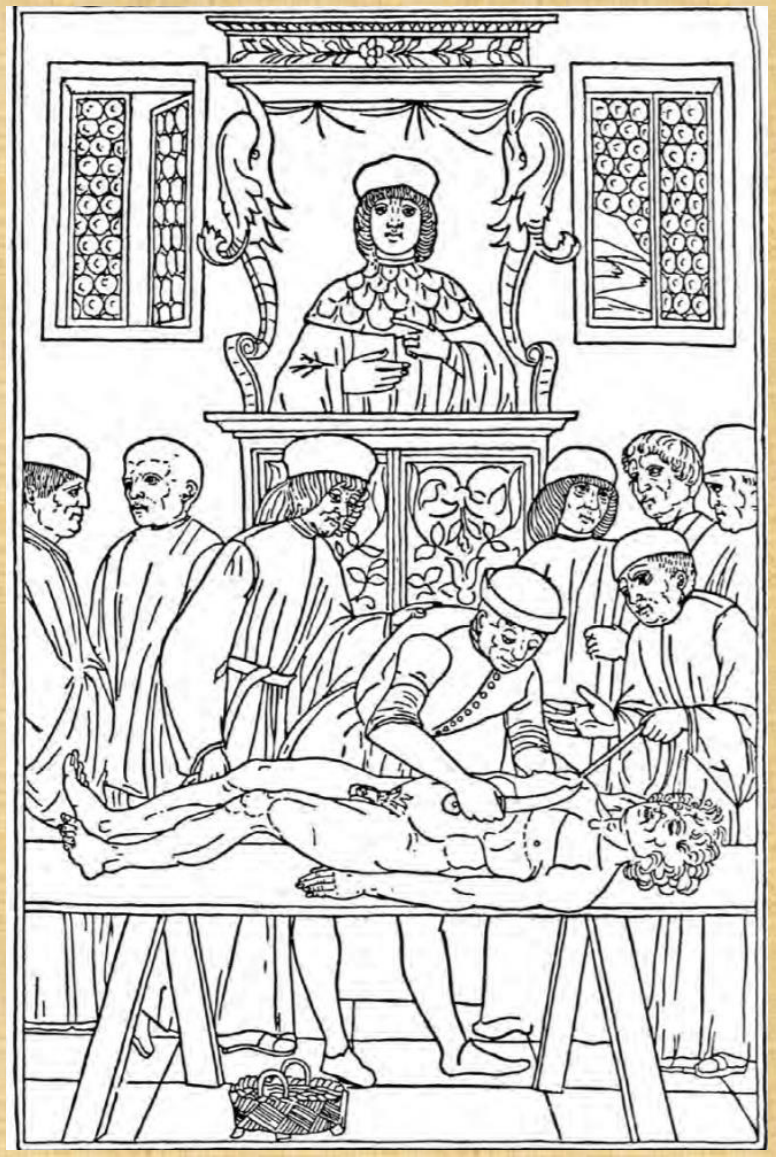


A fourteenth century drawing of the Cell Doctrine (c.1310) showing the influence of Avicenna. The cells are labelled (right-to-left) sensus communis, yimaginatio, estimativa, cogitavia vel yimaginatio, and vis memorativa. Interestingly, the diagram places the vermis (depicted here as containing an eye, presumably representing a form of inner awareness) between the fourth and fifth cells.

1200 years later…

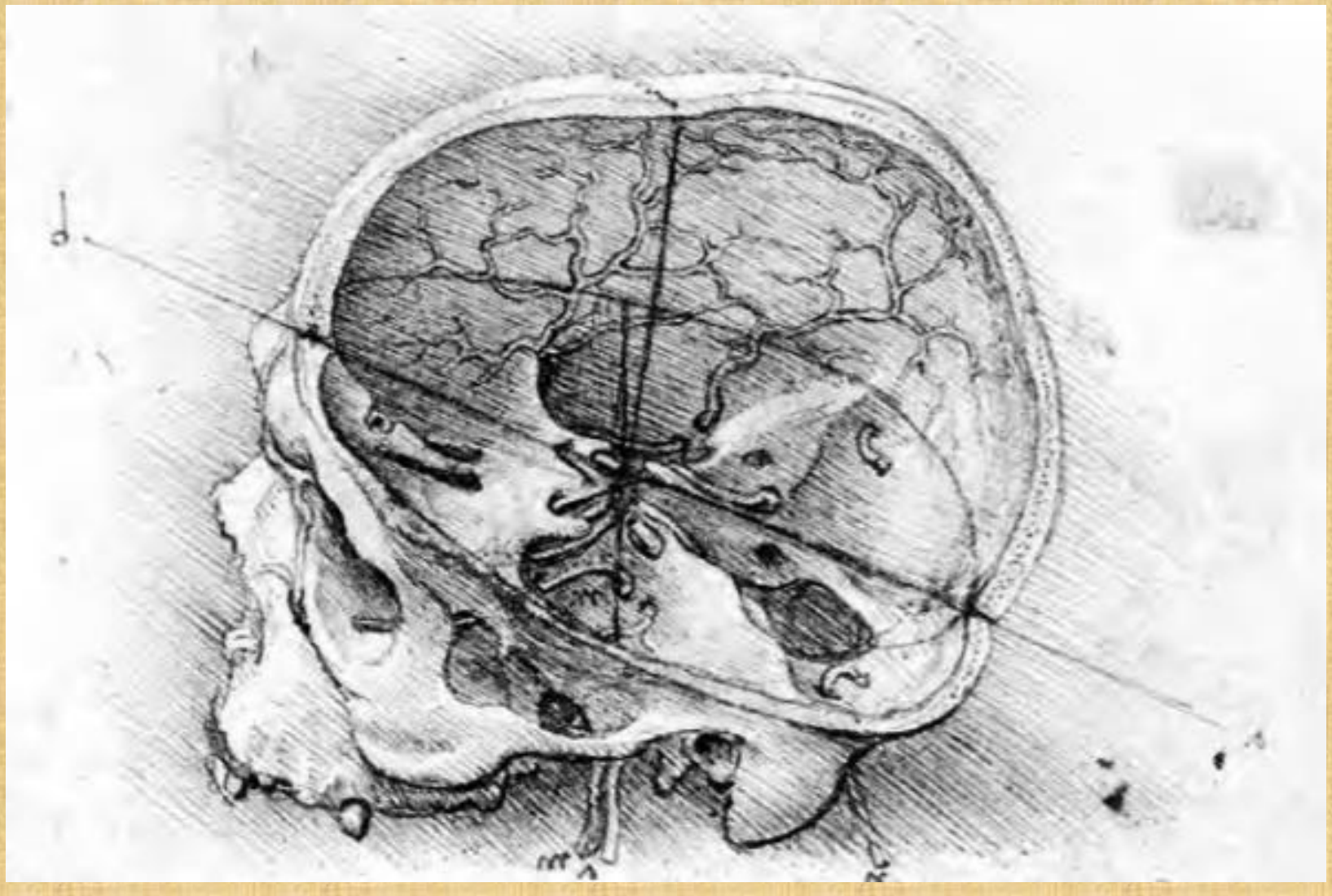
The dissection of human corpses had only taken place in Alexandria, and even then its practice was brief, perhaps lasting no more than a hundred years. After this there was no more human anatomisation until the thirteenth century – a hiatus of 1500 years.

Mondino de Luzzi (1275–1326)



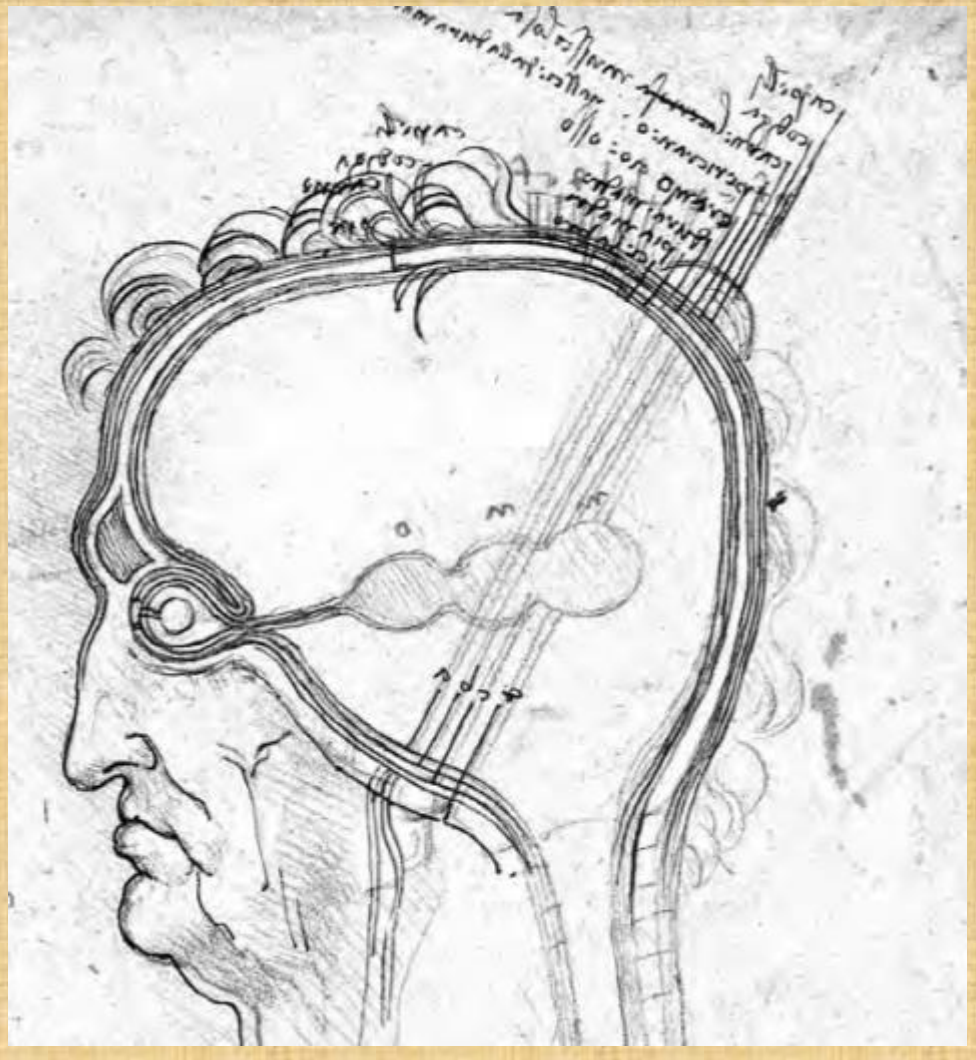
- Thanks to crusaders and…
- Church and…
- Sailors and…
- autorities…
- the first documented public human dissection was performed by Mondino de Luzzi in 1315

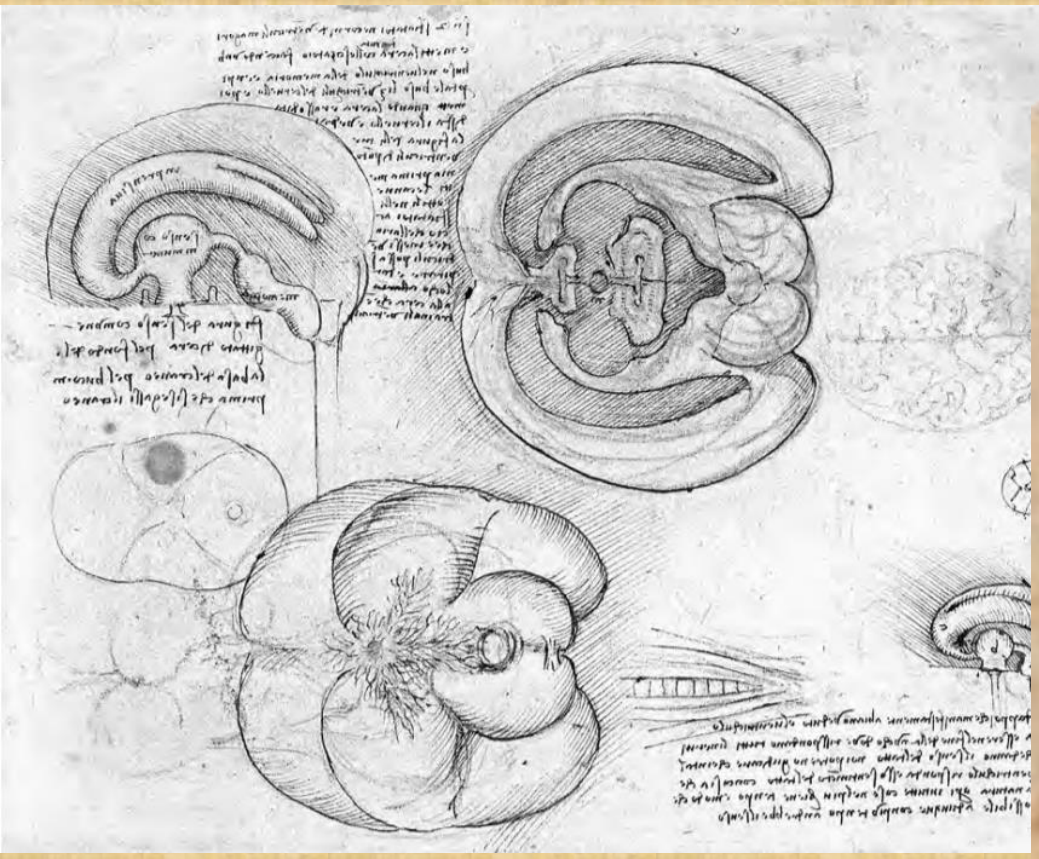
Leonardo da Vinci
1452 – 1519



- first attempts of Leonardo to draw the brain date from about 1487 to 1493 and they show his fascination with the Cell Doctrine and, in particular, the location of the sensus communis.

- imprensiva (i.e. where visual and auditory impressions arrive) – anterior
- Sensus communis – middle ventricle. ‘the eye without external light’.
- Memoria – posterior ventricle





- Bovine ventricular system depictet from the model, made by pouring wax inside.

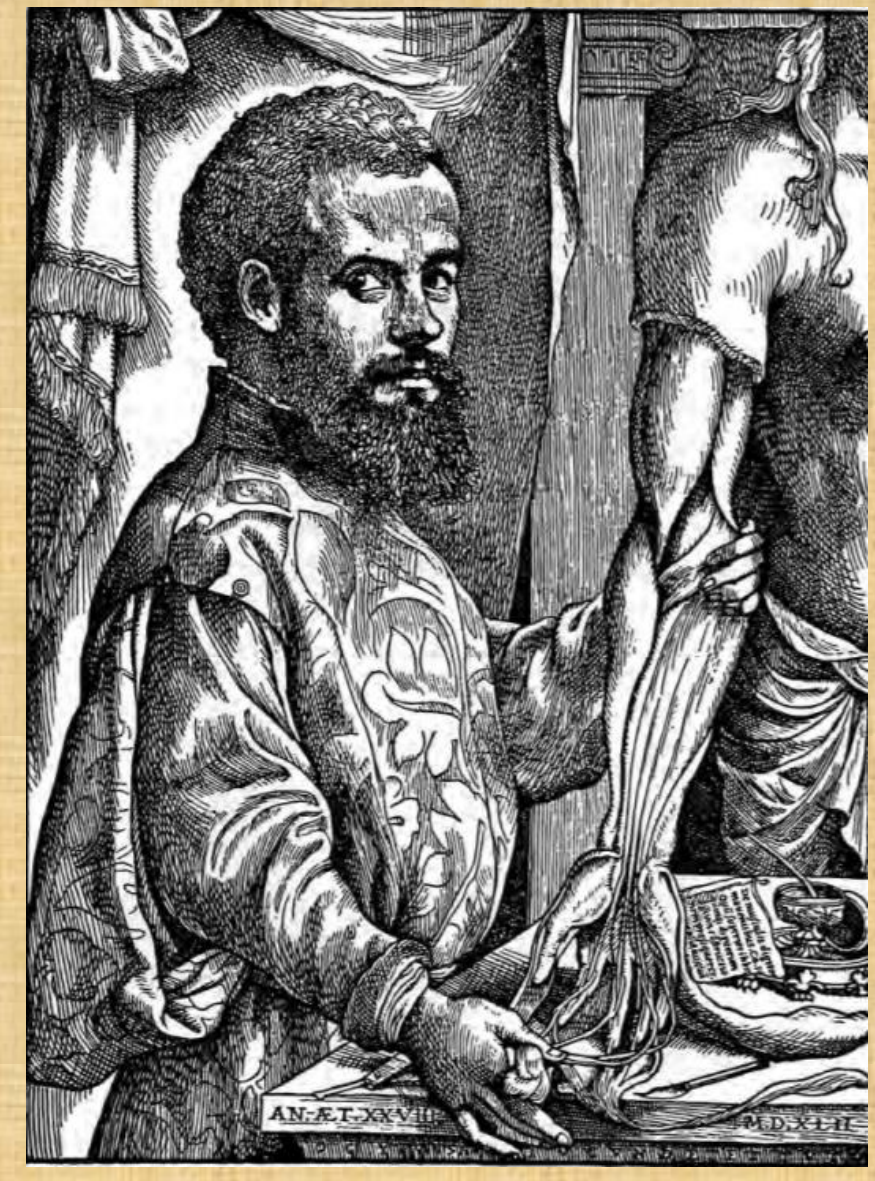
Jacopo Berengario da Carpi

- Violent man
- said to have engaged in quarrels and assaults, and even convicted of a robbery
- was appointed Lecturer in Surgery at Bologna in 1502
- achieve fame as a doctor for his use of mercury in the treatment of syphilis – a disease then prevalent among the priests of Rome

at 1521 published the fruits of his labours entitled

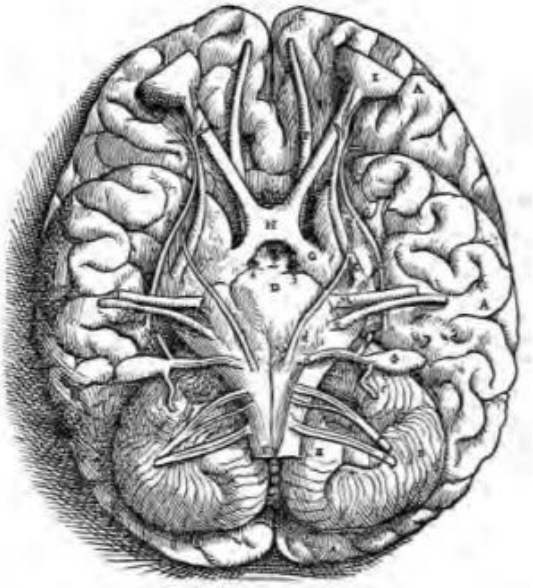
Commentaria super anatomia Mundini

Andreas Vesalius 1514-1564



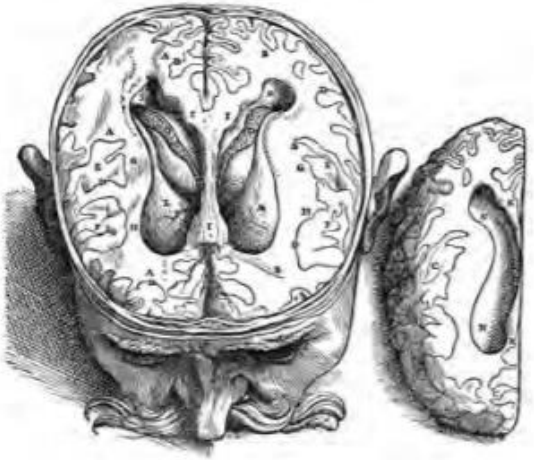
- proved Galen had made many errors in his anatomical work.
- De humani corporis Fabrica (On the Structure of the Human Body)

The front page of De humani corporis Fabrica by Vesalius published in 1563



(A)

(B)



(C)

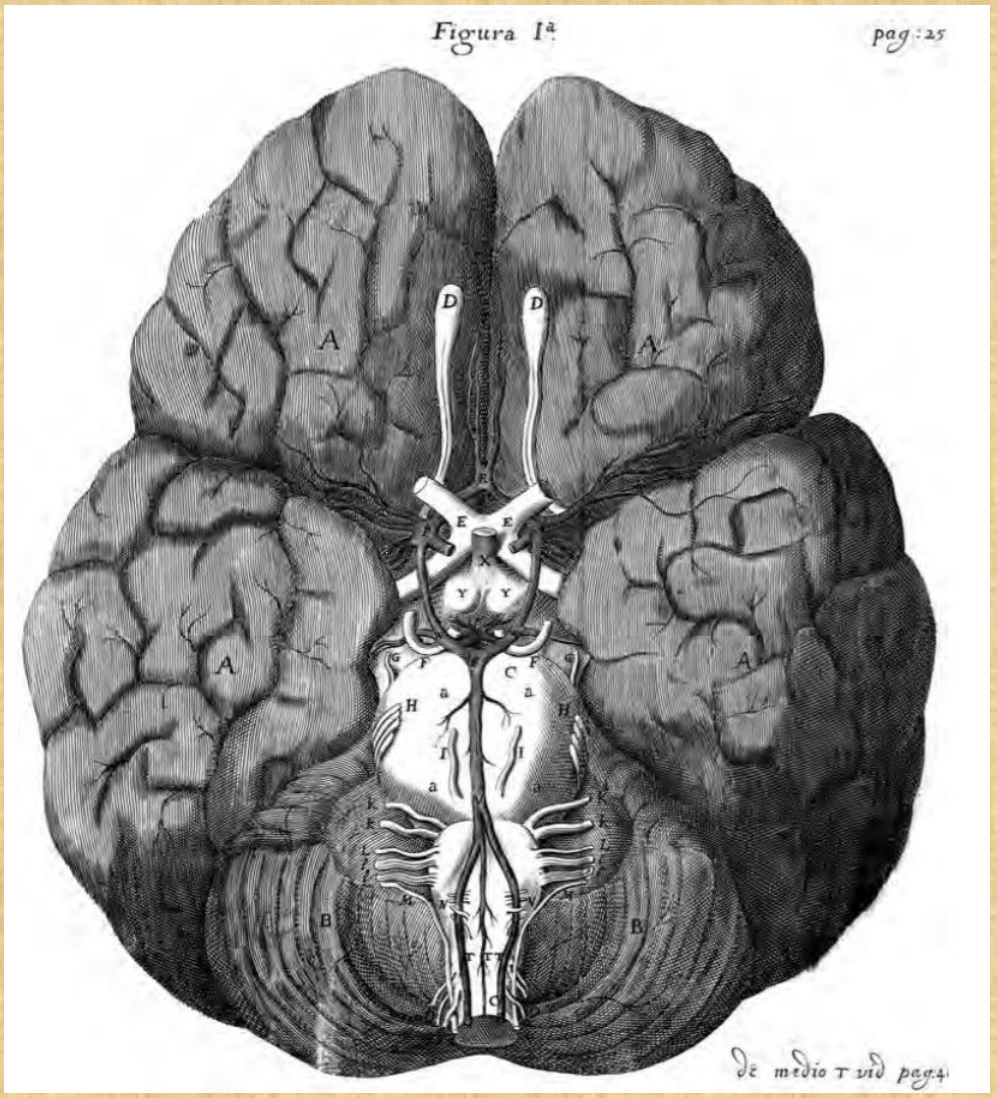
(D)

In 1562, after 11 years at the royal court, Vesalius resigned his post to undertake a pilgrimage to Jerusalem. The reasons for this decision are shrouded in mystery, with one source stating that Vesalius was forced to leave Europe after being accused of murder, following a botched autopsy on a noblewoman who was found to be still alive – an event attracting the interest of the Spanish Inquisition

René Descartes (1596–1650)

- Descartes' illustration of the movement of 'animal spirits' in response to burning (from L'homme published in 1662). Note how the nerve impulse conveying the sense of fire is 'reflected' in the middle ventricle back along the nerve pathway to the foot (mechanical theory).

Thomas Willis (1621-1675)



- Cerebri anatome: cui accessit nervorum descriptio et usus (Anatomy of the brain and the description and use of the nerves) was published in 1664.
- anterior commissure, corpus striatum, inferior olives and stria terminalis derive from Willis' work.
- Willis minimised the importance of the ventricles and placed mental functions in the brain's matter instead.
- Localised sensory, motor and intellectual functions to specific brain areas.

Luigi Galvani vs. Alessandro Volta

- Galvani coined the term animal electricity to describe the force that activated the muscles of his specimens.
- Along with contemporaries, he regarded their activation as being generated by an electrical fluid that is carried to the muscles by the nerves.

- At first, Volta embraced animal electricity
- He began to have his doubts when he found that a frog's muscle could be made to contract by bringing two different metals together on the surface of its nerve stump without either of them touching the muscle

Karl August Weinhold

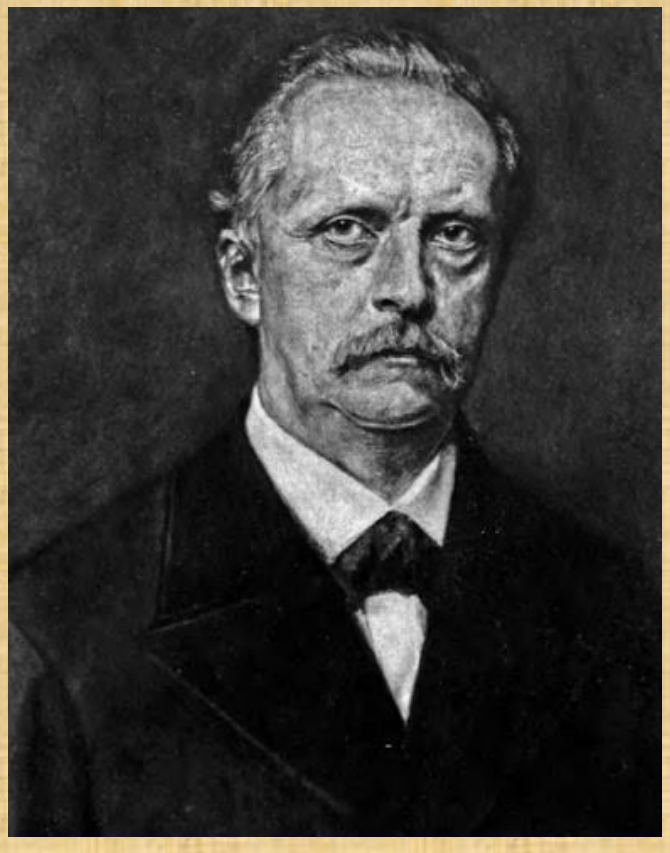
A book of 116 short chapters, one of which is entitled Observations on Seven Beheaded Criminals, its main aim was to ‘show’ how bimetallic electricity could be used to bring life back to a corpse.

Mary Shelley who used the idea to write Frankenstein – first published anonymously in 1818

Giovanni Aldini

- With electrodes elicited grimaces, bodily contortions, and abrupt spasmodic movements of the limbs – effects that persisted up to three hours after death.
- In one instance, the arm of a corpse is said to have slowly raised itself eight inches from the table, and maintained its position even when a considerable weight was placed in the hand.

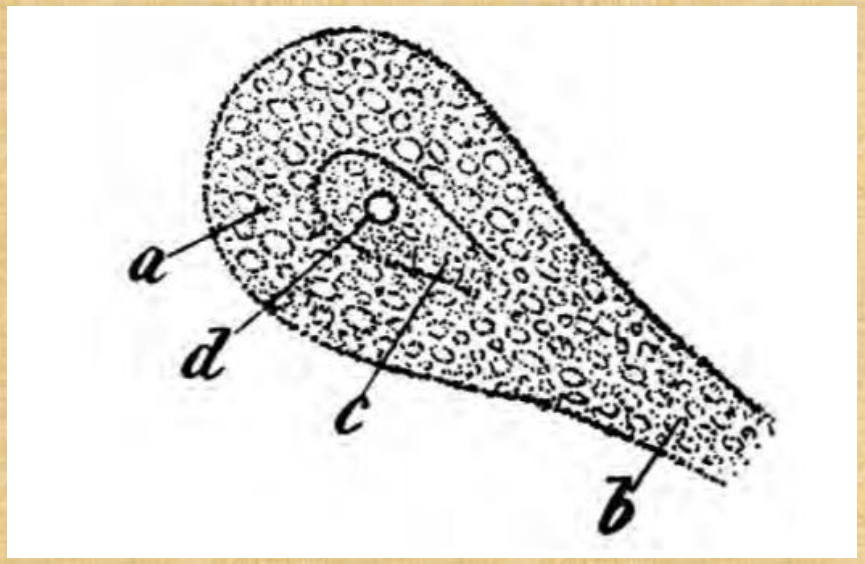
Hermann von Helmholtz (1821–1894)



- Was the first who among his many scientific achievements measured the velocity of the nervous impulse in 1850, found it to be between 50 and 100 m per second
- In 1847, Helmholtz showed there was nothing mysterious about the formation of animal heat when he proved that energy in a biological system is never created or lost, but only transformed from one form to another.

Jan Evangelista Purkinje (1787–1868)

- Established the University of Breslau as the ‘cradle of histology’ where he, and his students, made many important discoveries.
- One of them - first depiction of a nerve cell (or globule) by Gabriel Valentin (Purkinje’s student) in 1836, which is most likely a Purkinje cell taken from the cerebellum.



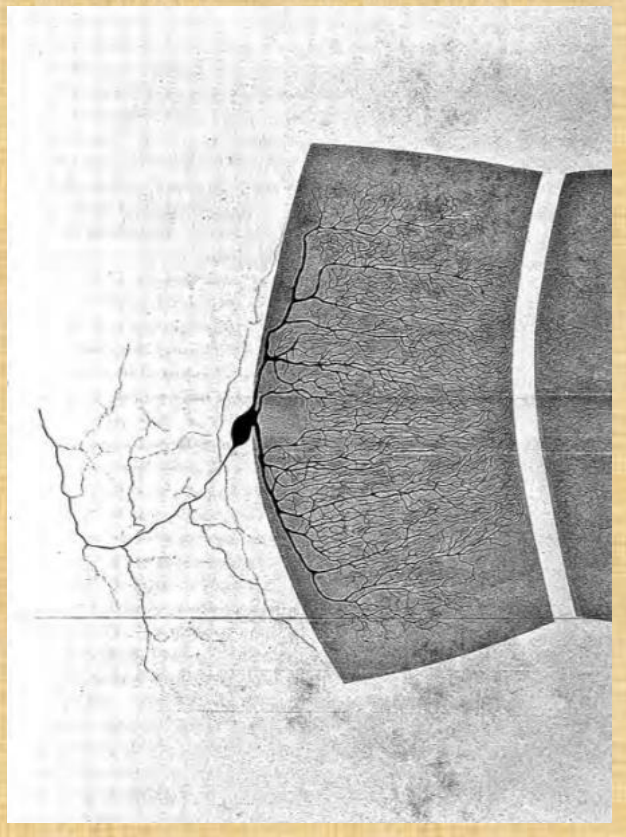
(a) cell body;
(b) appendage or the beginnings of the axon;
(c) central region of the cell;
(d) nucleus

Robert Remak (1815–1865)

- the first anatomist to fully describe cell division and show all animal cells derive from already existing ones.
- discovered myelin and being the first to propose nerve fibres extend from the cell body.

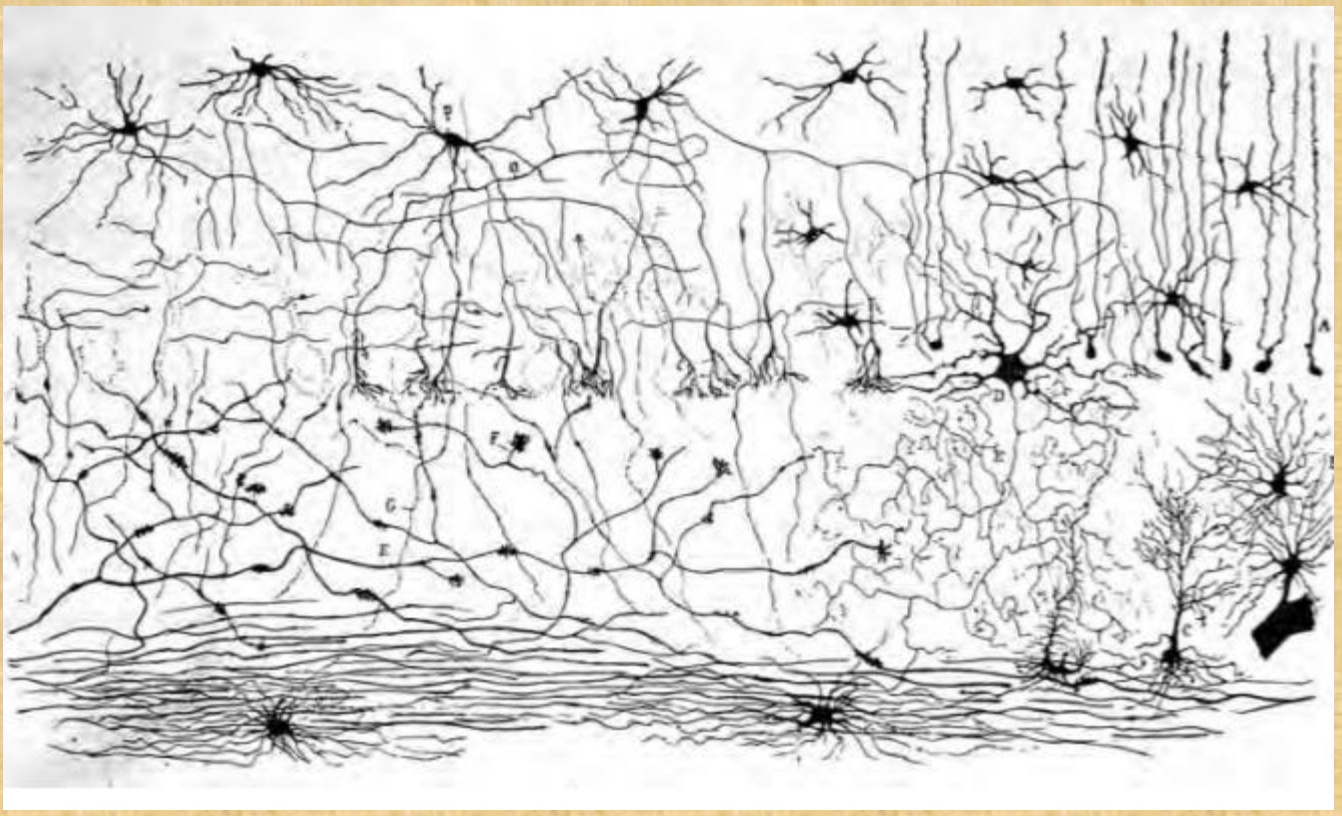
Camillo Golgi (1843–1926)

- the inventor of the silver impregnation method of staining in 1873. This stained a small proportion of nerve cells black enabling them to be clearly observed in their entirety under a microscope.



A human Purkinje cell (type 1) stained by Golgi (1883)

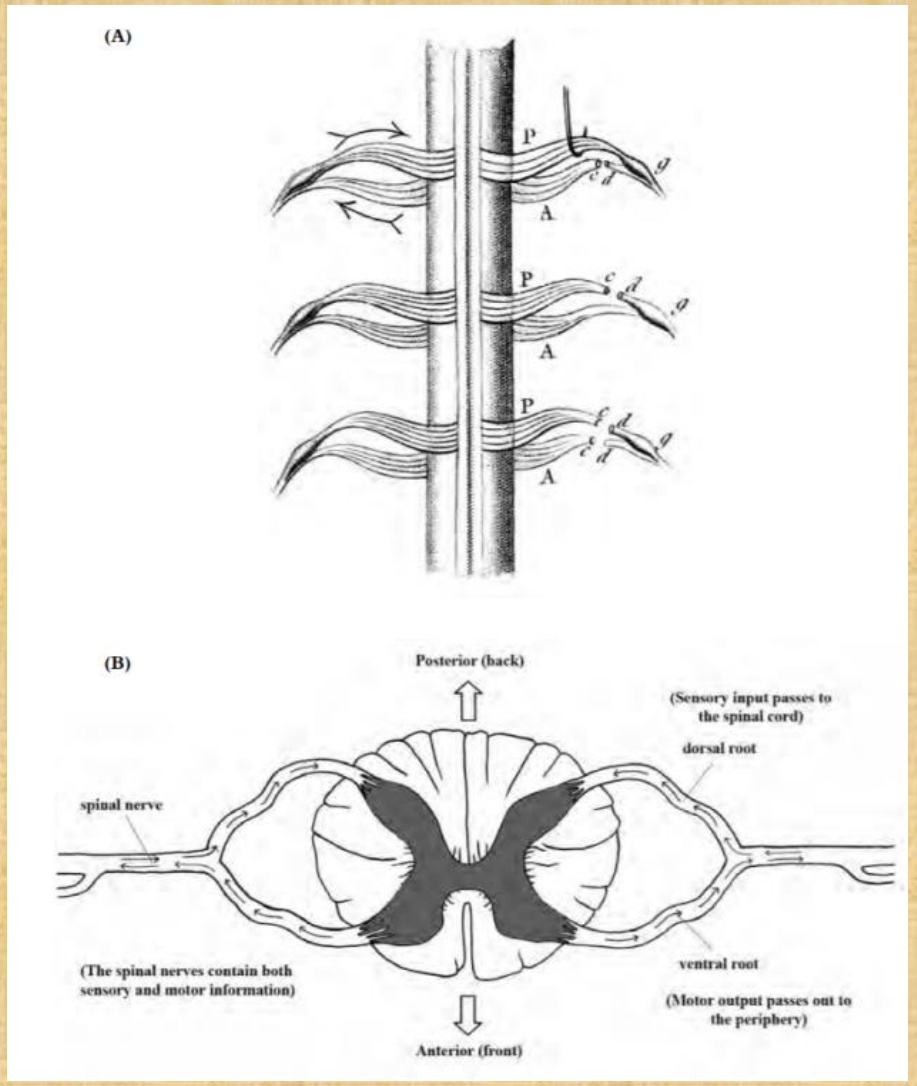
Santiago Ramón y Cajal (1853-1934)



- First description of layer formation
- Synapse theory

Functions of the nervous sysem

- Charles Bell (1774–1842) who was the first person to examine the behavioural effects of lesioning the spinal cord roots, which would lead him to recognise the anterior nerves served a motor function.
- Francois Magendie (1783–1855) who identified the sensory function of the posterior spinal cord roots in 1822



Reflex

Marshall Hall (1790–1857)

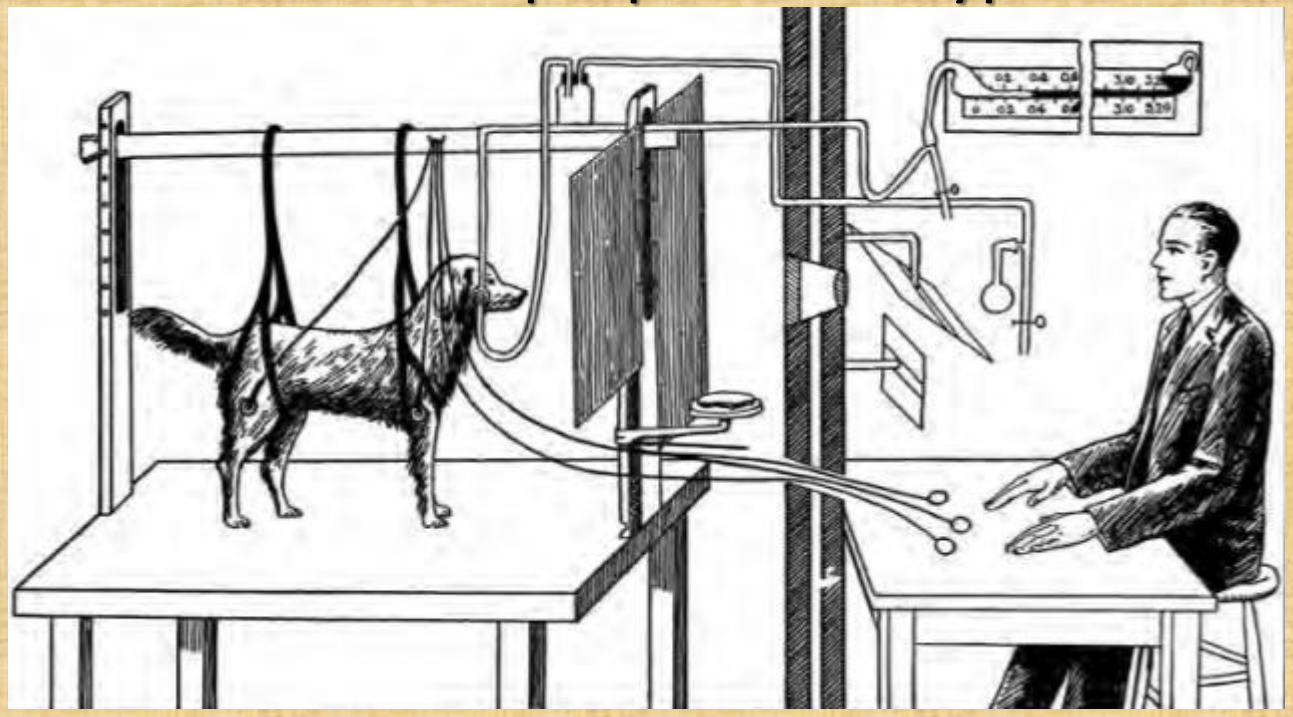
who rejected vitalist accounts of the reflex and replaced them with a mechanical explanation involving the nerves of the spinal cord and medulla.

Ivan Mikhailovich Sechenov (1829–1905)

who developed the idea of psychic reflexes governing all thought and behaviour. He was also the first to realise complex patterns of reflexes could be held in check by a simple process of inhibition.

Ivan Pavlov (1849–1936)

- began examining conditioned reflexes around 1904 after his dogs began to salivate in anticipation of being fed.
- His research would lead him to propose two types of reflex:
  - inborn
  - and learned

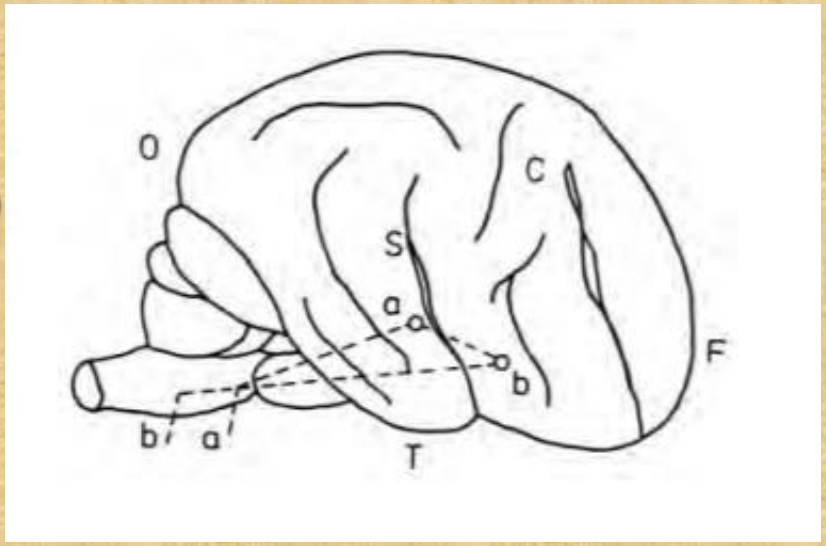


Memory
Karl Lashley (1890–1958)

- attempted to locate where memory engrams are stored in the brain.
- Would conclude that memory is stored throughout the cerebrum, with all parts of the cortex playing an equal role in its storage.
- Two main conclusions: (1) memory is stored throughout the cerebral cortex – a principle he called ‘mass action’; (2) all parts of the cortex play an equal role in the storage or memory – which he called ‘equipotentiality’.
- “*Brain Mechanisms and Intelligence*”(1929)

Localisation of functions

- Paul Broca (1824–1880) the father of localisation theory who was the first scientist to discover a brain area for the articulation of language.
- Carl Wernicke (1848–1904). German doctor who discovered a second language centre in the temporal lobes in 1874 involved in verbal comprehension.



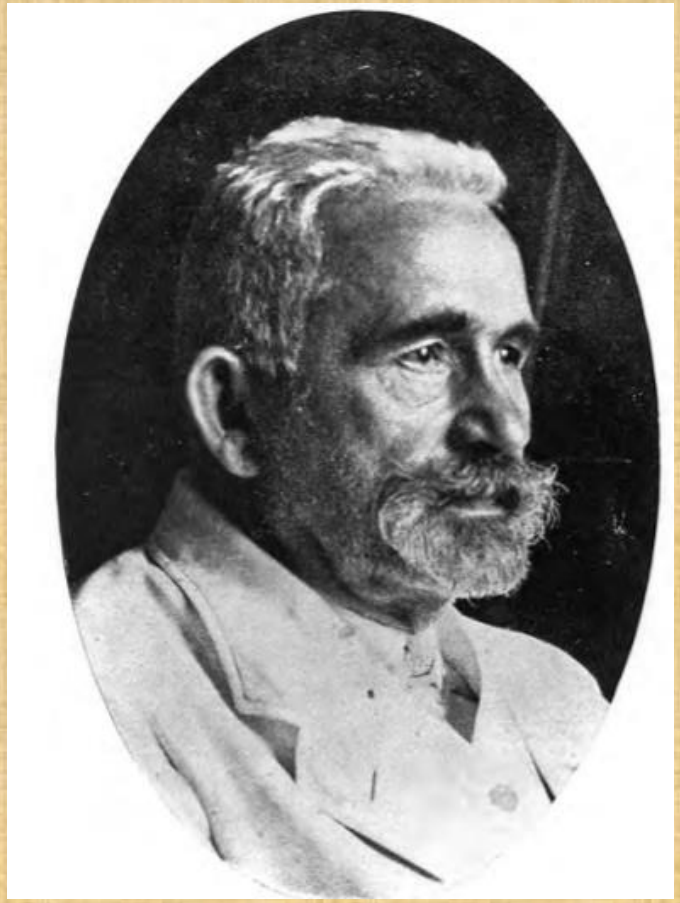
The processing of language envisaged by Wernicke, which shows the acoustic nerve projecting to a centre for language comprehension (a) and a centre for motor imagery and production (b) extending to brainstem areas

The ones who merge psychology and neurology(while the gain it's morphologic basis and the latter - functional)

- **Jean Marie Charcot (1825–1893).**
- Founder of Salpêtrière
- First described "la sclérose en plaques"
- **James Parkinson (1755 –1824)**
- Best known for his 1817 work – "An Essay on the Shaking Palsy", in which he was the first to describe "paralysis agitans", a condition that would later be renamed by Jean Charcot, who named the disorder 'La Maladie de Parkinson'(1824).

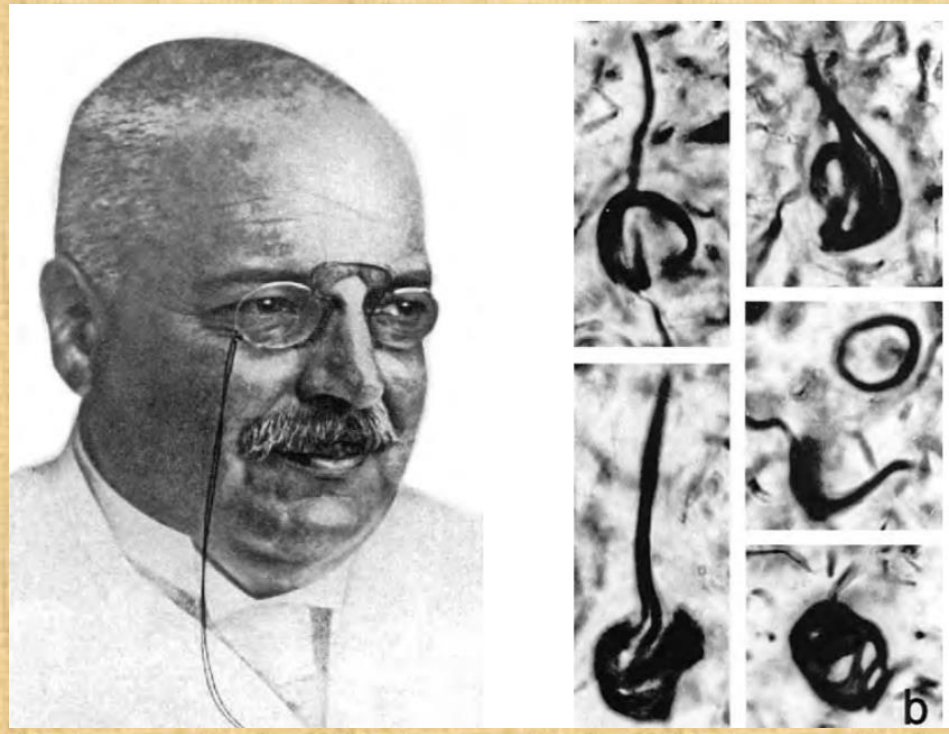
Emil Kraepelin (1856–1926)

- Developed a classification of psychiatric disorders, which forms the basis of many used today. He was also the first investigator to recognise what we today know as schizophrenia(1890s).



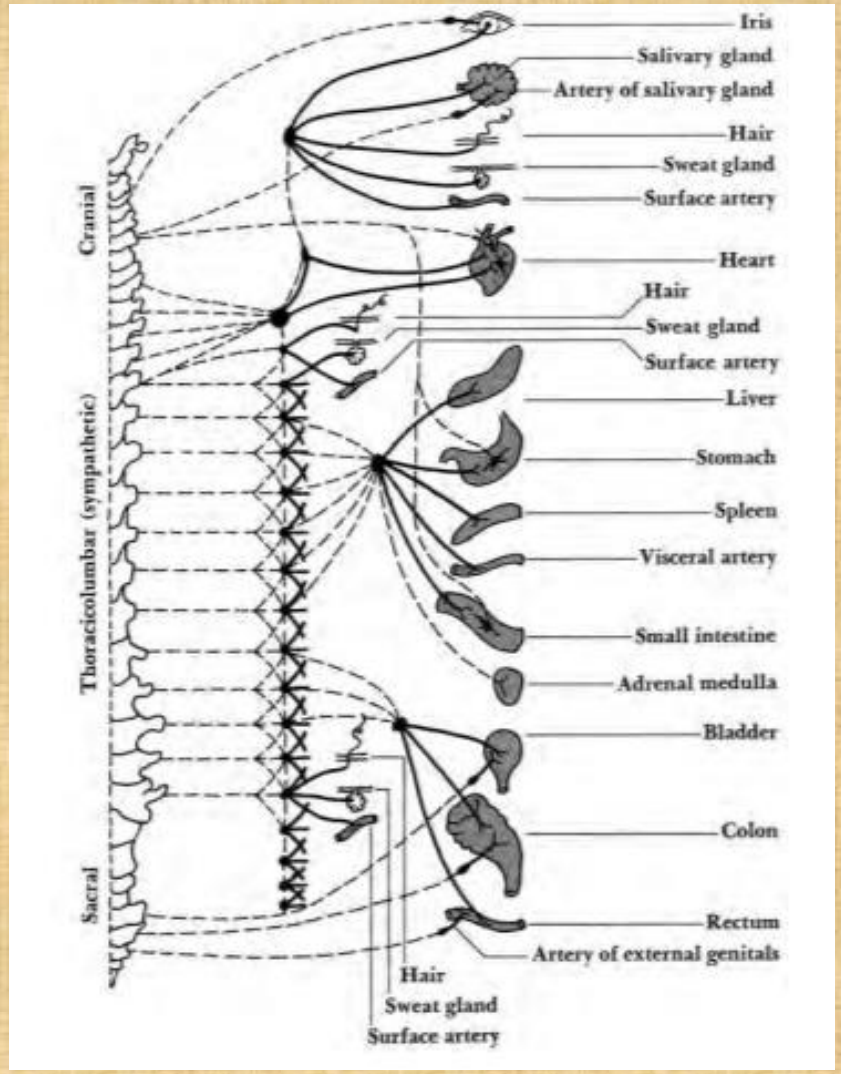
- German psychiatrist who discovered neurofibrillary tangles and plaques in a severely demented patient in 1905, later named Alzheimer's disease by Emil Kraepelin in 1910.

- Drawings from Alzheimer's laboratory of various forms of neurofibrillary tangles seen in the nerve cells of those with dementia.



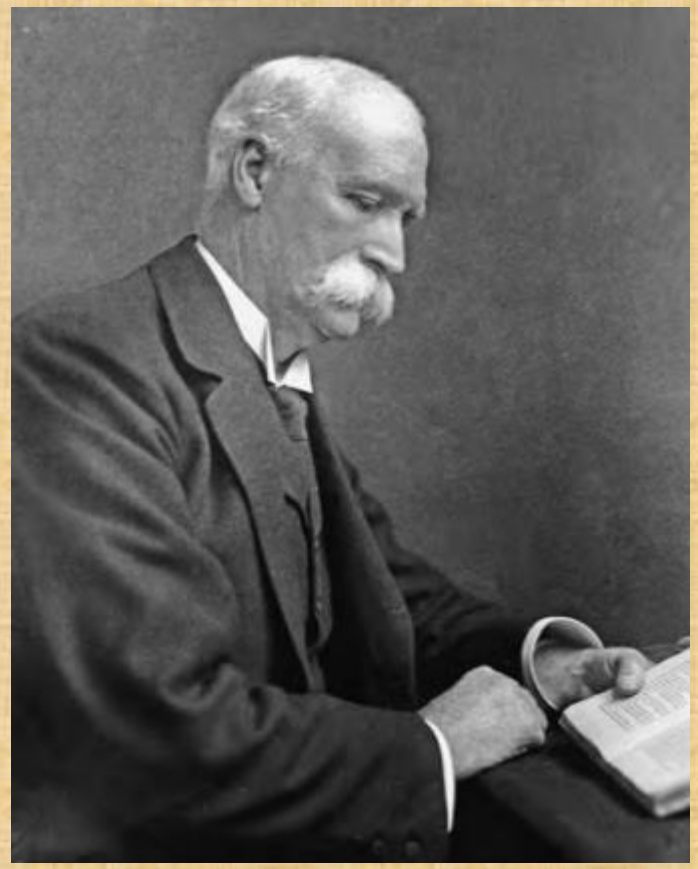
John Newport Langley (1852–1925).

- Cambridge physiologist who more than any other person was responsible for mapping out the autonomic nervous system (a term he coined in 1898). He also formulated the concept of ‘receptive substances’ in 1905.



William Macewen (1848–1924)

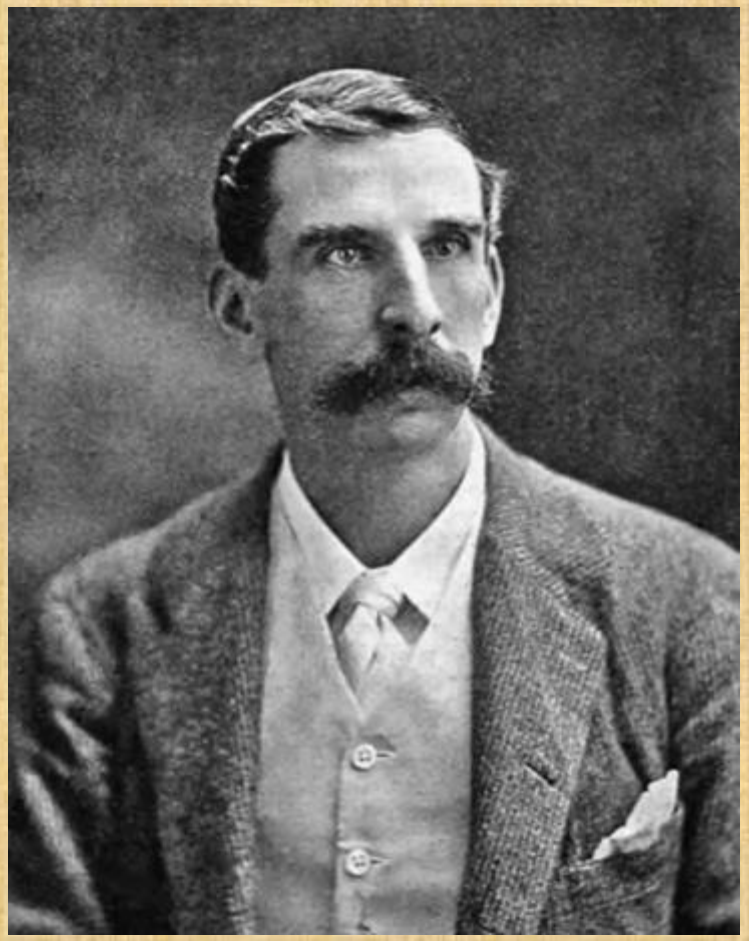
- Scottish surgeon at the Royal Glasgow Infirmary who performed the first modern operative procedure on the brain in 1879 by removing a meningeal tumour in a 14-year-old girl called Barbara Wilson.



Three fathers of neurosurgery as exclusive speciality

Sir Victor Horsley (1857–1916)

The first neurosurgeon at the National Hospital for Nervous and Mental Disease in London. Here he was to perform many pioneering operations including the first successful removal of a tumour from the spinal cord.



Three fathers of neurosurgery as exclusive speciality

Harvey Williams Cushing (1869 –1939)

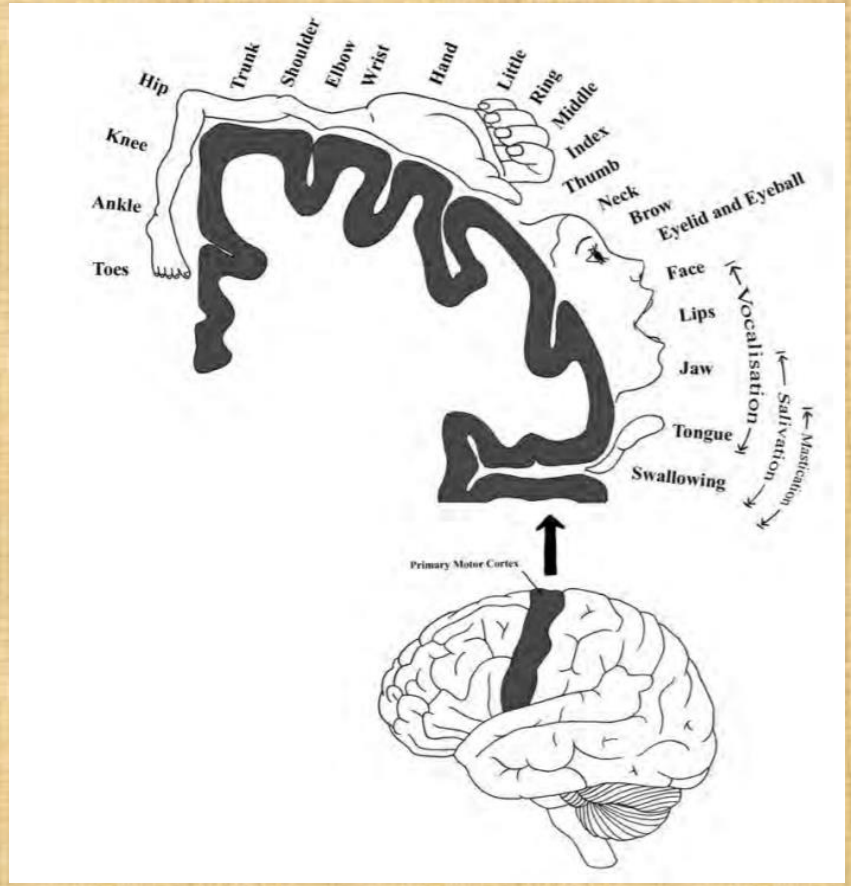
was an American neurosurgeon, pathologist, writer and draftsman. A pioneer of brain surgery, he was the first exclusive neurosurgeon and the first person to describe Cushing's disease.

Three fathers of neurosurgery as exclusive speciality

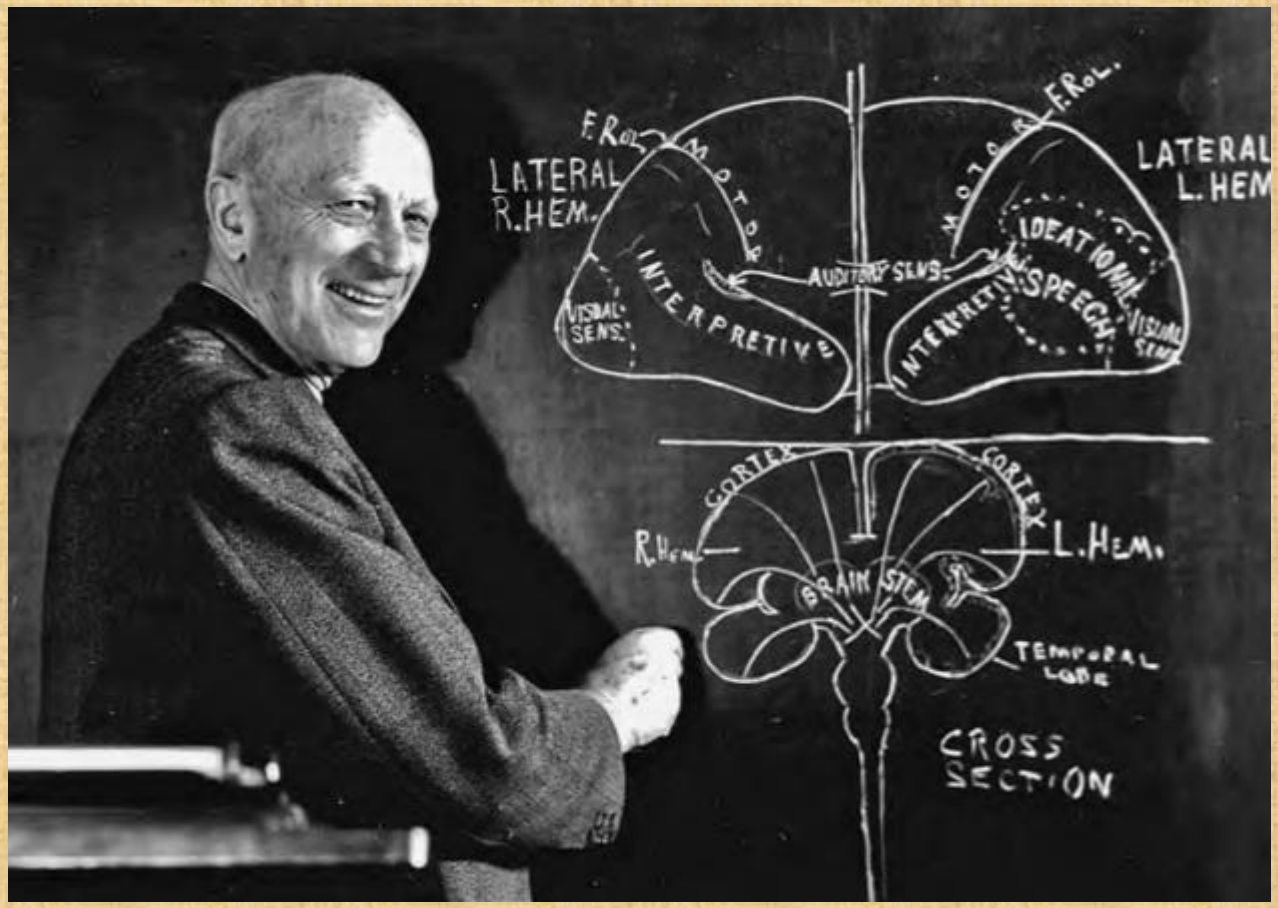
Walter Edward Dandy (1886 –1946) was an American neurosurgeon and scientist. He is considered one of the founding fathers of neurosurgery, along with Victor Horsley and Harvey Cushing. Dandy is credited with numerous neurosurgical discoveries and innovations

Wilder Penfield (1891–1976) fighting epilepsy

- founded the Montreal Neurological Institute in 1934 and pioneered the surgical treatment of epilepsy.
- First put in practice and used human stimulation of the brain with an electric current in fully conscious patients prior to their surgery
- First wake up, open brain monitorig of evoked potentials – eventually named Montreal procedure

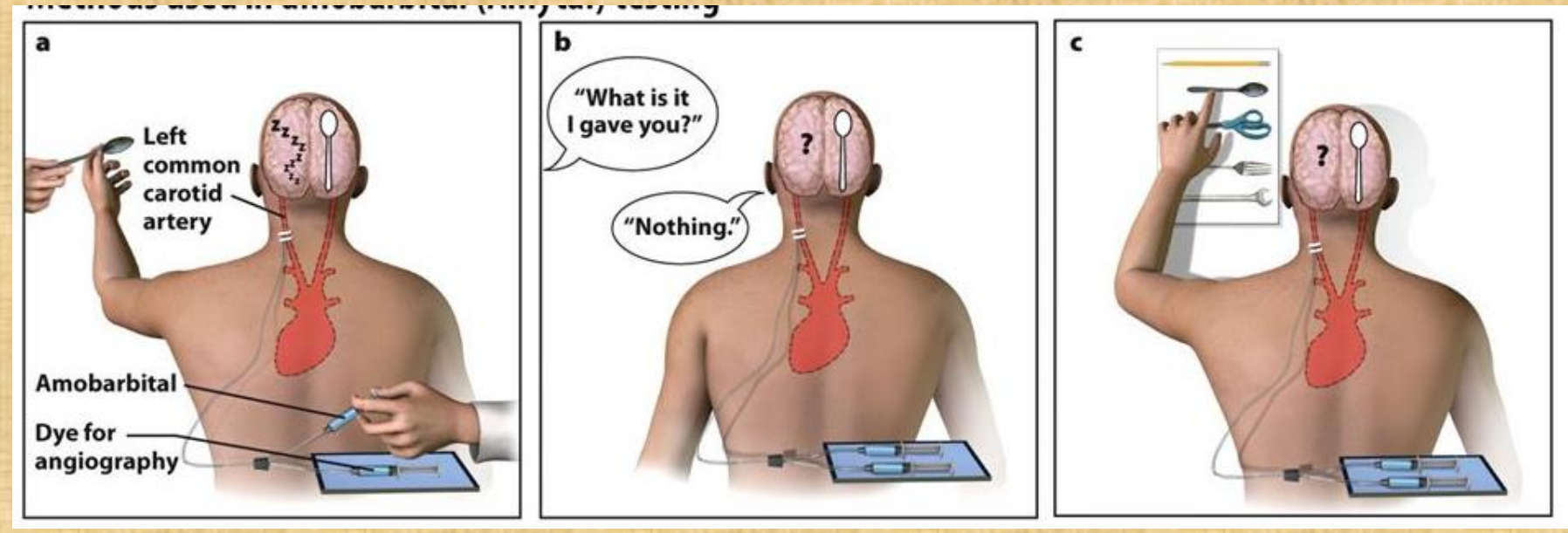


Wilder Penfield (1891–1976) learning from epilepsy



Juan Wada (1924)

- eveloped the test while he was a medical resident in Japan just after World War II, when he was receiving training in neurosurgery.
- Introduced it in 1949 at Montreal institute.

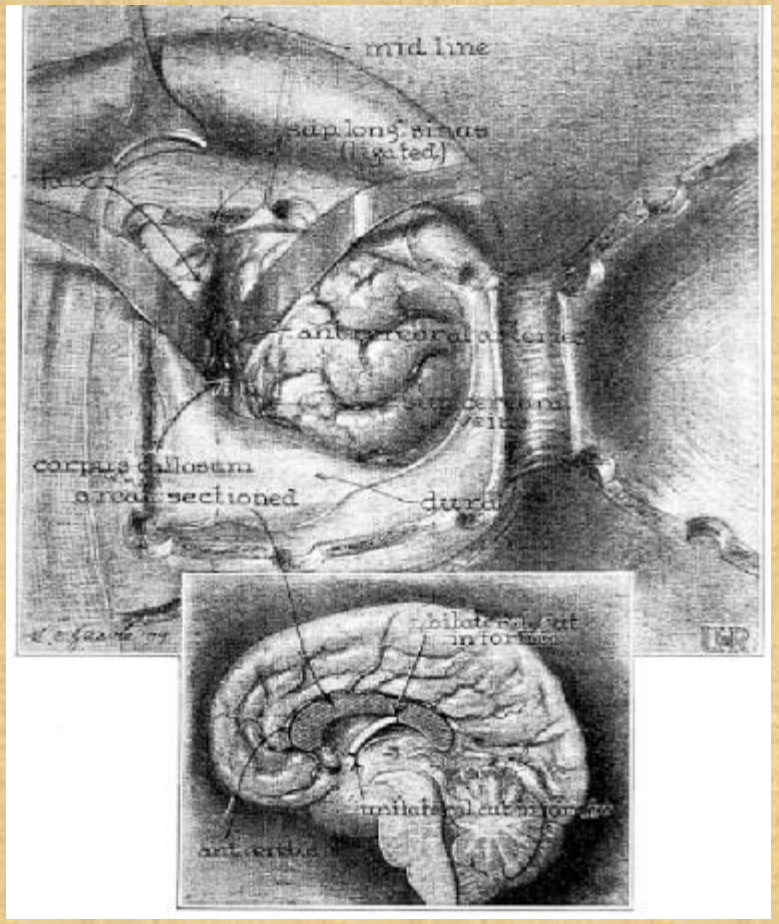


Egas Moniz (1874–1953)

- performed the first modern frontal lobotomy (with the help of surgeon Almeider Lima) in 1935 that led to a Nobel Prize in 1949.
- while the patient could often lead some type of independent existence, they were otherwise apathetic, lacked initiative, and acted without social restraint

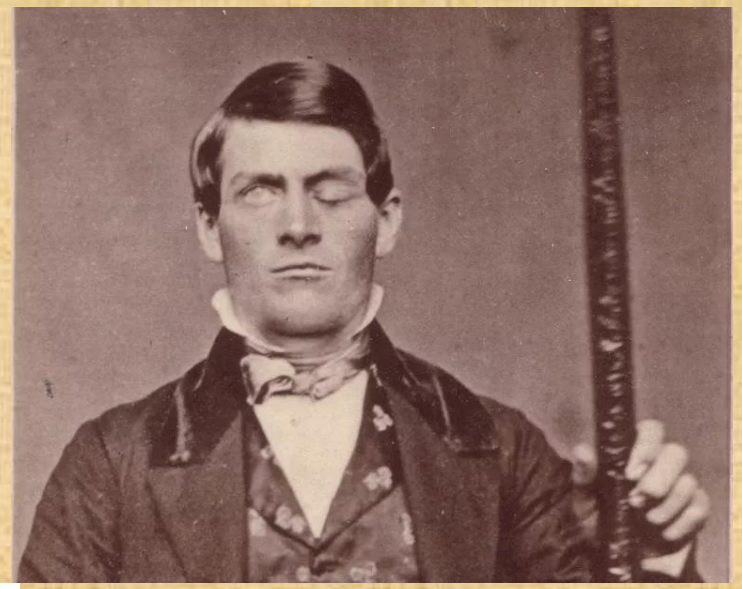
Roger Sperry, Philip Vogel and Joseph Bogen

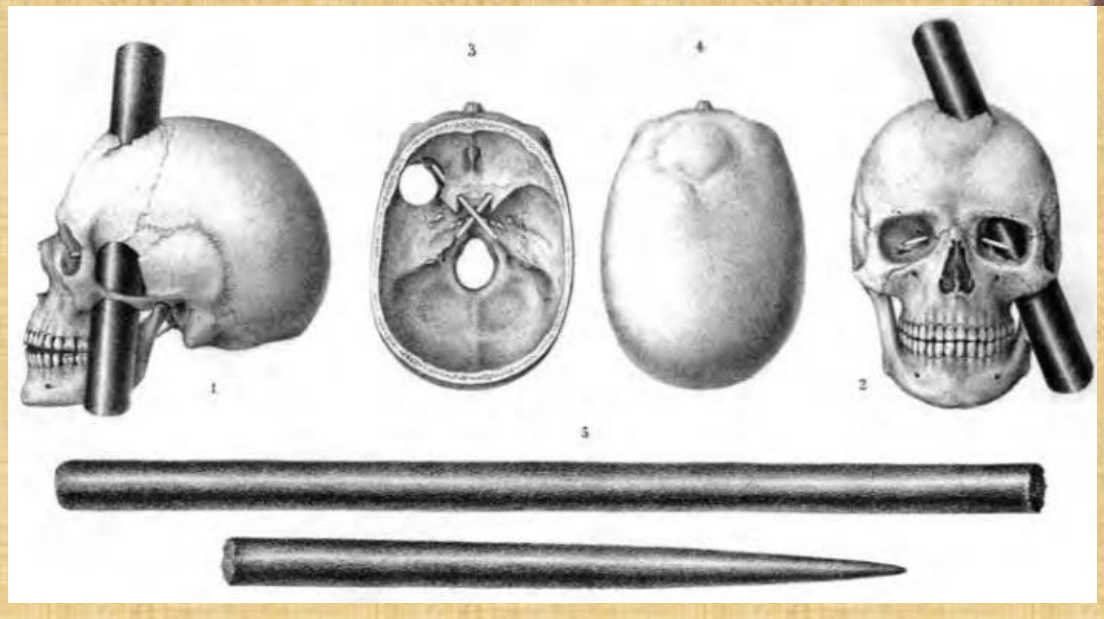
- Developed and studied callosotomy in 1940-50th
- Showed that different hemispheres – different personalities of the brain
- The left hemisphere proved superior at solving analytical problems for it was more rational and logical than the right.
- The right hemisphere was not entirely without language for some individuals could understand certain words and even read simple sentences. The right cortex was also more specialised when it came to spatial thinking and solving puzzles. It also constantly outperformed the left at recognising faces and pictures. Furthermore, the right hemisphere (as demonstrated by the performance of the left hand), showed superior ability at drawing pictures, learning mazes, completing jigsaws and solving geometric puzzles.



Phineas P. Gage (1823–1860)

An American railroad construction foreman remembered for his improbable survival of an accident in which a large iron rod was driven completely through his head, destroying much of his brain's left frontal lobe, and for that injury's reported effects on his personality and behavior over the remaining 12 years of his life—effects sufficiently profound (for a time at least) that friends saw him as "no longer Gage."





Henry Molaison (HM) (1926–2008).

- A young American who underwent an operation by William Scoville in 1953 to remove his medial temporal lobes in an attempt to treat his severe epilepsy. It resulted in a profound anterograde amnesia, which caused HM to forget the events of his life almost instantaneously
- Little could anybody have realised his name (or rather initials) would be mentioned in almost 12,000 journal articles over the course of his life
- operation hadn't affected his intelligence, since HM had an above average IQ 118 and short term memory.
- Still, the moment HM was distracted, the memory of what he was attending to disappeared from his thoughts.

to be continued…

Thnx☺