香港教育大學
The Education University of Hong Kong

人文學院十周年名家講座

日期: 2022/10/18

時間: 10:00-12:00

模式:
混合模式【現場參與/線上直播】

地點:
香港教育大學田家炳演講廳(D1-LP-02)

語言和認知

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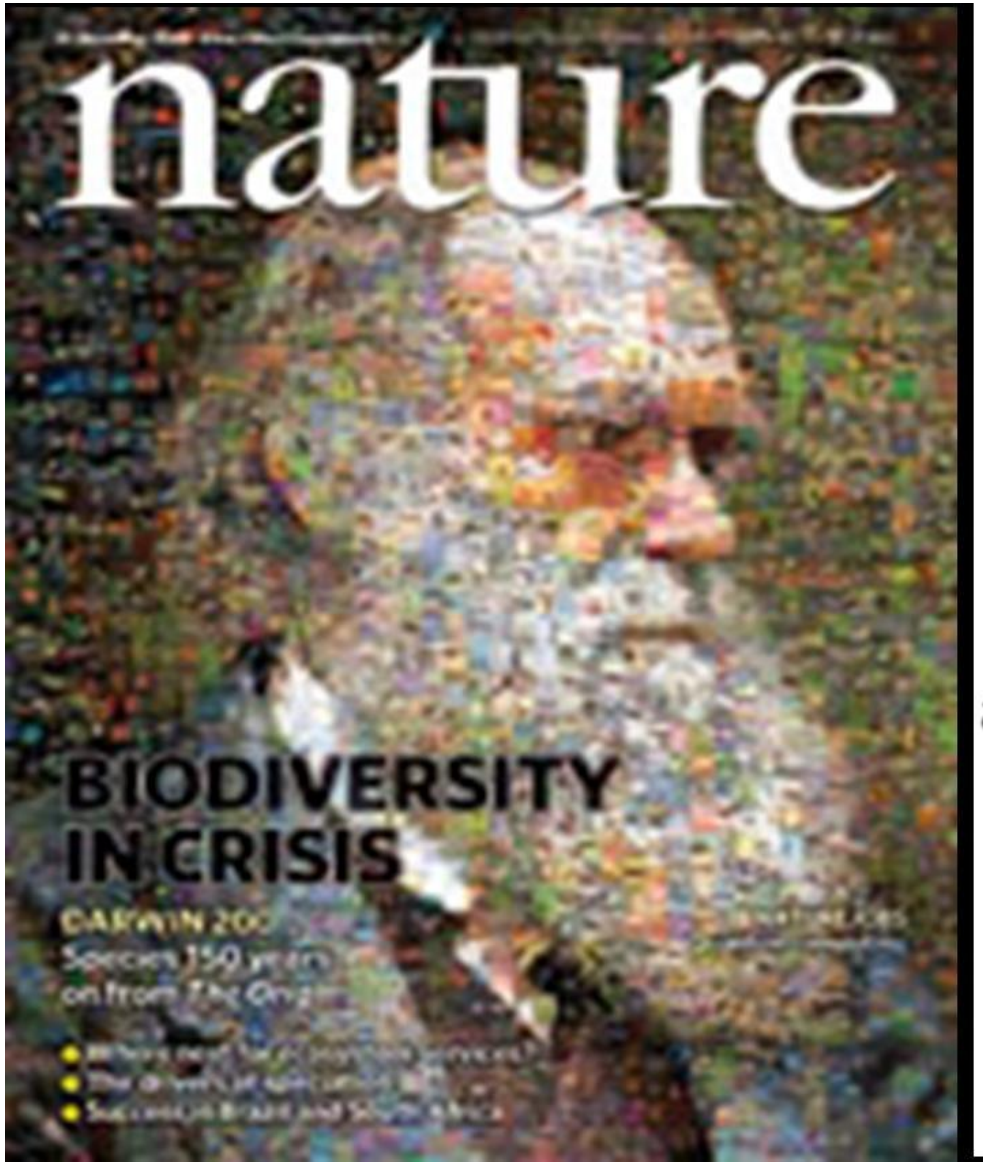
今天很高興來到教育大學，與大家一同慶祝人文學院十周年紀念。

目前世界局勢混亂，衝突戰爭無處不在，希望人文學院可以培養出越來越多具有人文素養的傑出學者，堅持人性關懷及與大自然和諧共處的原則，為人類社會的發展指出一條康莊大道。

蔡元培. 1928. 中央研究院历史语言研究所集刊。发刊词.

- “同是动物，
- 为什么只有人类能不断的进步，能创造文化?
- 因为人类有历史，而别的动物没有。因为他们没有历史，不能够把过去的经验传说下去。。。
- 为什么只有人类能创造历史，而别的动物没有?
- 因为人类有 **变化无穷的语言**”。

严复 first translator of Huxley：“物竞天择，适者生存”。



1859. On the Origin of Species by Means of Natural Selection or The preservation of Favored Races in the Struggle for Life.

1871. The Descent of Man, and Selection in Relation to Sex.

1872. The Expression of the Emotions in Man and Animals.

科學對這一段漫長的生命故事的了解，近年來有著大大的進展。之前我們研究這個故事的唯一數據，只有依靠憑運氣挖掘出來的化石，例如在周口店博物館內所展示的北京猿人。可是自從基因學參與了這方面的研究，這一領域的知識就在日新月異地增長。有人說過**20世紀是研究物理學的黃金時代**，尤其是物理、化學、天文等，**而21世紀則是研究生命科學的黃金時代**，我覺得這種說法非常恰當。從2000年起，基因學（或稱遺傳學）與神經科學研究取得了種種突破，也產生了很多諾貝爾獎得主。

例如前幾天剛宣布的頒給Svante Pääbo的諾貝爾醫學獎，是為了讚揚他發明的古DNA萃取法，這種方法能夠從幾千年前的化石裡提取出古DNA，以幫助我們理解現代人跟一些已絕種的古人類之間的關係。比方有一種已滅絕的古人類叫丹尼索瓦人(Denisovan)，經過古DNA的分析，我們知道他們與西藏人的祖先曾共同繁衍過後代子孫，**因此他們遺留在現代藏人身上的基因，協助藏人在生理上可以適應高海拔的環境**。

Svante Pääbo

Neanderthal Man

In Search of Lost Genomes

New York 2014
Basic Books

Major breakthrough in studying prehistory:

ANCIENT DNA

从化石中萃取DNA!

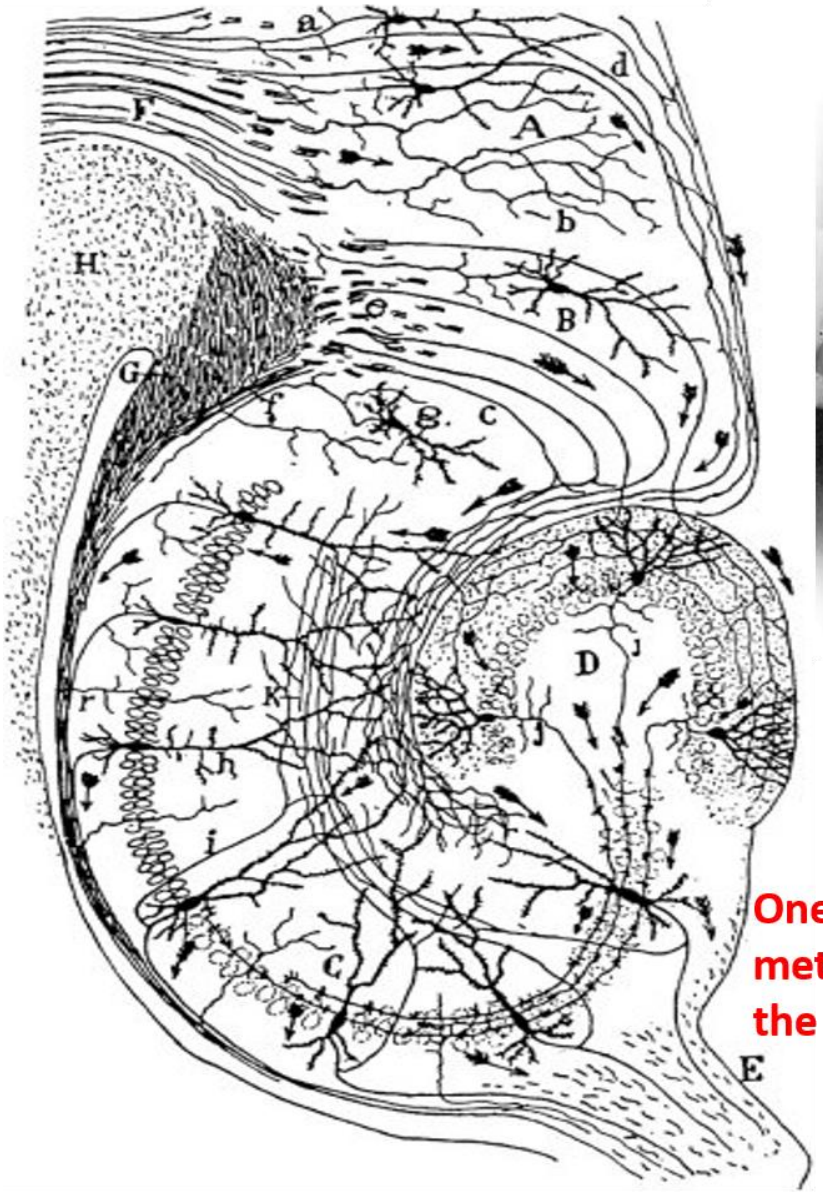
Just won the 2022

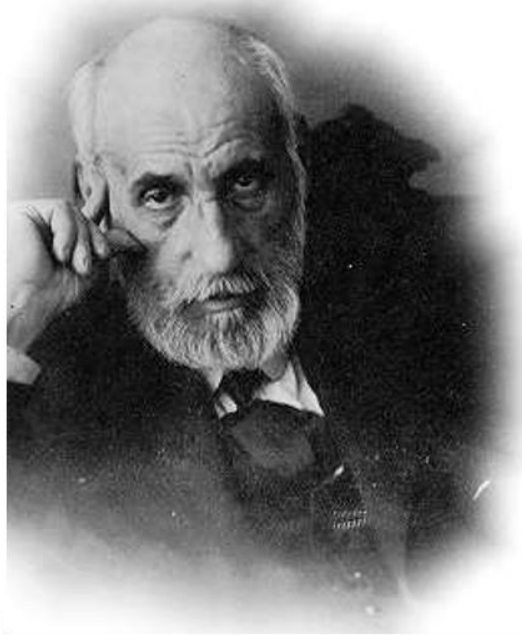
NOBEL PRIZE

for Physiology or Medicine.

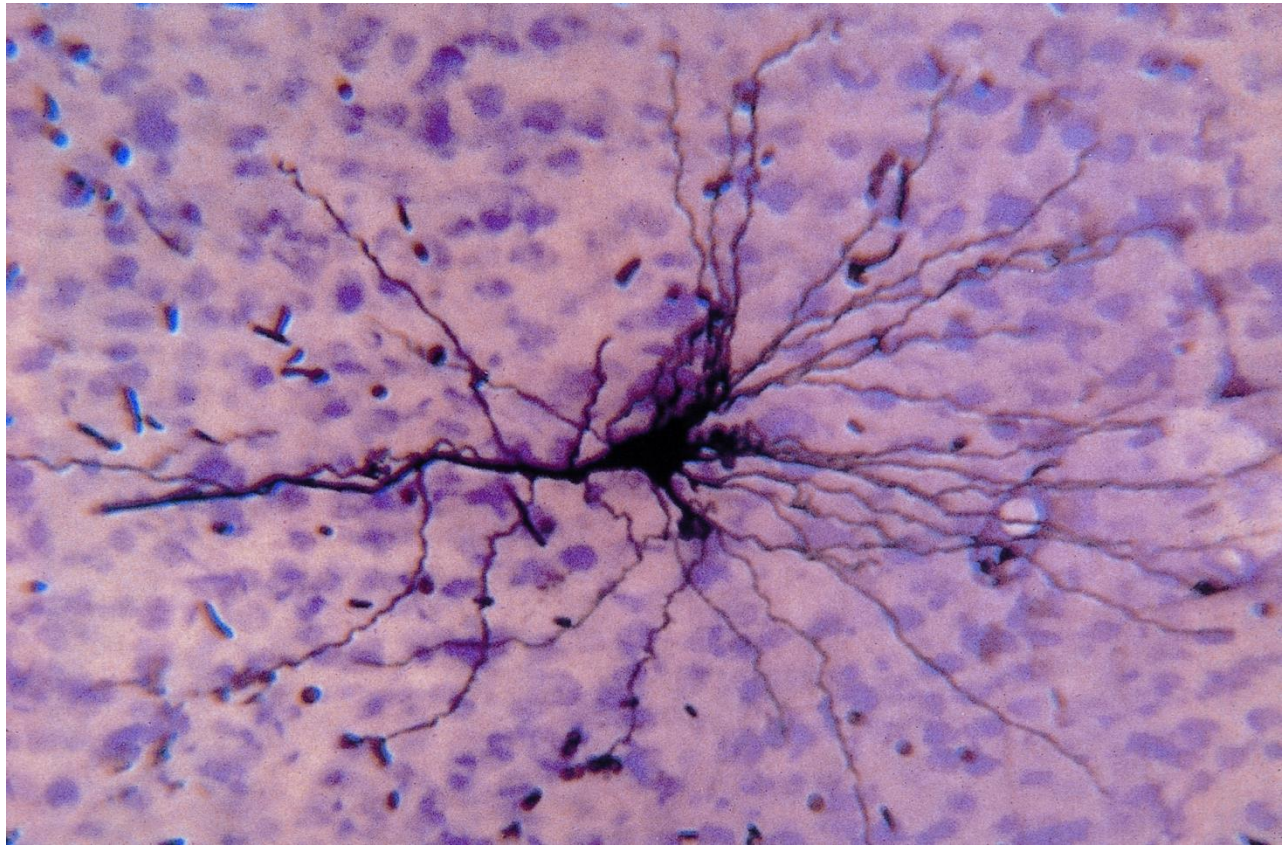
Ramon Santiago y Cajal

1852-1934. Nobel Prize 1906.

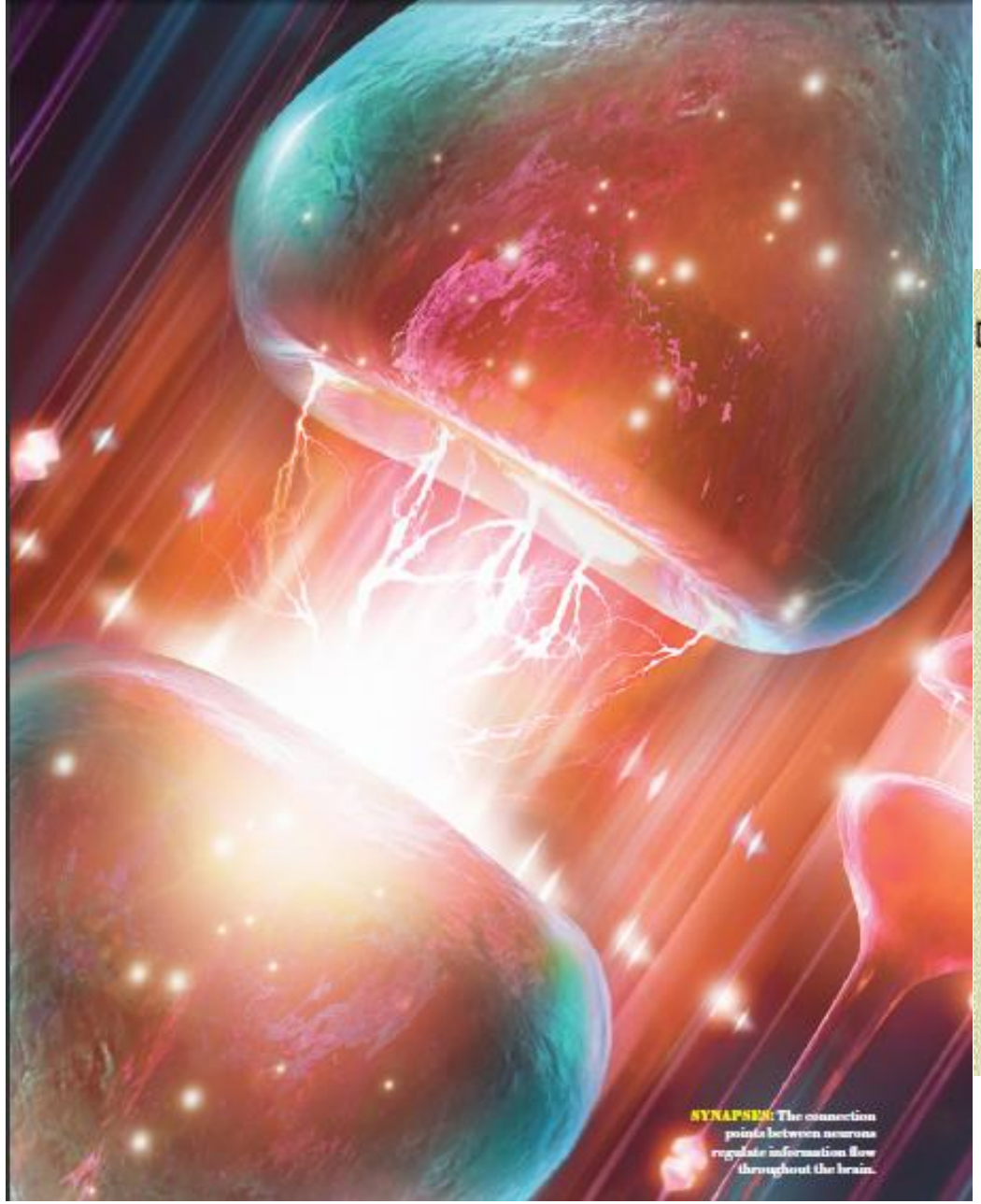


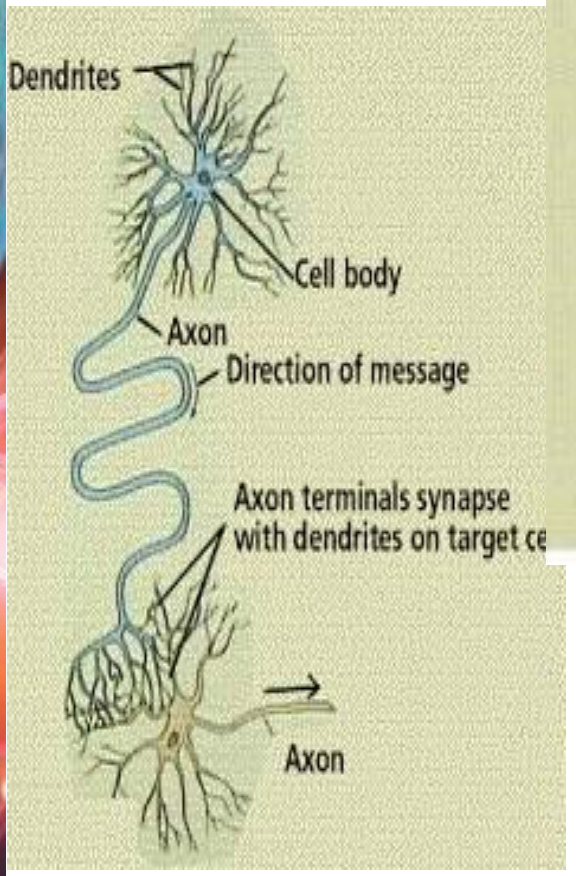


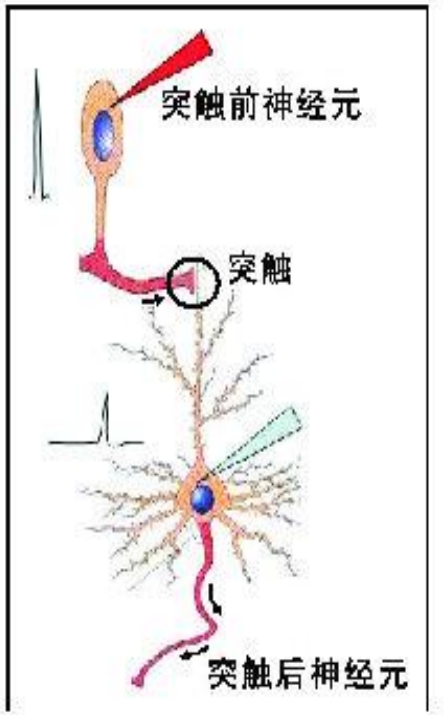
One of Cajal's numerous meticulous drawings of the brain's neural circuits.



两个神经元





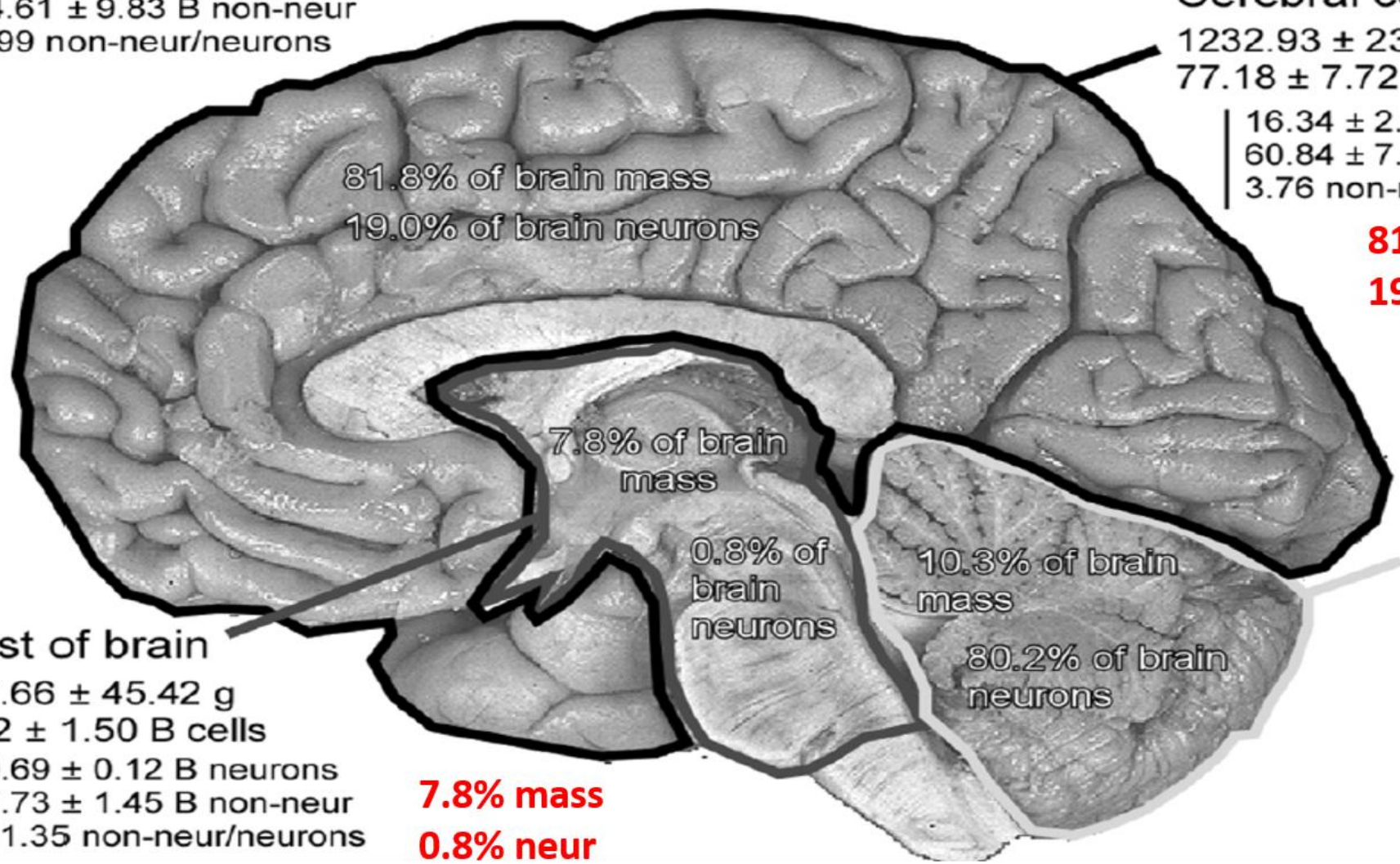


前后两个神经元突触之间信息传递。

Sejnowski, Terry & Tobi Delbruck.
THE LANGUAGE OF THE BRAIN.
Scientific American, October 2012.

Azevedo, F. et al. 2009. Equal numbers of neuronal and nonneuronal cells make the human brain an isometrically scaled-up primate brain. *Journal of Comparative Neurology* 513.532-41.

Whole brain
1508.91 ± 299.14 g
170.68 ± 13.86 B cells
- 86.06 ± 8.12 B neurons
- 84.61 ± 9.83 B non-neur
- 0.99 non-neur/neurons



Cerebral cortex (GM+WM)
1232.93 ± 233.68 g
77.18 ± 7.72 B cells
- 16.34 ± 2.17 B neurons
- 60.84 ± 7.02 B non-neur
- 3.76 non-neur/neurons

81.8% mass
19.0% neur

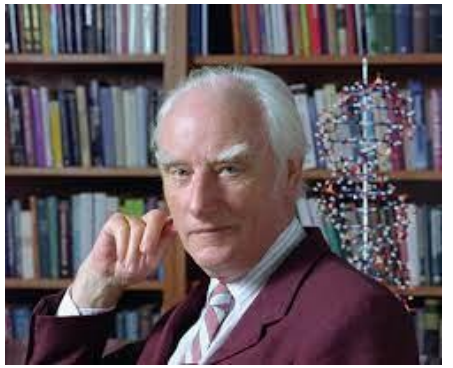
Rest of brain
117.66 ± 45.42 g
8.42 ± 1.50 B cells
- 0.69 ± 0.12 B neurons
- 7.73 ± 1.45 B non-neur
- 11.35 non-neur/neurons

7.8% mass
0.8% neur

Cerebellum
154.02 ± 19.29 g
85.08 ± 6.92 B cells
- 69.03 ± 6.65 B neurons
- 16.04 ± 2.17 B non-neur
- 0.23 non-neur/neurons

10.3% mass; 80.2% neur

Crick, **F**. Nobel 1962 for explaining double helix of DNA. (1994). The Astonishing Hypothesis. Touchstone.



- "The Astonishing Hypothesis is that YOU, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules. As Lewis Carroll's Alice might have phrased it, **'You are nothing but a pack of neurons**.' This hypothesis is so alien to the ideas of most people alive today that it can truly be called astonishing."
- "Our minds – the behaviour of our brains – can be explained by the interactions of nerve cells (and other cells) and the molecules associated with them."
- "The single most characteristic human ability is that we can handle a complex language fluently.
- "Man is endowed with a relentless curiosity about the world … We must hammer away until we have forged **a clear and valid picture not only of this vast universe in which we live but also of our very selves**."

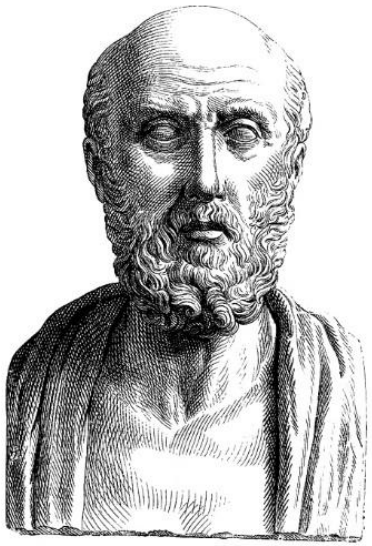
「這個驚人的假說是，你，你的喜與悲，你的記憶與抱負，你的身分認同與自由意志，其實都不過是龐大的神經細胞及其相關分子之間的行為而已。正如 Lewis Carroll筆下的愛麗絲可能會說的：
『**你不過是一堆神經元而已**。』這個假說與當今世上多數人的理念如此格格不入，因此的確可以稱得上是驚人的。」

「我們的心智——也就是我們大腦的行為—可以用神經細胞（與其他細胞）和與其相關的分子之間的互動來解釋。」

「人類最富特色的一項能力就是，我們能流利地掌握一個複雜的語言。」

「人類被賦予了對世界的無盡好奇心…我們必須持續努力，才能**對我們所處的這個龐大宇宙，也對我們自己本身，勾勒出一幅明晰且有效的圖像**。」

*"And men ought to know that **from nothing else … but from the brain** come joys, delights, laughter and sports, and sorrows, griefs, despondency, and lamentations. And by this, in an especial manner, we acquire wisdom and knowledge, and see and hear, and know what are foul and what are fair, what are bad and what are good, what are sweet, and what unsavory… And by the same organ we become mad and delirious, and fears and terrors assail us… All these things we endure from the brain, when it is not healthy … **In these ways I am of the opinion that the brain exercises the greatest power in the man**.*



***This is the interpreter to us of those things which emanate from the air, when it [the brain] happens to be in a sound state**."*

Hippocrates *quoted on p.509 of Syntactic Complexity. Givon & Shibatani, eds.2009. Emphasis added.*

「人類應該知道，除了大腦以外別無他物，能帶來喜樂、愉悅、歡笑、嘲弄、悲愁、憂傷、沮喪與歎息。也只有靠大腦，藉由特別的方式，我們才能獲取智慧與知識，看到、聽到、知道東西的優劣、好壞、甜美或無味……
同時也因為這個器官，我們才會變得瘋狂、錯亂，充滿恐懼與驚駭……
我們得在大腦不健全的時候忍受這些情緒……

因此我認為大腦對人的宰制權最大。
當大腦恰好處於健全狀態時，
對我們來說它就是顯露於空氣中的
一切事物的詮釋者。」

Hippocrates *quoted on p.509 of Syntactic Complexity.*
Givon & Shibatani, eds.2009. Emphasis added.

The Cambridge Declaration on Consciousness

On this day of July 7, 2012, a prominent international group of cognitive neuroscientists, neuropharmacologists, neurophysiologists, neuroanatomists and computational neuroscientists gathered at The University of Cambridge to reassess the neurobiological substrates of conscious experience and related behaviors in human and non-human animals.

……

We declare the following: "*The absence of a neocortex does not appear to preclude an organism from experiencing affective states. Convergent evidence indicates that non-human animals have the neuroanatomical, neurochemical, and neurophysiological substrates of conscious states along with the capacity to exhibit intentional behaviors. Consequently, the weight of evidence indicates that humans are not unique in possessing the neurological substrates that generate consciousness. Nonhuman animals, including all mammals and birds, and many other creatures, including octopuses, also possess these neurological substrates.*"

劍橋的意識宣言

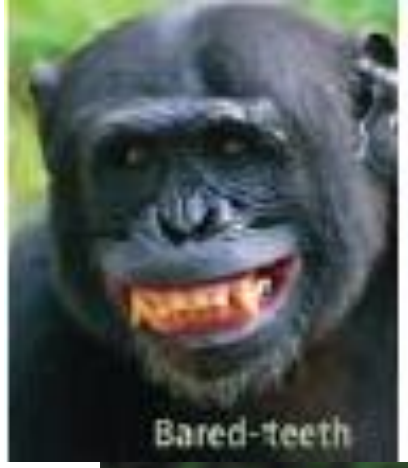
2012年7月7日這天，國際上一群頂尖的認知神經科學家、神經藥學家、
神經生理學家、神經解剖學家和計算神經學家，雲集在劍橋大學，
以重新評估人類及人類以外的動物的意識經驗和相關行為的神經生物基質。

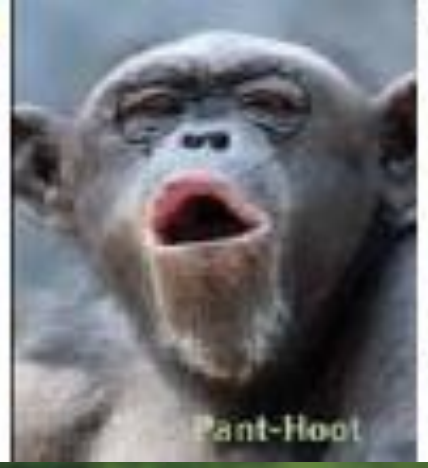
……

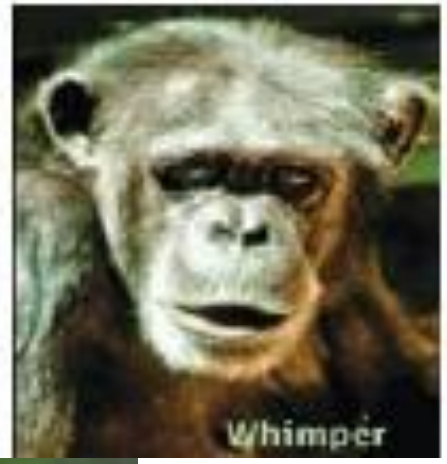
我們的宣言如下：「缺乏腦皮層似乎不會讓有機體無法體驗到情感狀態。
越趨一致的證據顯示，人類以外的動物也具備意識狀態的神經解剖、
神經化學和神經生理基質，並且有能力展現出有意圖的行為。
因此，證據的重要性顯示，

人類並非擁有能衍生出意識的神經基質的唯一物種。

人類以外的動物，包括所有哺乳動物、鳥類及許多其他生物如章魚等，
也都擁有這些神經基質。」







F. B. M. de Waal.
A century of getting to know the chimpanzee.
Nature 437.56-59, 2005.

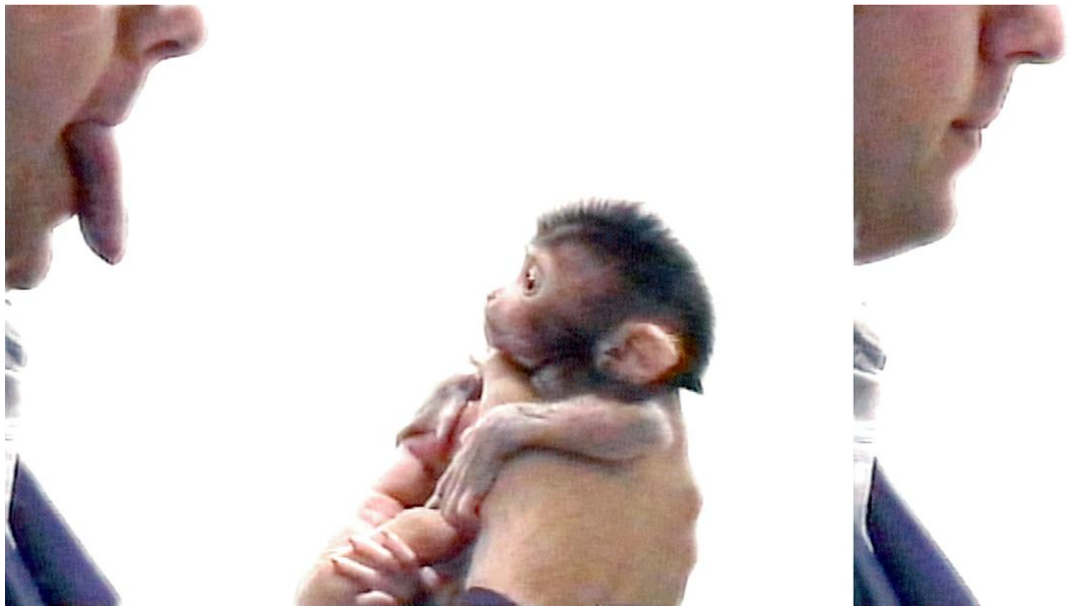
与黑猩猩相识**100**年。

1927.Köhler, Wolfgang. The mentality of apes: Harcourt Brace.
1971. Goodall, Jane. In the Shadow of Man: Houghton Mifflin.
1972 Premack, Ann James & David Premack. 1972. Teaching language to an ape. *Scientific American*.
1994. Savage-Rumbaugh, Sue & Roger Lewin. Kanzi: The Ape at the Brink of the Human Mind: John Wiley and Sons.
2007. Herrmann, E. et al. Humans Have Evolved Specialized Skills of Social Cognition: The Cultural Intelligence Hypothesis. *Science* 317.1360-66.
2009. Liszkowski,U.et al. Prelinguistic Infants, but Not Chimpanzees, Communicate About Absent Entities. *Psychological Science* 20.654-60.

Imitation by primates & mirror neurons.

Arbib, M. A. 2013. How the Brain got Language: the Mirror System Hypothesis. *Oxford University Press.*

Gross, Liza. 2006.
Evolution of Neonatal Imitation.
PLoS Biology Vol. 4/9/2006, e311.



Meltzoff, A.N. & Moore, M.K. 1977.
Imitation of facial & manual gestures by human neonates.
Science 198, 75–78.

Povinelli, D.J. & J.Vonk. 2003. Chimpanzee minds: suspiciously human? *Trends in Cognitive Sciences* 7.157-60. 黑猩猩有自我意识。

Mirror Self-recognition: A Case of Cognitive Convergence in Humans and other Animals
Diana Reiss, Ph.D,

The Francis Crick Memorial Conference
Consciousness in Human and Non-Human Animals
Cambridge University 2012.

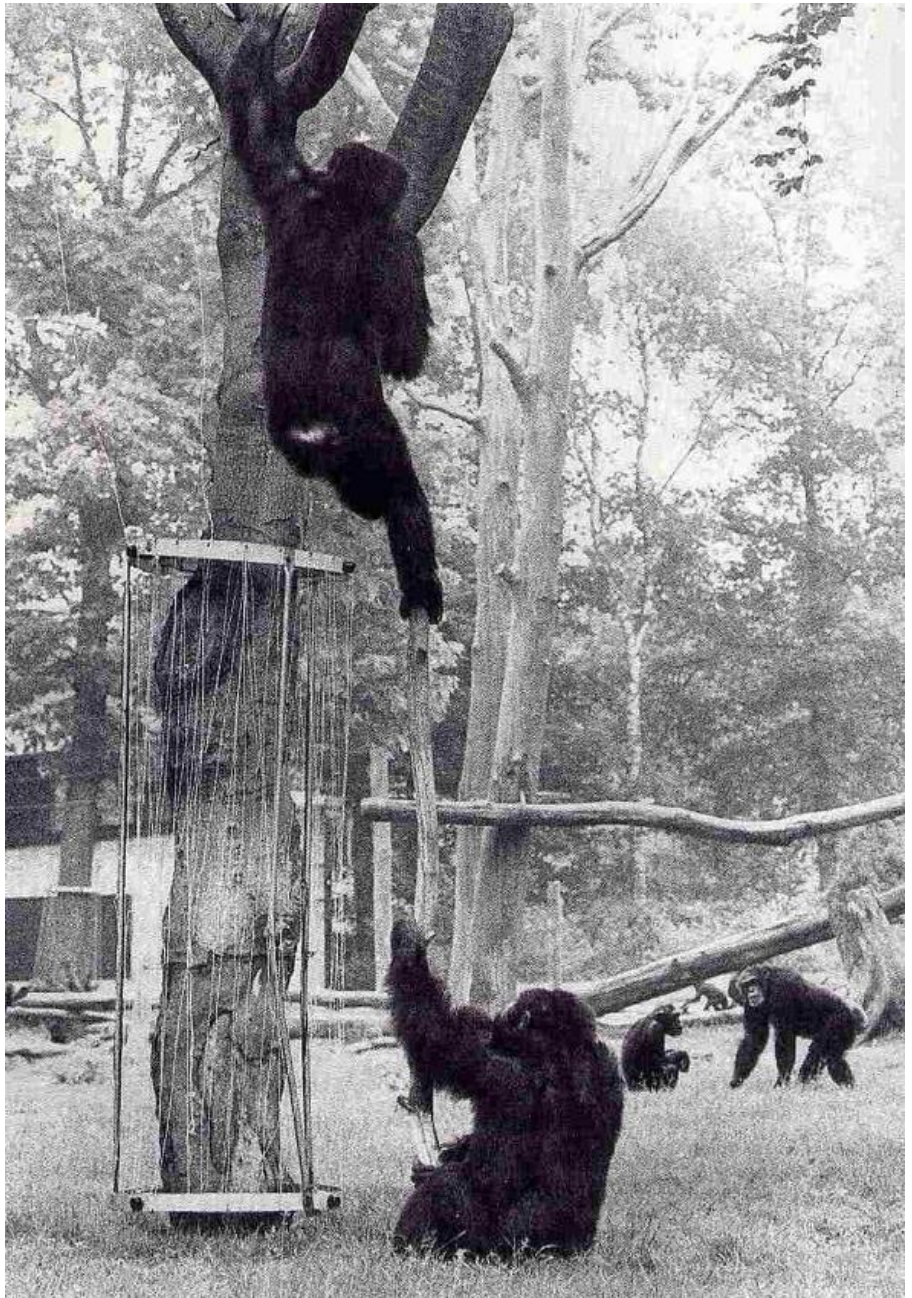
"**MSR emerges in children between 18-24 months & in chimpanzees between 2.5-4.5 years of age. ... Our findings suggest that young dolphins may show advanced cognition at an earlier age with respect to mirror self-directed behavior as compared to humans & chimpanzees**."

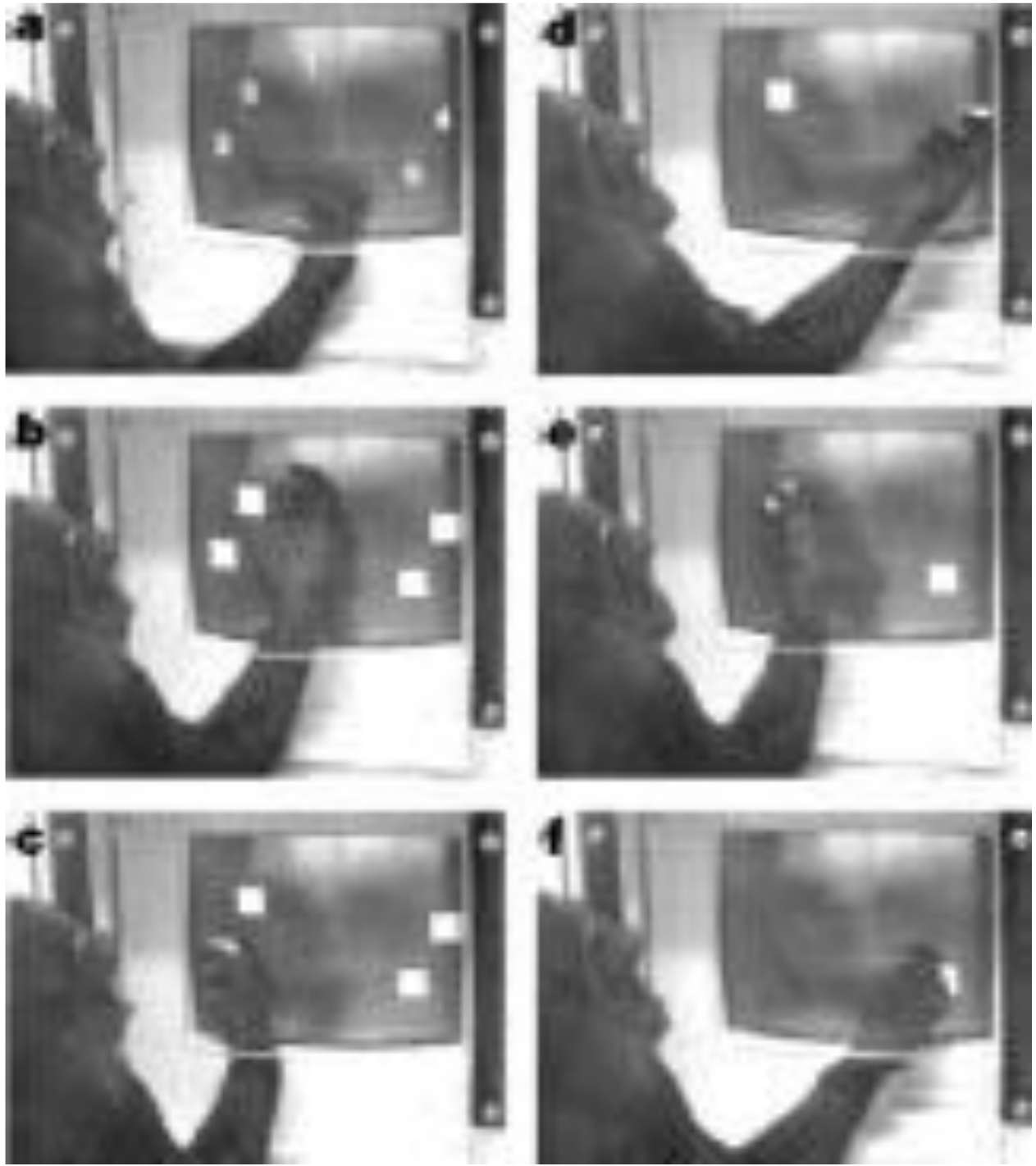
Pictured are **bonobos** (*Pan paniscus*), a highly sociable ape species that is one of the closest extant relatives to humans. Kret et al. found that bonobos' attention is biased toward images of scenes with emotional behaviors relative to neutral images of their own species. **Among emotional images, bonobos were most drawn to images of prosocial behaviors such as grooming**, unlike species that are biased toward images of distress or aggression, such as humans and chimpanzees. …
PNAS April 5, 2016.

Capuchin monkeys are found in Central America; separated from human line over 35 Mya..

Experiments of Franz de Waal on Capuchin monkey & concept of fairness. https://www.youtube.com/watch?v=lKhAd0Tyny0, accessed 20180319.

Tool Use and Cooperation by Chimpanzees. Frans de Waal *Chimpanzee Politics* 1998:194

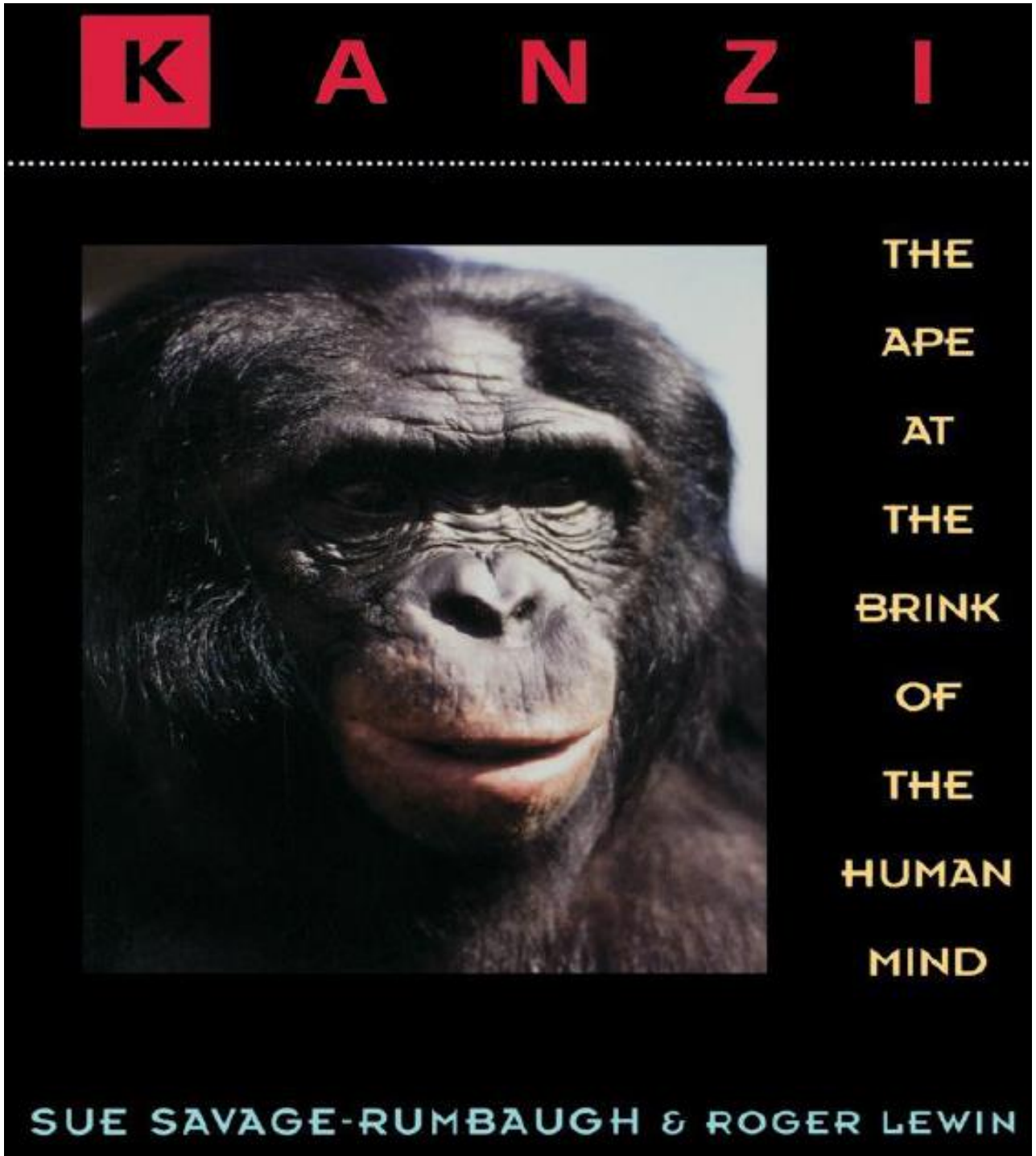




Kawai, N. & Matsuzawa, T. 2000 Numerical memory span in a chimpanzee. *Nature* 403:39–40.

"In one testing session, after Ai had chosen the correct number and all the remaining items were masked by white squares, a fight broke out among a group of chimpanzees outside the room, …
Ai abandoned her task & paid attention to the fight for about 20 seconds, after which she returned to the screen & completed the trial without error".

黑猩猩的空间与数字记忆力



"Baby Kanzi shortly after he arrived at the Language Research Center. Kanzi arrived accompanied by his mother, Matata, when he was six months old. (*Photograph by Sue Savage-Rumbaugh).*

Savage-Rumbaugh, S. & R. Lewin (1994). Kanzi: The Ape at the Brink of the Human Mind.

"By three years of age, it became apparent that Kanzi was learning lexigrams readily all on his own. He especially liked traveling out-of-doors, so we developed a portable keyboard. Here is our earliest attempt, a computer in a suitcase in 1983, long before the appearance of the first commercial portable computers. When Kanzi touched a symbol, it lighted up and the computer kept a record".

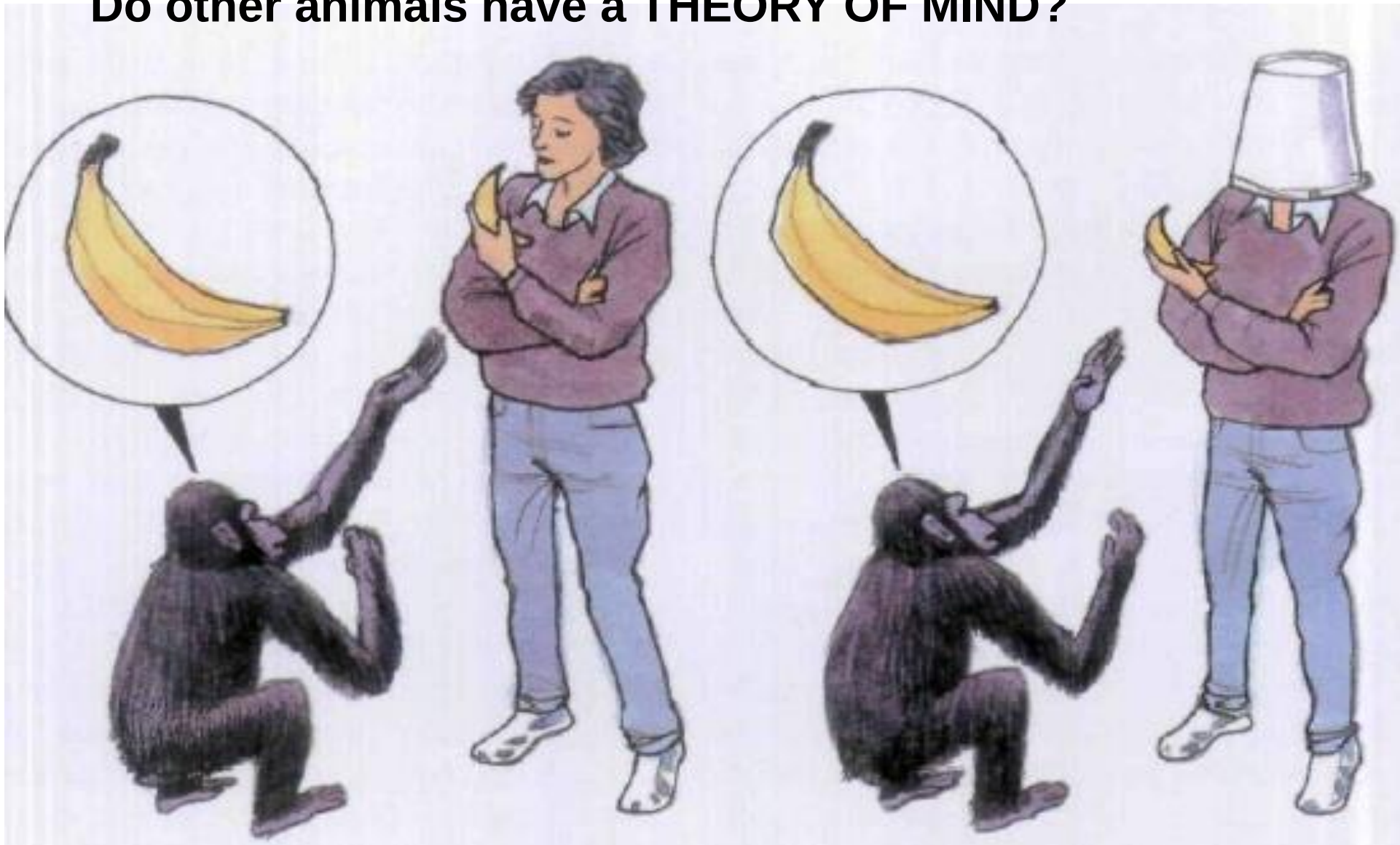
Schoenemann, P. T. (2022). "Evidence of Grammatical Knowledge in Apes: An Analysis of Kanzi's Performance on Reversible Sentences." Frontiers in Psychology **13.**

"Ape language acquisition studies have demonstrated that apes can learn arbitrary mappings between different auditory or visual patterns and concepts, satisfying the definition of symbol use. The extent to which apes understand aspects of grammar is less well accepted. … One of the most famous examples is **Kanzi**, a bonobo who reportedly responded correctly to a large number of novel commands. However, based on his performance on a small subset of reversible sentences—where the understanding of English syntax was critical—the extent to which he demonstrated grammatical knowledge has been questioned. Using a randomization study it is shown here that his performance actually vastly exceeds random chance, supporting the contention that he does in fact understand word order grammatical rules in English. … **It also removes from serious consideration the view that apes lack any kind of grammatical ability. From an evolutionary perspective, Kanzi's ability is most likely to result from homologous brain circuitry, although this is ultimately an empirical question**. …..

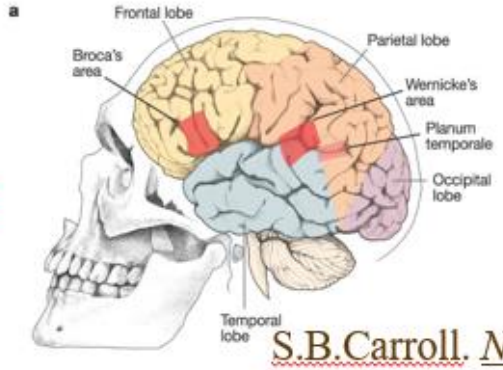
The fact that Nim Chimsky … apparently did not show these abilities is of course not relevant to whether these other ape research programs using different methods were successful (**there are many reasons why a research methodology may fail to show some cognitive ability in an animal** besides that the animal actually lacks that ability, e.g., inadequate motivation, inadequate learning protocol, etc. …). The claim that since **human language abilities are much richer than those found among non-human animals, this fact by itself rules out any meaningful continuity … is similarly misguided**. A difference in richness is good evidence for a difference in degree, it is not good evidence for a difference in kind. A recognition of the basic language-relevant cognitive abilities in apes and other non-human animals, regardless of how limited it might be in these species, is foundational for understanding of how language evolved."

MORAL: ABSENCE OF EVIDENCE SHOULD NOT BE CONFUSED WITH EVIDENCE OF ABSENCE !!

Corballis, M.C. 2007. *American Scientist* 95.240-48.
The Uniqueness of Human Recursive Thinking.
Do other animals have a THEORY OF MIND?



Genetic basis of human brain evolution. 2008. Vallender, Eric, et al. *Trends in Neuroscience*.



S.B.Carroll. *Nature*. 2003.

hominin

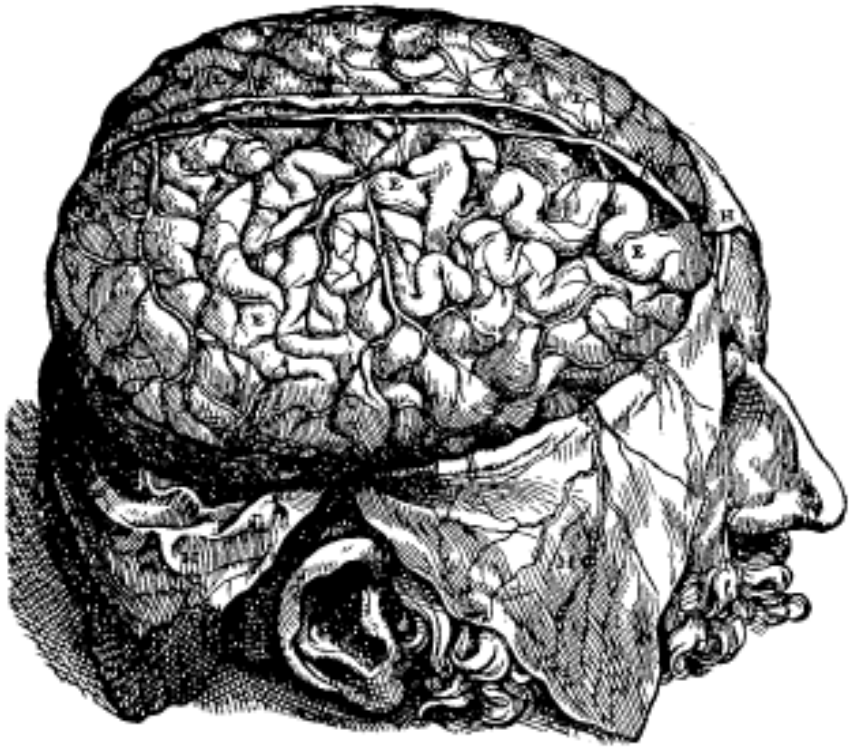
南方古猿 Australopithecus
巧人 Homo habilis
直立人 Homo erectus
智人 Homo sapiens

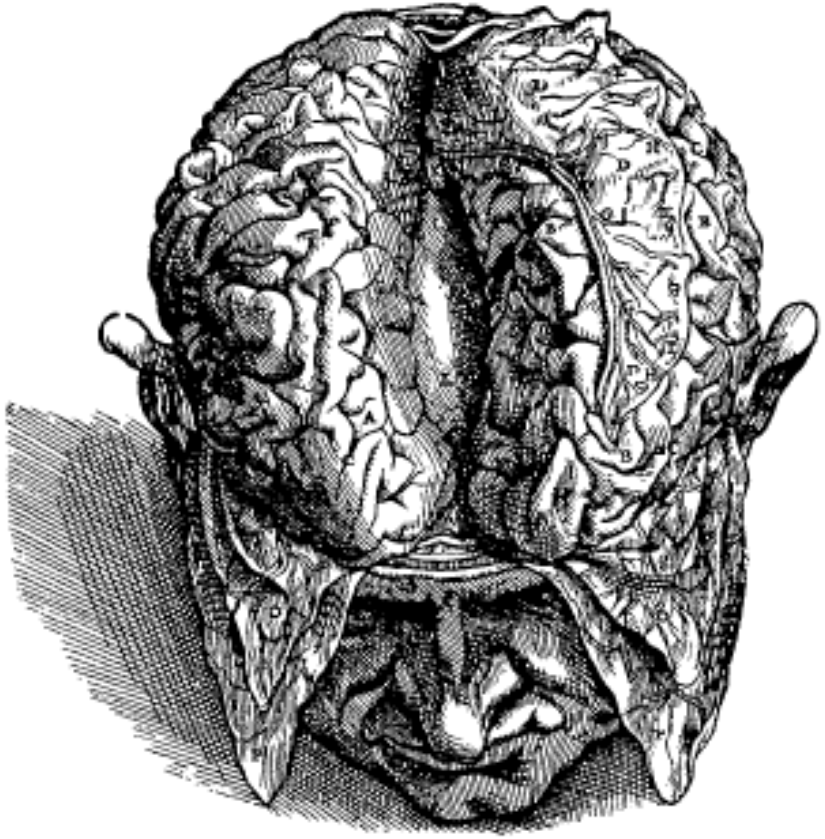
	Human	Chimpanzee 黑猩猩	Gorilla 大猩猩	Orangutan 红毛猩猩	Gibbon 長臂猿	Old World monkeys	New World monkeys
Millions of years since last common ancestor with human	---	5–7	7–9	~14	~18	~25	35–40
Genetic difference from human	---	~1.2%	~1.6%	~3.1%	~4.0%	~6.5%	~11.5%
Brain volume in cm^3	1129–1685	230–415	400–565	300–400	70–152	33–205	4–123

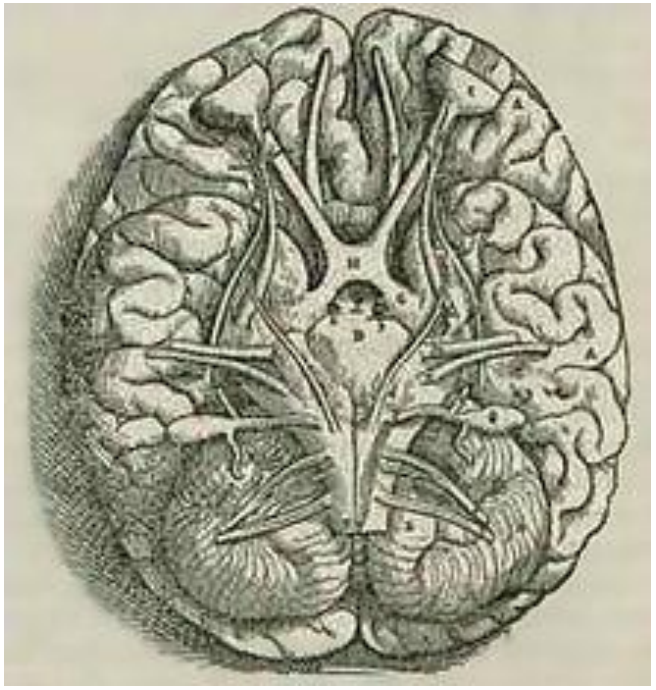
TRENDS in Neurosciences

‘This is from perhaps the most important book in the history of medicine, the "***Fabric of the Human Body***", published in 1543 by Andreas Vesalius.’

Fundamental Neuroscience, 2 ed. 2003:40.







Short version of How your vocal organs work. Geoff Lindsey, University of Southern California.

Three pioneers in studies of Language Disorders & Brain.

研究語言障礙的三位先驅。

Paul Pierre Broca
(1824-1880)

Carl Wernicke
(1848-1904)

Jules Dejerine
(1849-1917)

Dick, F. et al. 2001. Language Deficits, Localization, and Grammar: Evidence for a Distributive Model of Language Breakdown in Aphasic Patients and Neurologically Intact Individuals. *Psychological Review* 108.759-88.

Broca's aphasia:

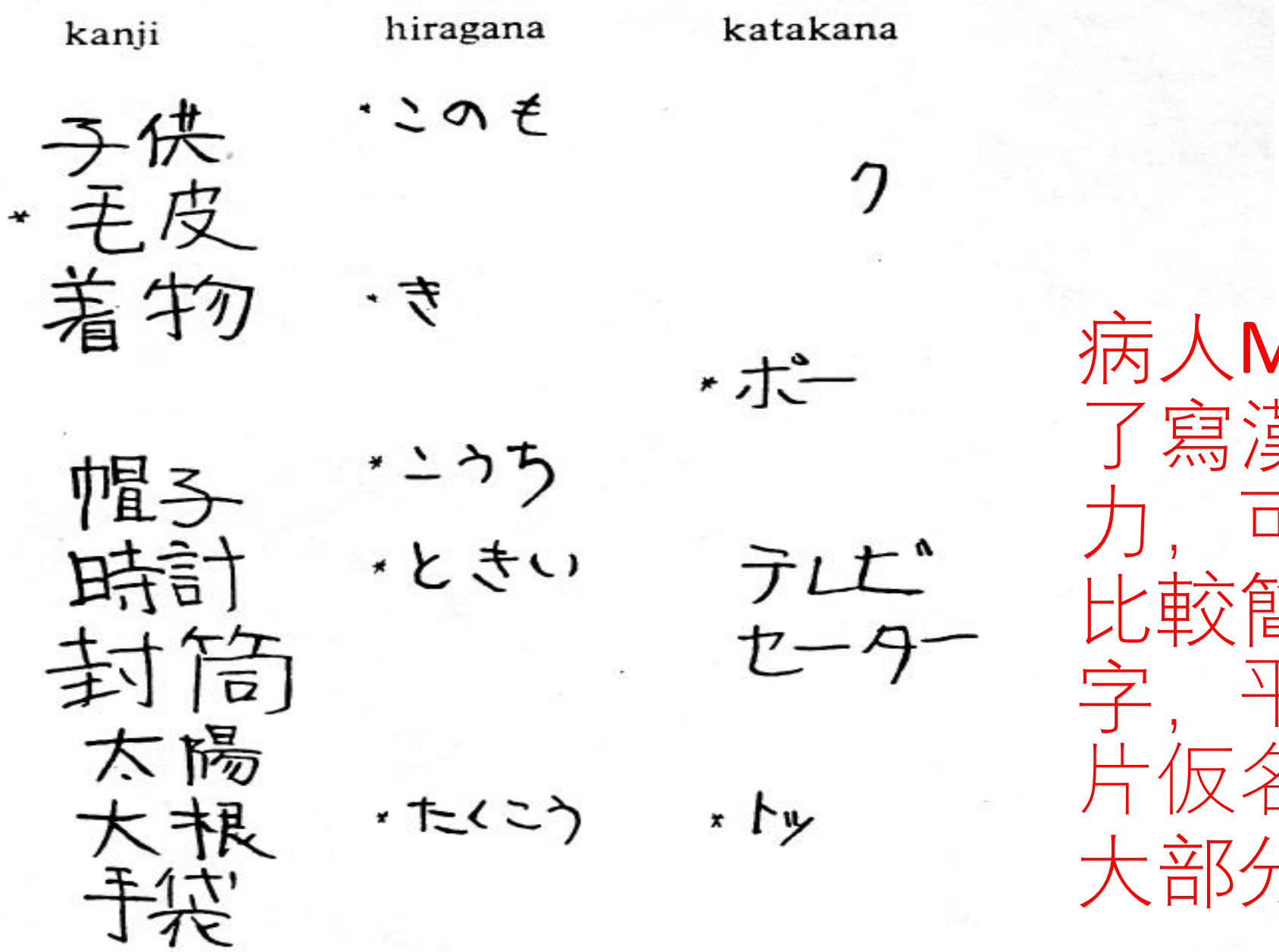
"Alright. . . . Uh ... stroke and uh ... I . . . huh tawanna guy . . . h ... h ... hot tub and.... And the ... two days when uh . . . Hos . . . uh ... huh hospital and uh . . . amet... am ... ambulance."

Broca, P. (1861). "Nouvelle observation d'aphémie produite par une lésion de la moitié postérieure des deuxième et troisième circonvolution frontales gauches." Bulletin de la Société Anatomique **36**: 398-407.

Wernicke's aphasia.

"It just suddenly had a feffort and all the feffort had gone with it. It even stepped my horn. They took them from earth you know. They make my favorite nine to severed and now I'm a been habed by the uh stam of fortment of my annulment which is now forever."

Dick, F. et al. 2001. Language Deficits, Localization, and Grammar: Evidence for a Distributive Model of Language Breakdown in Aphasic Patients and Neurologically Intact Individuals. *Psychological Review* 108.759-88.



* Error words.

Figure 4. Performance of M.T. (a Type 1 patient) on the task of writing high-frequency words in *kana* and *kanji*.

病人M.T.保留了寫漢字的能力，可是兩种比較簡單的文字，平仮名及片仮名，卻已大部分受損。

Dronkers, N. (1996). "A new brain region for coordinating speech articulation." ***Nature*** **384: 159-161.**

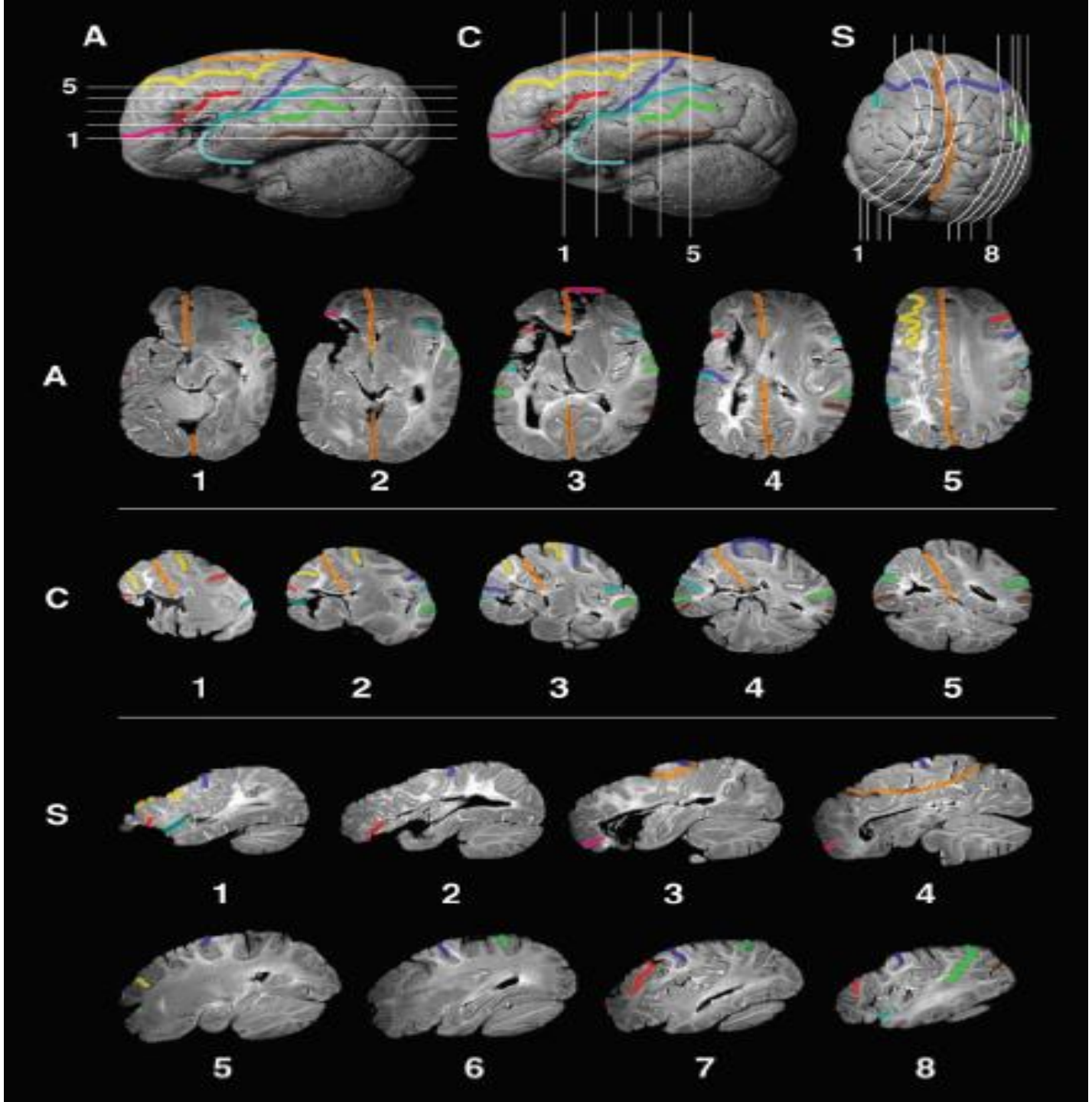
Dronkers, N. F., et al. (2000). Language and the Aphasias. Principles of Neural Science, 4th ed. E. Kandel, et al.**: 1169-1187.**

Dronkers, N. F., et al. (2007). "**Paul Broca's historic cases: high resolution MR imaging of the brains of Leborgne and Lelong**." ***Brain*** **130: 1432-1441.**

Dronkers, N. F., O. Plaisant, M. T. Iba-Zizen & E. A.Cabanis. 2007. Paul Broca's historic cases: high resolution MR imaging of the brains of Leborgne and Lelong. *Brain* 130.1432-41.

A

B



Dronkers, N. et al. 2007.

Paul Broca's historic cases: high resolution MR imaging of the brains of Leborgne & Lelong.

Brain 130.1432-41. Fig.4.

"Sagittal, axial and coronal slices through the brain reveal lesions in the left inferior frontal gyrus, deep inferior parietal lobe and anterior superior temporal lobe. In addition, there is extensive subcortical involvement including the claustrum, putamen, globus pallidus, head of the caudate nucleus and internal and external capsules. The insula is completely destroyed. The entire length of the superior longitudinal fasciculus is also obliterated, along with other frontal-parietal periventricular white matter. The medial subcallosal fasciculus is also affected." *p.1436.*

Damasio, A. 2003： 73. Looking for Spinoza: Joy, Sorrow and the Feeling Brain, Harcourt.

"Any complex mental function results from concerted contributions by many brain regions at varied levels of the central nervous system rather than from the work of a single brain region . . . "

「任何複雜的心智功能，都來自不同層次的中樞神經系統裡許多大腦區塊共同的貢獻，而不是單獨一個大腦區塊的運作所致。」

Geschwind 1976: 88:

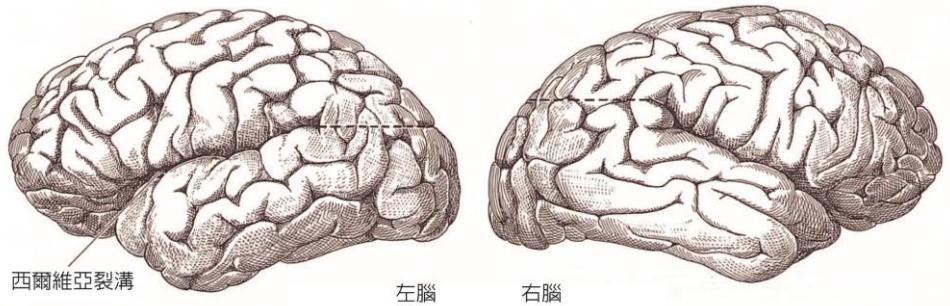
'…a real understanding of language will not be achieved until we have a reasonable notion of its neurological mechanisms' .

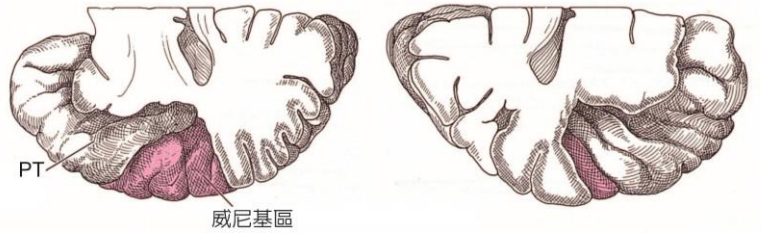
除非我們對**語言的神經機制**有合理的概念，

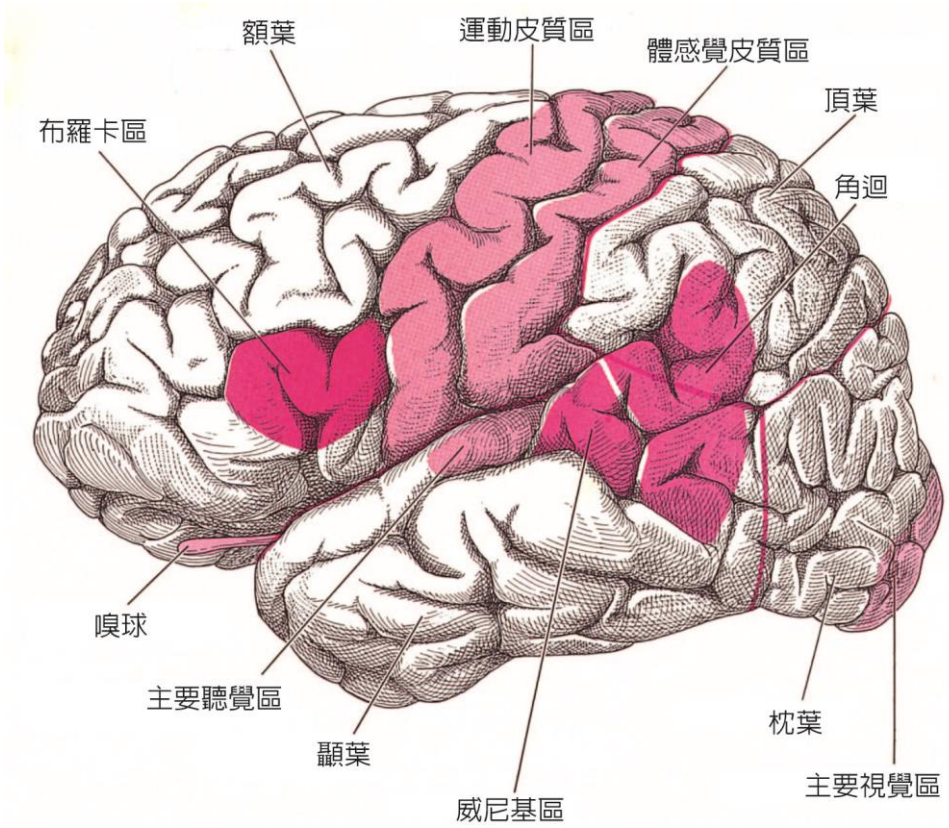
否則無法真正理解語言。

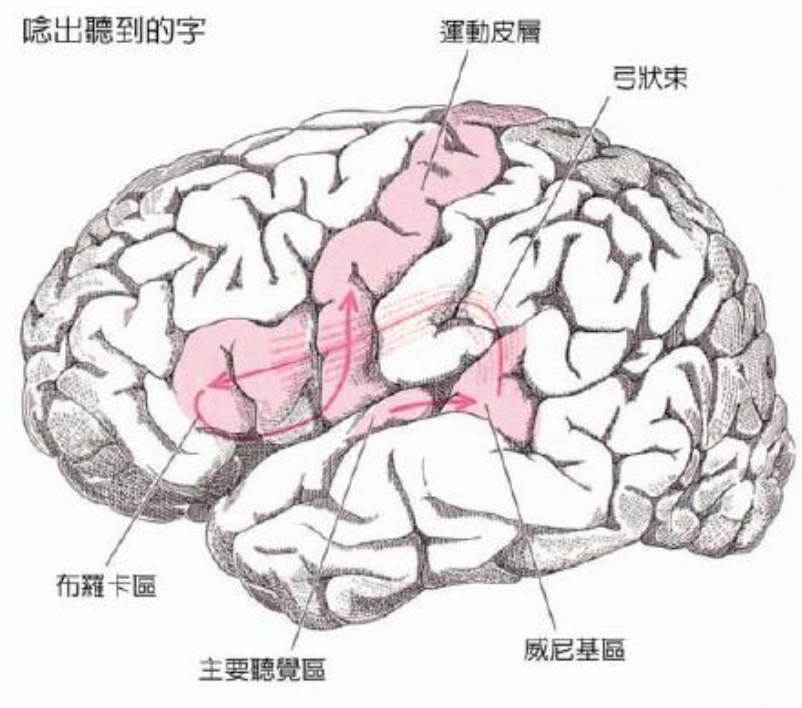
Geschwind, N. and W. Levitsky (1968). "Human Brain: Left-Right Asymmetries in Temporal Speech Region." Science **161( ): 186-187, 112 July.**

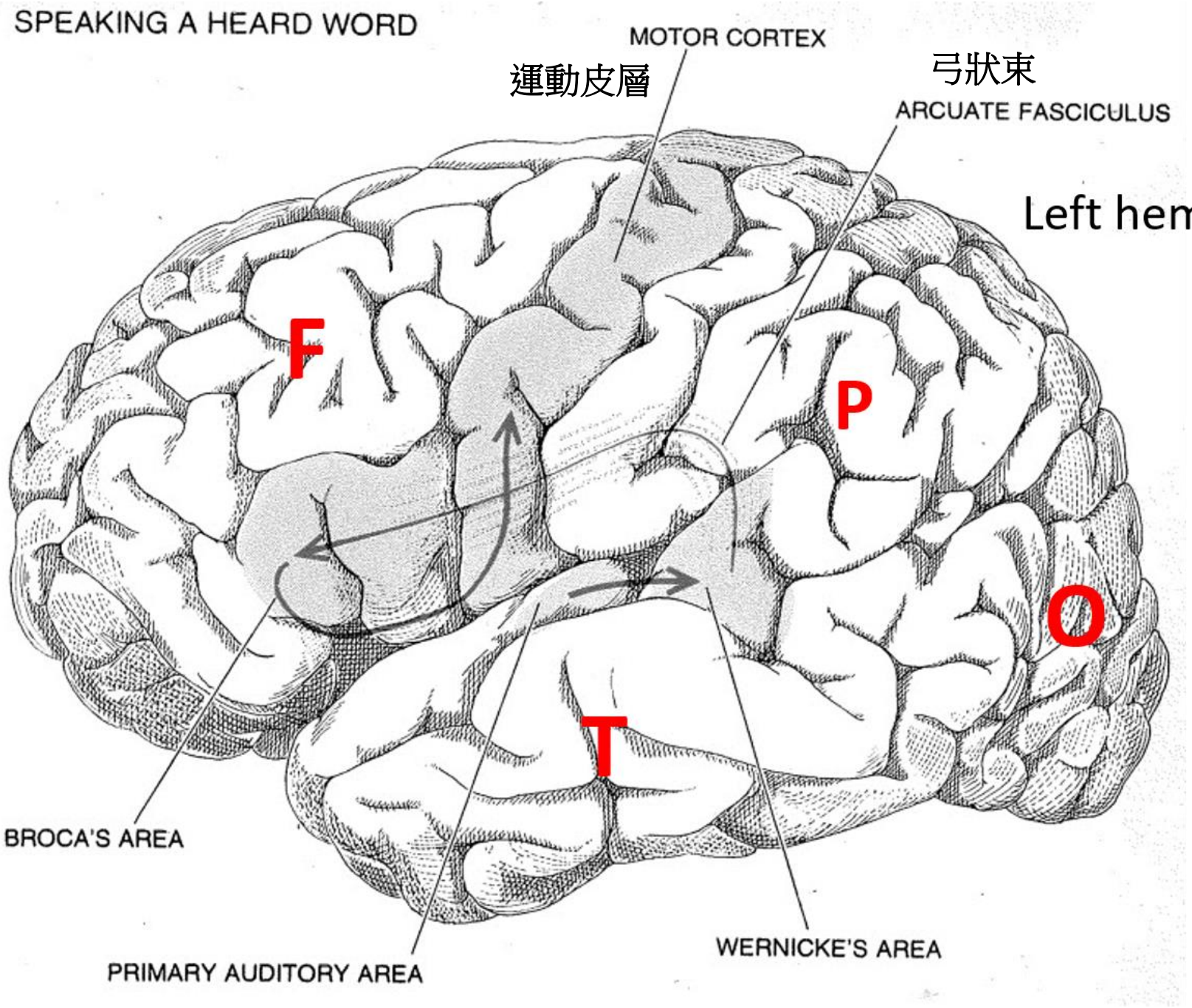
Geschwind, N. (1979). "Specializations of the human brain." Scientific American **241(3): 158-168.**











Reprinted in 王士元 2008.
語言湧現: 發展與演化.
中央研究院 語言學研究所.

Left hemisphere & its four lobes:

Frontal, 額葉
Parietal, 頂葉
Temporal, 顳葉
Occipital. 枕葉

Geschwind, Norman. 1979.

Specializations of the human brain.

Scientific American 241.158-68.

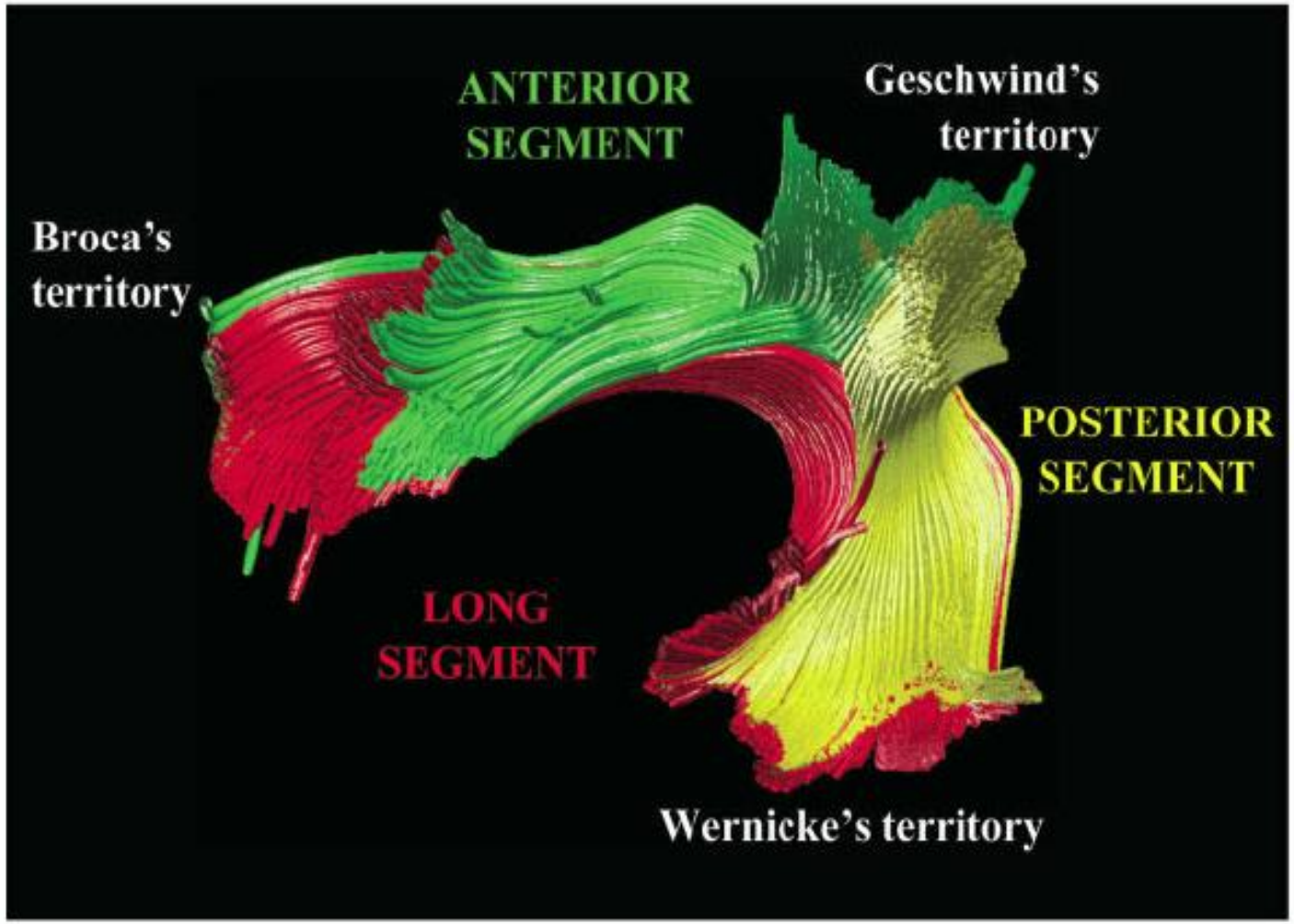
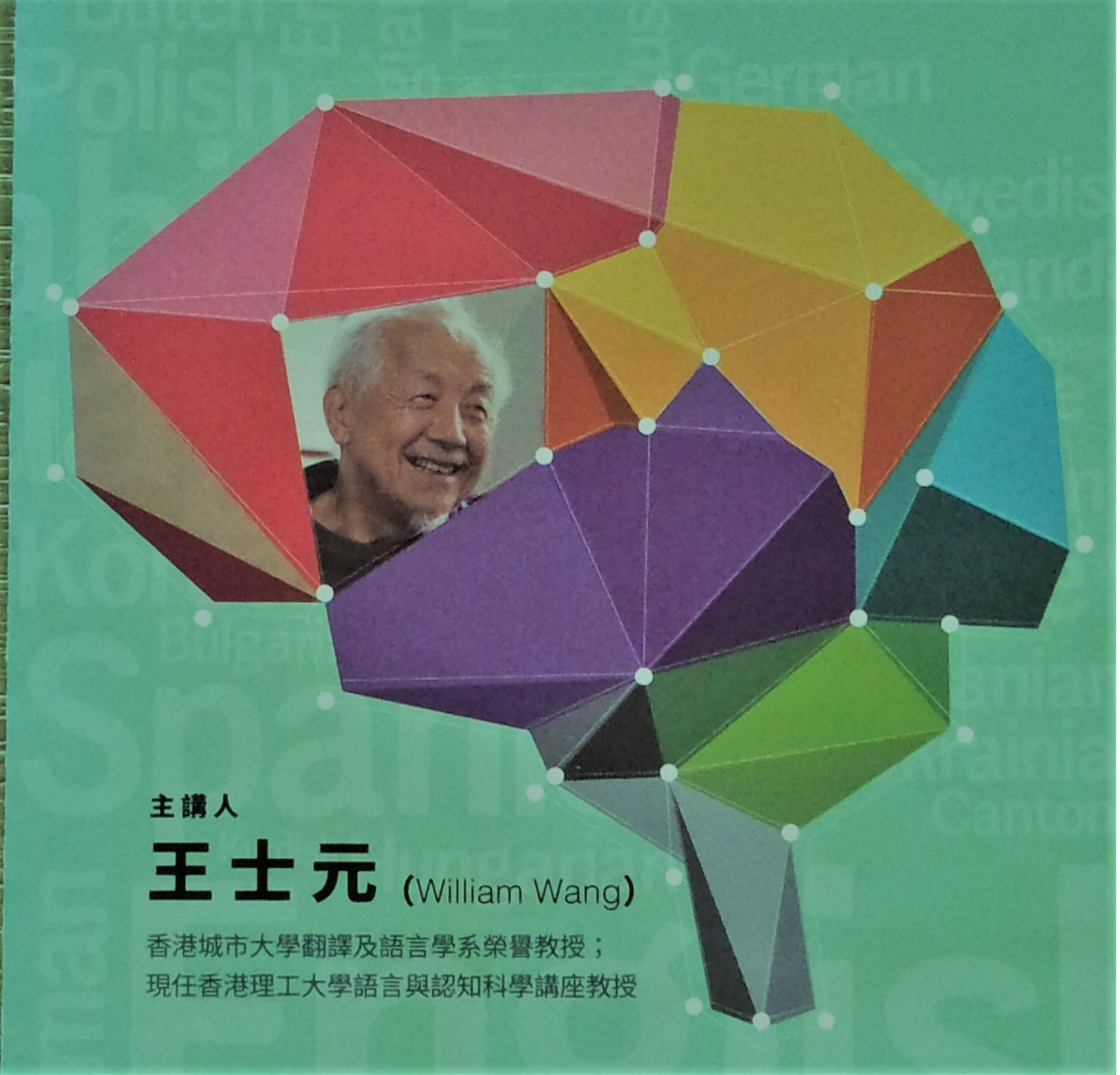


Fig 3. Tractography reconstruction of the arcuate fasciculus using the two-region of interest approach. Broca's and Wernicke' territories are connected through direct and indirect pathways in the average brain. The direct pathway (long segment shown in red) runs medially and corresponds to classical descriptions of the arcuate fasciculus. The indirect pathway runs laterally and is composed of an anterior segment (green) connecting the inferior parietal cortex (Geschwind's territory) and Broca's territory and a posterior segment (yellow) connecting Geschwind's and Wernicke's territories. Note the color coding in this figure differs from that used in Figures 1 and 2.



1. Frontal Lobe 额叶

Prefrontal Cortex

Motor Gyrus

Broca's Area

Central Sulcus 中央沟

2. Parietal Lobe 顶叶

Sensory Gyrus

Lateral Sulcus 外侧沟

3. Temporal Lobe 颞叶

Auditory Area

Wernicke's Area

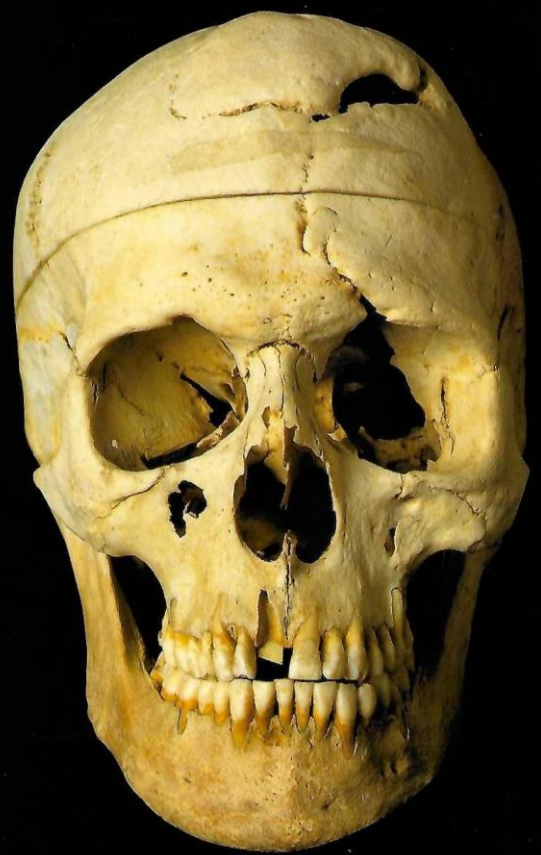
4. Occipital Lobe 枕叶

Visual Area

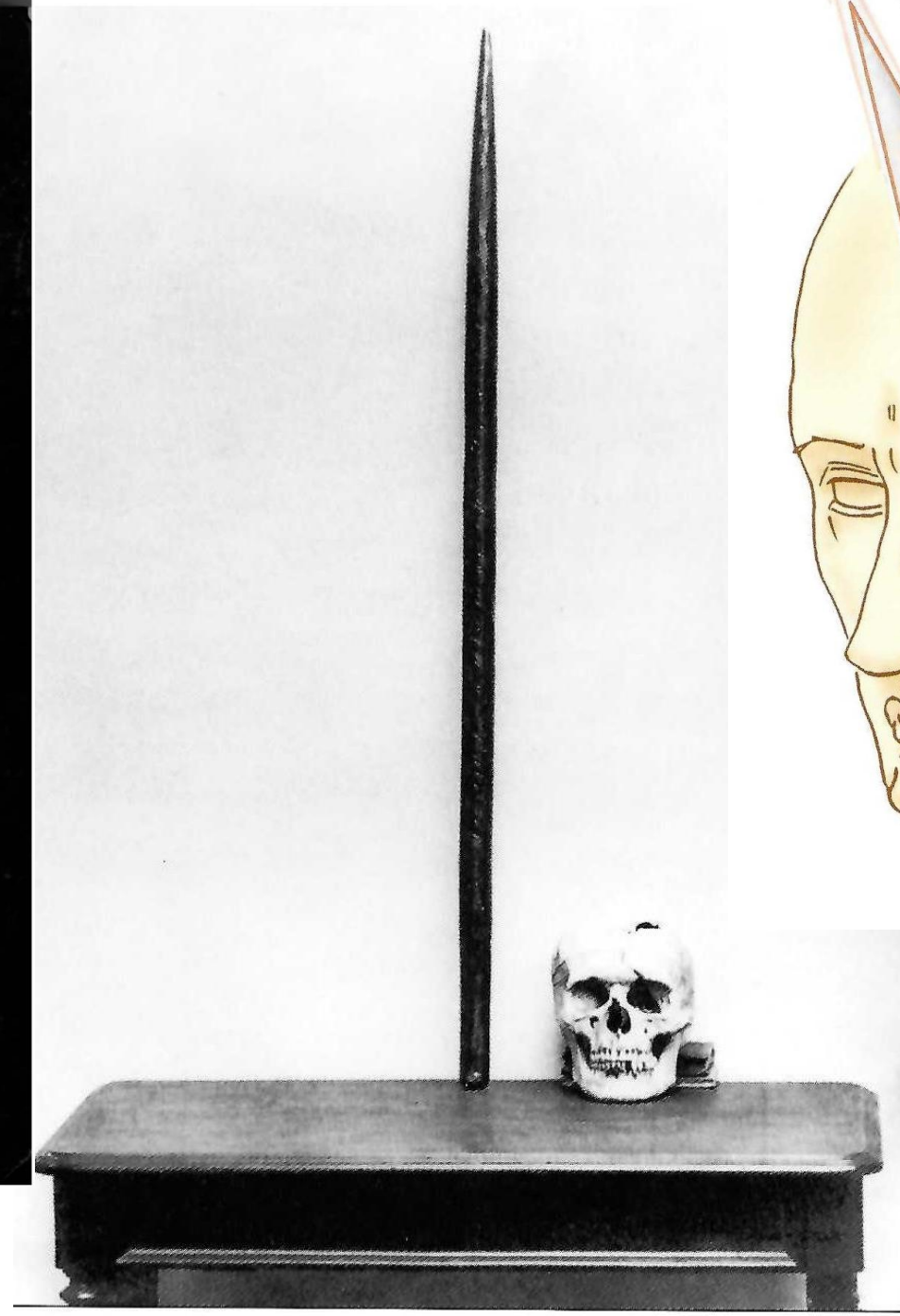
Cerebellum 小脑

PHINEAS GAGE

A Gruesome but True Story About Brain Science



by JOHN FLEISCHMAN



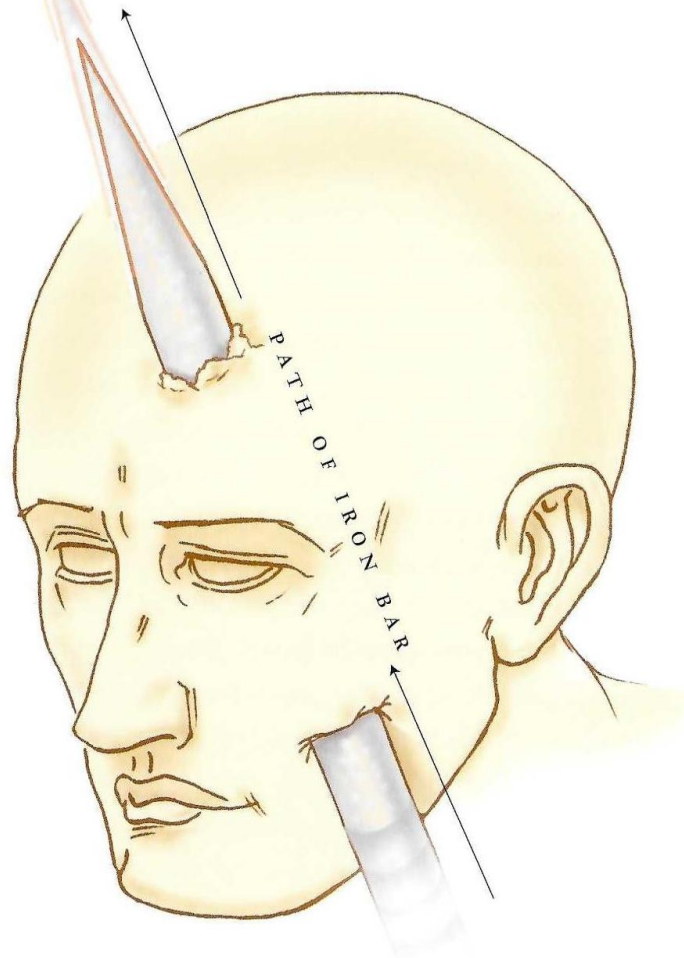
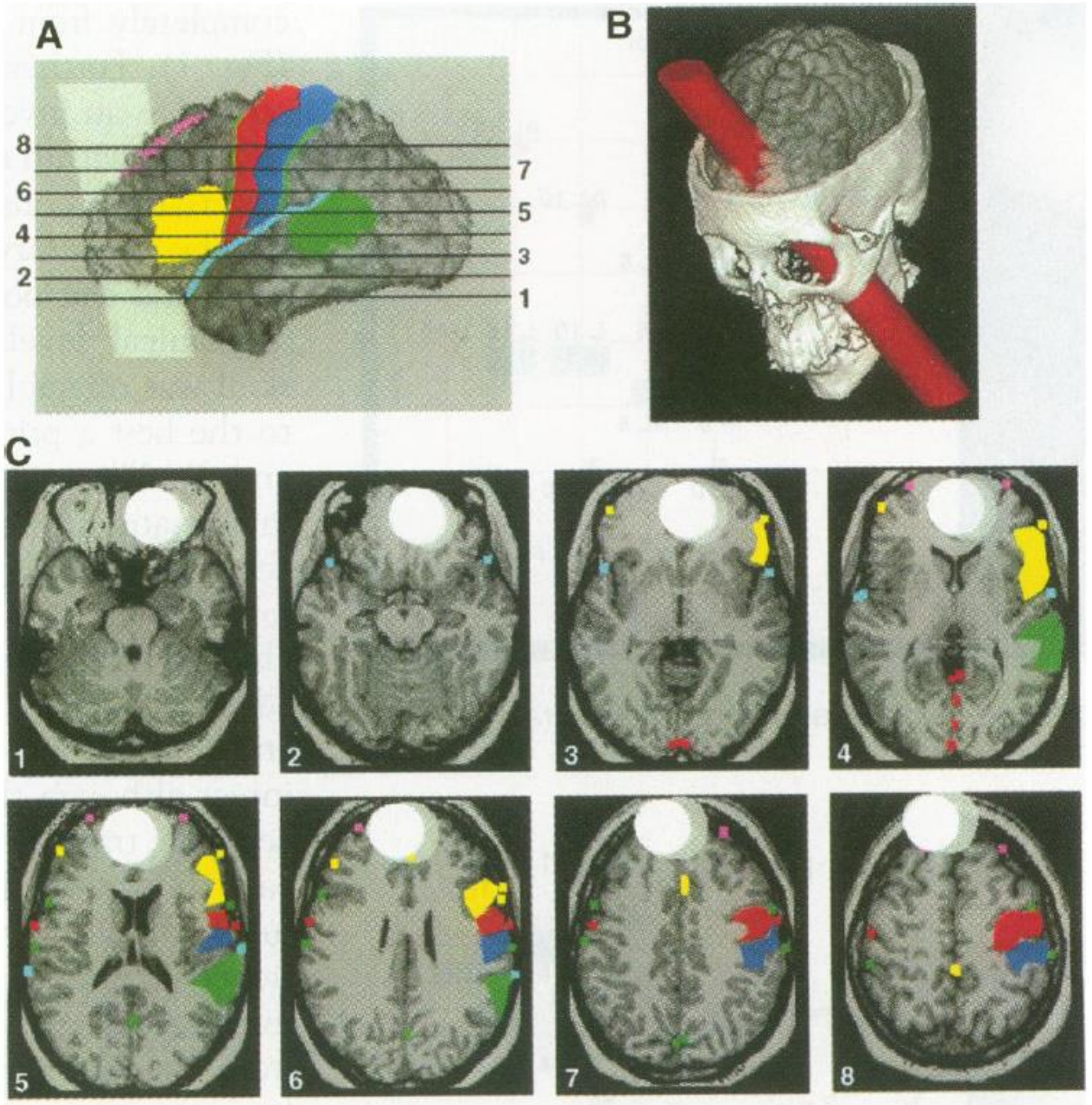


Fig. 5. Normal brain fitted with the five possible rods. The best rod is highlighted in solid white [except for (**B**), where it is shown in red]. The areas spared by the iron are highlighted in color: Broca, yellow; motor, red; somatosensory, green; Wernicke, blue. (**A**) Lateral view of the brain. Numbered black lines correspond to levels of the brain section shown in (**C**). (**D** and **E**) Medical view of left and right hemispheres, respectively, with the rod shown in white.



Damasio, H., et al. (1994). "The Return of **Phineas Gage**: Clues About the Brain from the Skull of a Famous Patient." *Science* *264: 1102-1105*.

“ … Gage fits a neuroanatomical pattern that we have identified to date in 12 patients within a group of 28 individuals with frontal damage. **Their ability to make rational decisions in personal and social matters is invariably compromised and so is their processing of emotion**. On the contrary, their ability to tackle the logic of an abstract problem, to perform calculations, and to call up appropriate knowledge and attend to it remains intact. The establishment of such a pattern has led to the hypothesis that emotion and its underlying neural machinery participate in decision making within the social domain and has raised the possibility that the participation depends on the ventromedial frontal region. This region is reciprocally connected with subcortical nuclei that control basic biological regulation, emotional processing, and social cognition and behavior, for instance, in **amygdala** and **hypothalamus**.”

Damasio, H., et al. (1994). "The Return of Phineas Gage: Clues About the Brain from the Skull of a Famous Patient." Science 264: 1102-1105.

Antonio Damasio, 2013.

Damasio, A. R. and N. Geschwind (1984). "The Neural Basis Of Language." Ann. Rev. Neurosci. **7: 127-147.**

Damasio, A. (1994). Descartes' Error: Emotion, Reason, and the Human Brain. *Reprinted 2015.*

- - (1999). The Feeling of What Happens: Body and Emotion in the Making of Consciousness.

- - (2003). Looking for Spinoza: Joy, Sorrow and the Feeling Brain.

- - (2010). Self comes to mind : constructing the conscious brain.

- - (2018). The Strange Order of Things: Life, Feeling, and the Making of Cultures.

笛卡儿

René Descartes

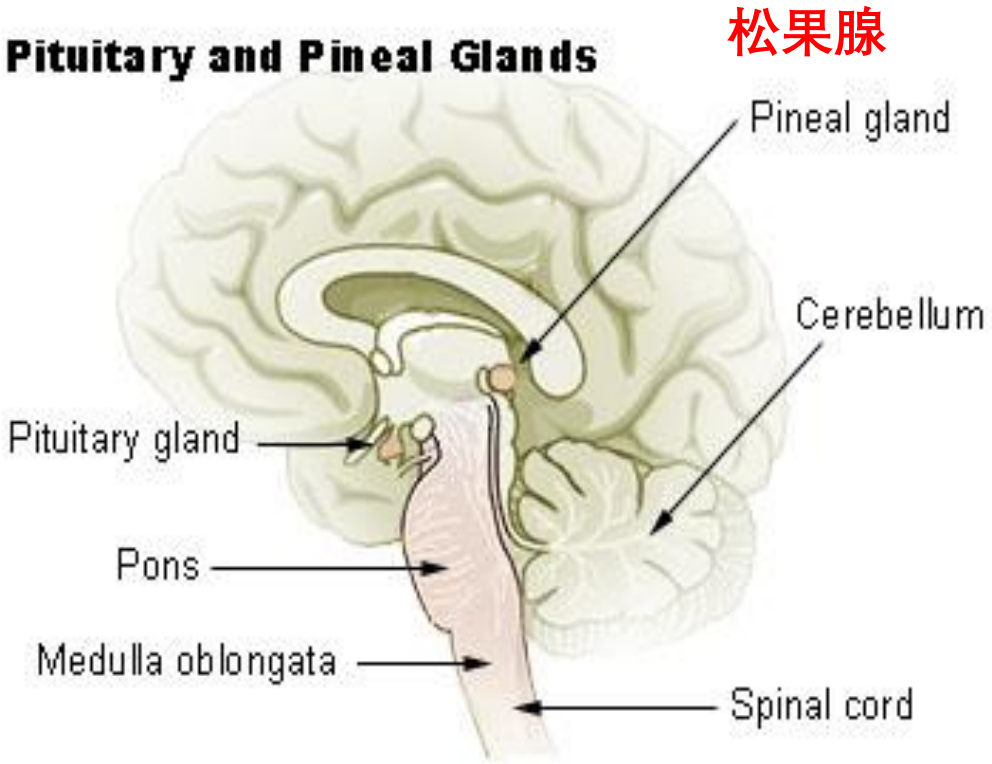
(1596 – 1650) was a French philosopher, mathematician, scientist and lay Catholic who invented analytic geometry, linking the previously separate fields of geometry and algebra. … Descartes is also widely regarded as one of the founders of modern philosophy.

wikipedia

Descartes, R. 1637/1970. The Philosophical Works of Descartes rendered into English. Columbia University Press.

"Je pense donc je suis." "Cogito ergo sum." "I think therefore I am."

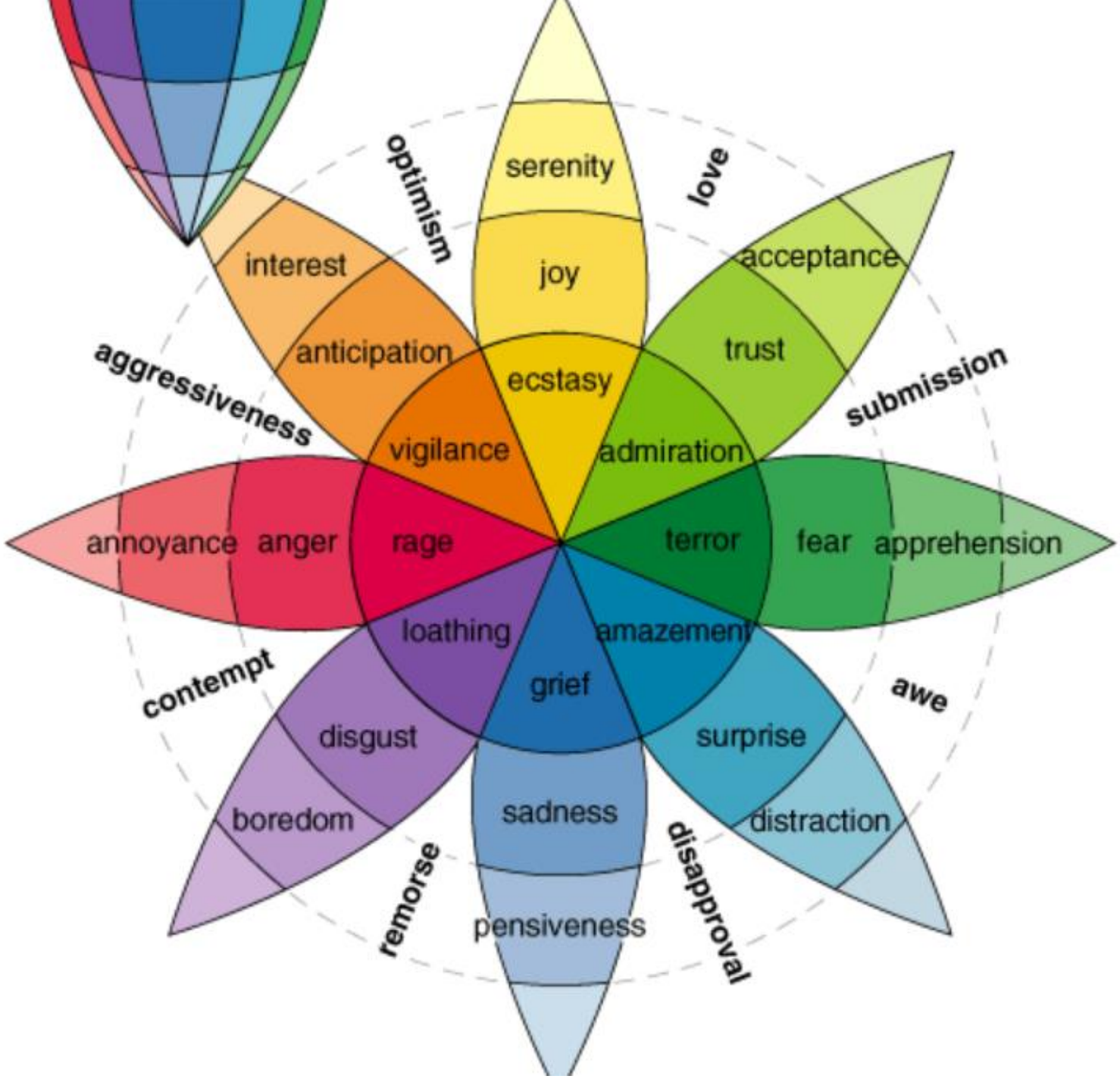
Descartes 1637- "… the soul by which I am what I am, is entirely distinct from body, and is even more easy to know than is the latter; and even if latter were not, the soul would not cease to be what it is."



Damasio 1994:249.

"This is Descartes' error: the abyssal separation between the body and mind, between the sizable, dimensional, mechanically operated, infinitely divisible body stuff, on the one hand, and the unsizable undimensioned, un-pushpullable, mind stuff; the suggestion that reasoning, and moral judgment, and the suffering that comes from physical pain or emotional upheaval might exist separately from the body. Specifically: the separation of the most refined operations of mind from the structure and operations of a biological organism."

「這正是笛卡兒的錯：身與心之間有如深淵般的分離，
也就是一方面是有尺寸、有空間維度、
機械運作且可無限分割的身體，
與沒有尺寸、沒有空間維度、
推不了也拉不了的心智之間有如深淵般的分離；
這意味著推理和道德判斷，
以及因身體疼痛或情感起伏而來的苦楚，
都可以脫離身體而存在。尤其是，把最精密的心智運作，
與生物有機體的構造和運作區隔開來。」



Plutchik, R. 2001.

The Nature of Emotions.

Figure 6. Author's three-dimensional circumplex model describes the relations among emotion concepts, which are analogous to the colors on a color wheel. The cone's vertical dimension represents intensity, & the circle represents degrees of similarity among the emotions. The eight sectors are designed to indicate that there are eight primary emotion dimensions defined by the theory arranged as four pairs of opposites. In the exploded model the emotions in the blank spaces are the primary dyads—emotions that are mixtures of two of the primary emotions.

American Scientist July.

Basic Emotions, adapted from Plutchik 2001.

		Weak	Basic	Strong
		Serenity 寧靜	Joy 喜悅	Ecstasy 狂喜
1	Love 愛			
		Acceptance 接受	Trust 相信	Admiration 欽佩
2	Submission 順服			
		Apprehension 顧慮	Fear 害怕	Terror 恐懼
3	Awe 敬畏			
		Distraction 分心	Surprise 驚喜	Amazement 訝異
4	Disapproval 不贊成			
		Pensiveness 沉思	Sadness 難過	Grief 悲傷
5	Remorse 悔恨			
		Boredom 無聊	Disgust 厭惡	Loathing憎惡
6	Contempt 鄙視			
		Annoyance 厭煩	Anger 生氣	Rage憤怒
7	Aggressiveness 攻擊性			
		Interest 興趣	Anticipation 期待	Vigilance 警覺
8	Optimism 樂觀			
		Serenity寧靜	Joy 喜悅	Ecstasy狂喜

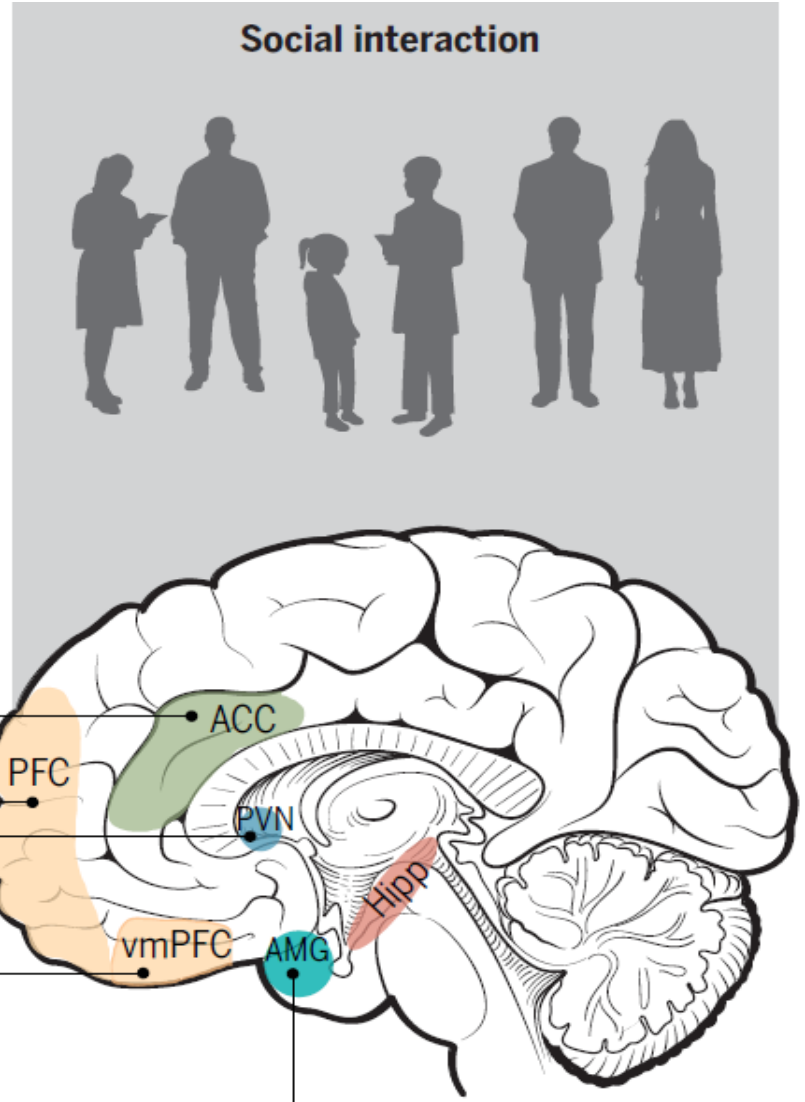
Anterior cingulate cortex (ACC)
This brain region functions in the detection and valuation of social processes such as interactions with dominant males and females in primates, and decision-making games in humans.

Prefrontal cortex (PFC)
In humans, this brain region is activated in response to various social cognitive tasks such as empathy, moral decision making, and judging the mental states of others. In rodents, stimulation of excitatory neurons abolishes social exploration and preference.

Paraventricular nucleus of the hypothalamus (PVN)
Magnocellular neurons of the PVN produce the neuropeptide oxytocin. Oxytocin is secreted to brain regions involved in sociability and social cognition, such as the ventral tegmental area and PFC. Reduced levels of oxytocin are documented in autism.

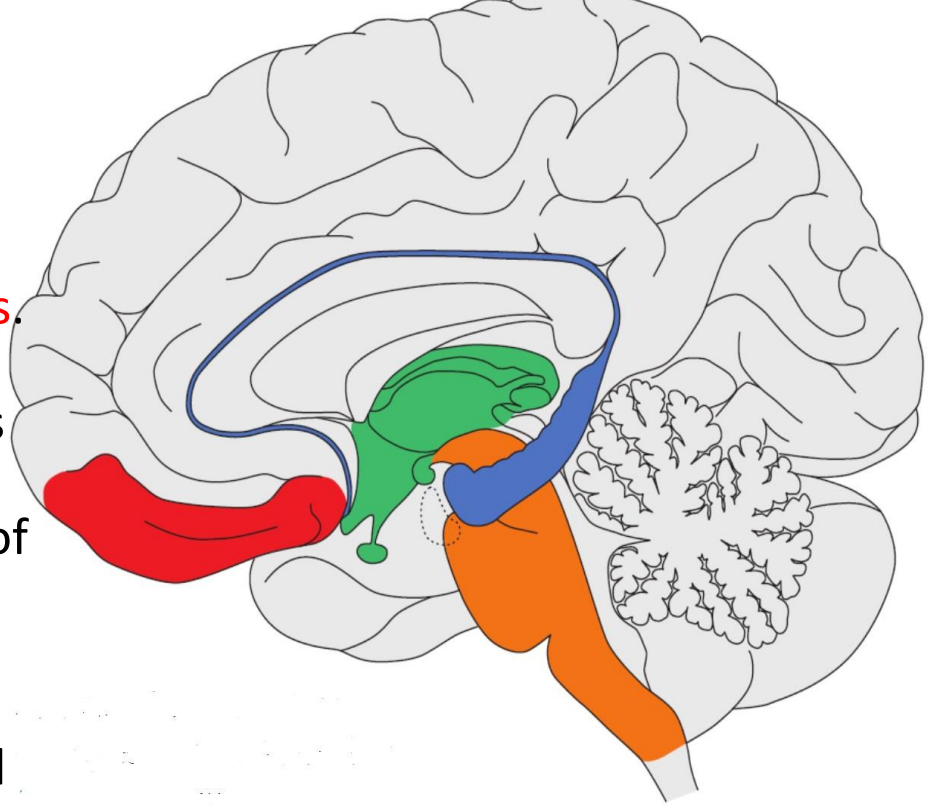
Ventromedial prefrontal cortex (vmPFC)
Lesions to this part of PFC result in social isolation and apathy in humans. The vmPFC is also important in the learning of cues that predict social reward. Children with ASD display reduced vmPFC activation in response to social reward.

Amygdala (AMG)
Amygdalar volume correlates with the size and complexity of social networks in humans. This brain region functions in the analysis of social situations. Individuals with autism demonstrate reduced activation of this brain region in response to social judgment tasks.



Sherwin, E., et al. 2019.Microbiota & the social brain. *Science* **366.**

“ … We propose that four classes of emotions originate from **four neuroanatomically distinct cerebral systems**. These emotional core systems constitute a quartet of affect systems: the **brainstem**-, diencephalon-, hippocampus-, and orbitofrontal-centered affect systems. The affect systems were increasingly differentiated during the course of evolution, and each of these systems generates a specific class of affects (e.g., ascending activation, pain/pleasure, attachment-related affects, & moral affects). The affect systems interact with each other, and activity of the affect systems has effects on – & interacts with – biological systems denoted here as emotional effector systems. These effector systems include motor systems (which produce actions, action tendencies, and motoric expression of emotion), peripheral physiological arousal, as well as attentional & memory systems. Activity of affect systems & effector systems is synthesized into an emotion percept (pre-verbal subjective feeling), which can be transformed (or reconfigured) into a symbolic code such as language. Moreover, conscious cognitive appraisal (involving rational thought, logic, & usually language) can regulate, modulate, & partly initiate, activity of affect systems & effector systems. Our emotion theory integrates psychological, neurobiological, sociological, anthropological, & psycholinguistic perspectives on emotions in an interdisciplinary manner, aiming to advance the understanding of human emotions & their neural correlates.”



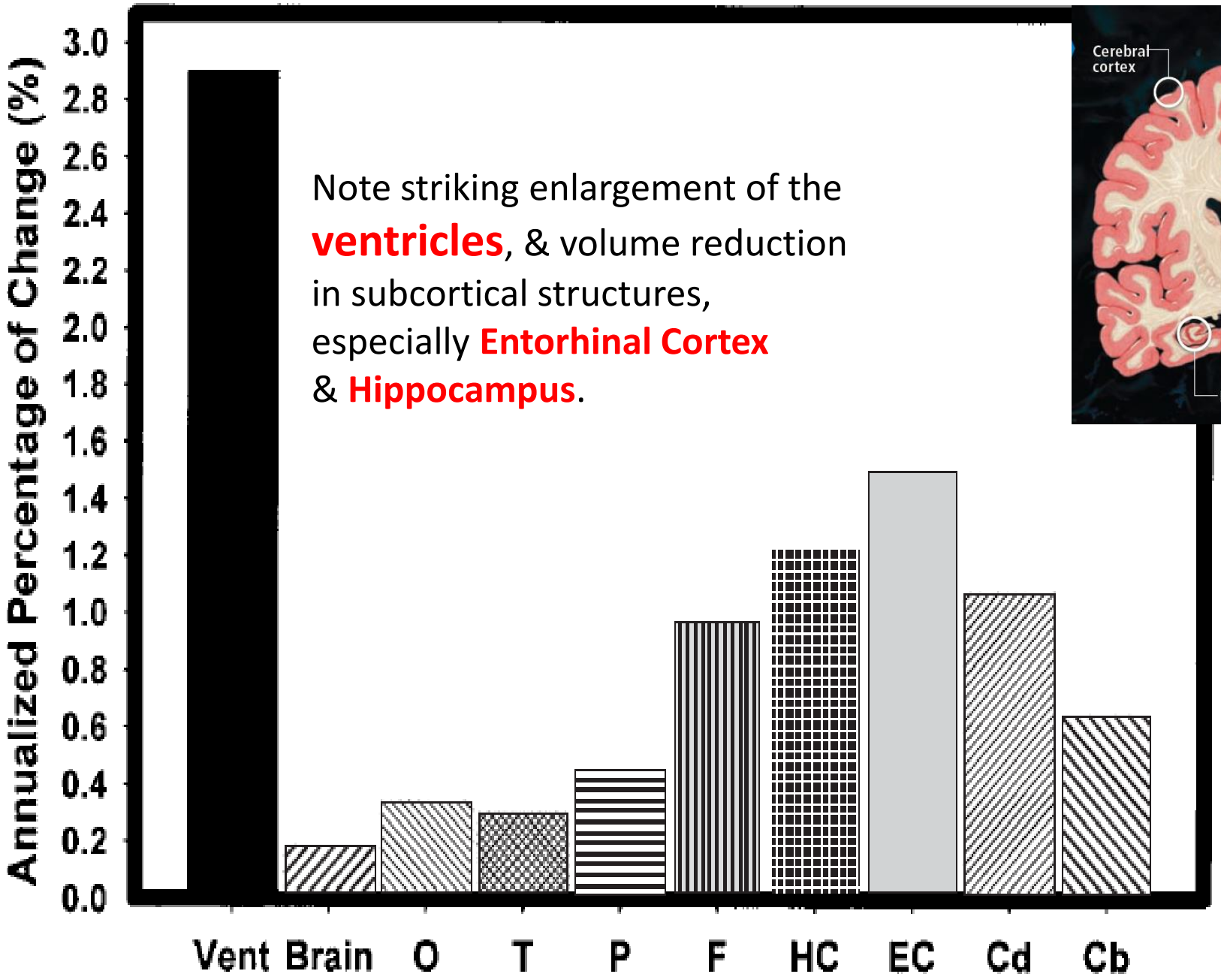
brainstem-centred (orange), 腦幹
diencephalon-centred (green), 間腦
hippocampus-centred (blue), 海馬體
orbitofrontal-centred (red) system. 眶額皮層

Koels Koelsch, S., et al. (2015).
The quartet theory of human emotions: An integrative and neurofunctional model.
Physics of Life Reviews **13: 1-27.**

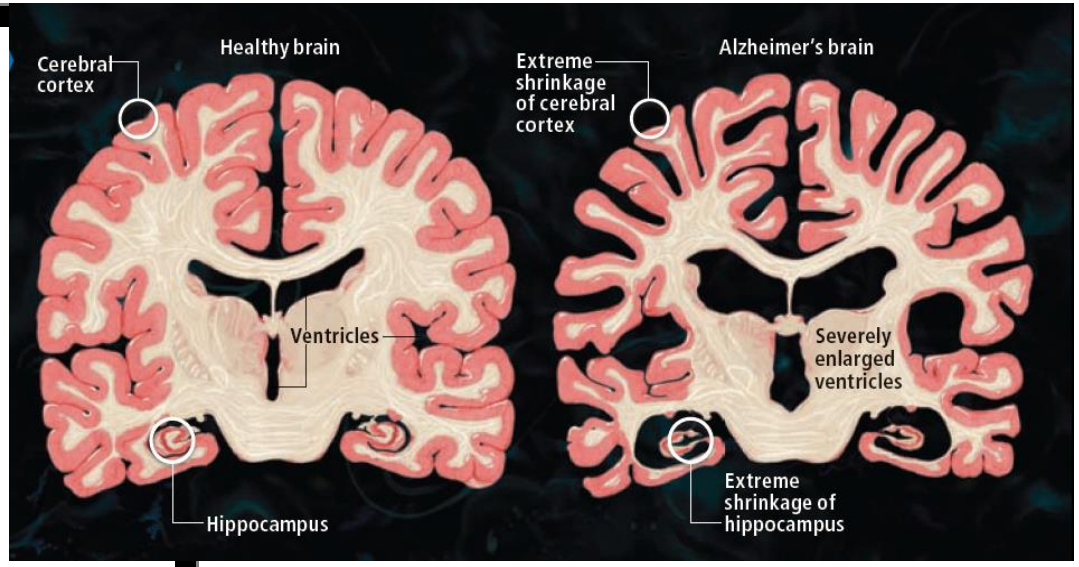
第七次全 国人口普查 国家统计局局长 宁吉喆 2021年5月11日

Age	All	0 – 14	15 – 59	≧60		61 - 64	≧65
#	1.41 B	253 M	894 M	264 M		73 M 5.20%	**191 M** **13.50%**
%		17.95%	63.35%	18.70%		These 2 columns are breakdowns of the ≧60 column to the left.	
% Dif.	2010 1.34 B **+5.22%**	**+1.35%**	**-6.79%**	**+5.44%**			

Professor Charles Kuen Kao (高錕) (1933-2018), was the recipient of a Nobel Prize in Physics in 2009, & was known as the
"Father of Fibre Optics".
He had Alzheimer's Disease, as did his father.

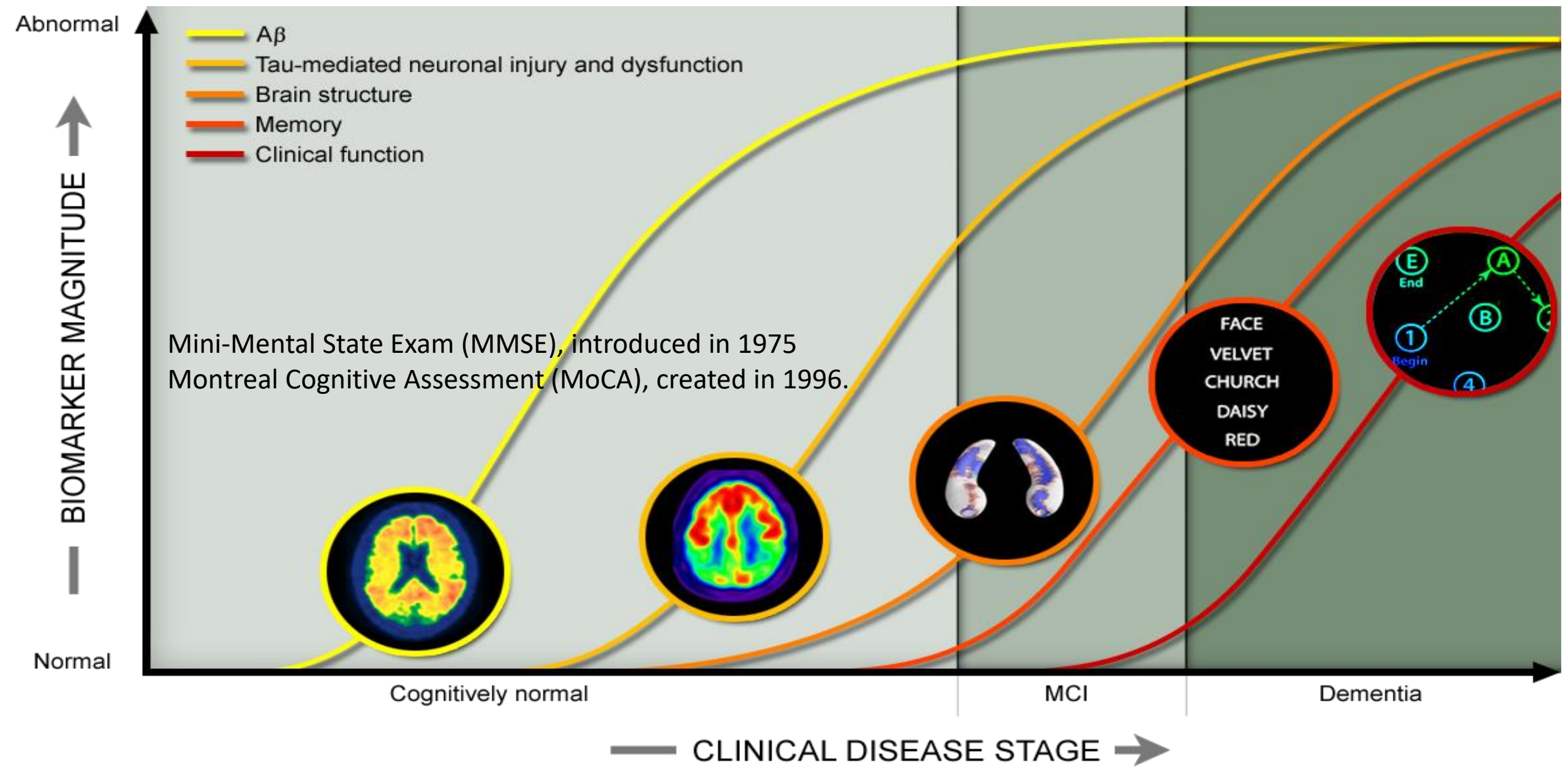


Note striking enlargement of the **ventricles**, & volume reduction in subcortical structures, especially **Entorhinal Cortex** & **Hippocampus**.

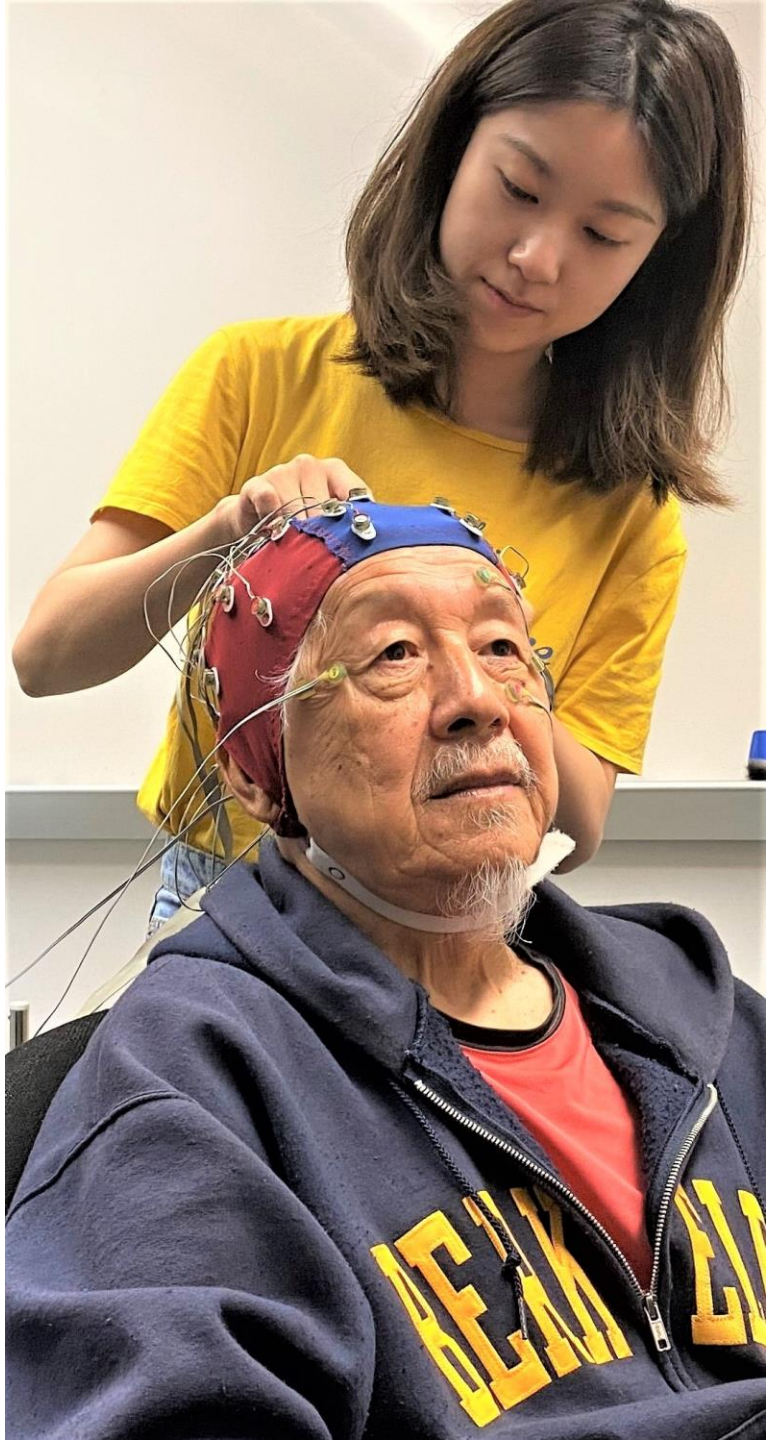


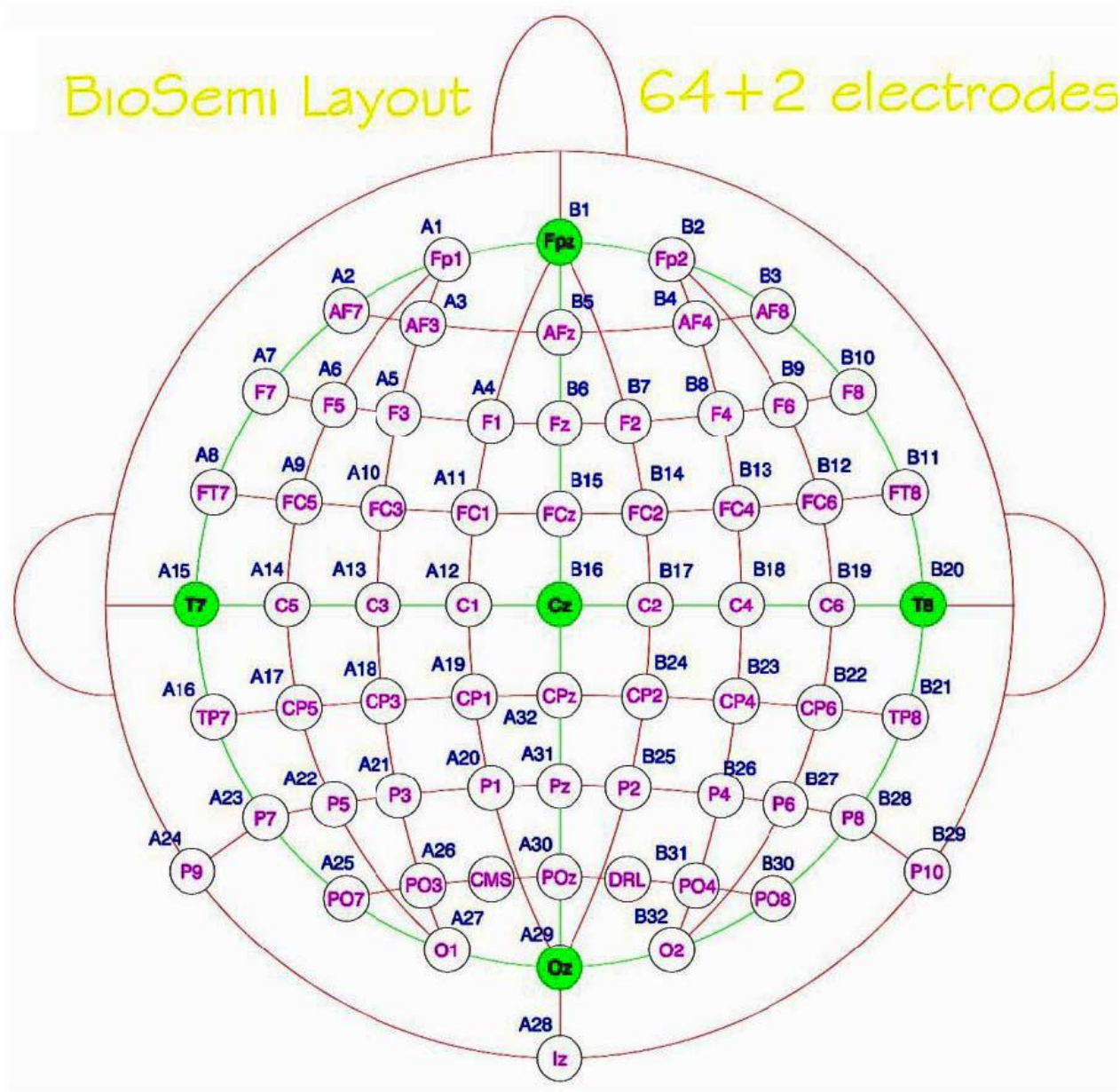
Cabeza, R.et al. eds. 2005:41. *Cognitive Neuroscience of Aging Linking Cognitive and Cerebral Aging*: Oxford University Press.

Stix, G. 2010. Alzheimer's: Forestalling the darkness. *Scientific American* 50-7.

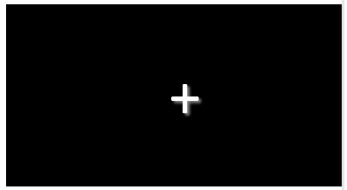


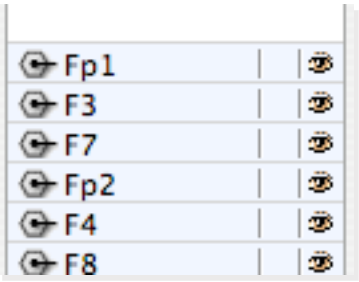
http://adni.loni.usc.edu/studydesign/background-rationale/ Based on Jack, C.R., et al. (2010). Hypothetical model of dynamic biomarkers of the Alzheimer's pathological cascade. *Lancet Neurol.* *9*(1), 119-128.





Subject A. BioSemi 32 channel. 20200902 @ GH146 HKPU




Fp1
F3
F7
Fp2
F4
F8

T1 MP-RAGE

TE = 2.29 ms TR = 2000 ms TI = 900 ms

Video produced by Manson Fong, 2017.

Young

Old

Tzeng, O. J. L. and W. S.-Y. Wang. 1983. The first two R's. American Scientist **71**: 238-243.

Stroop, J. R. 1935. Studies of interference in serial verbal reactions. Journal of Experimental Psychology **18**: 643-662.

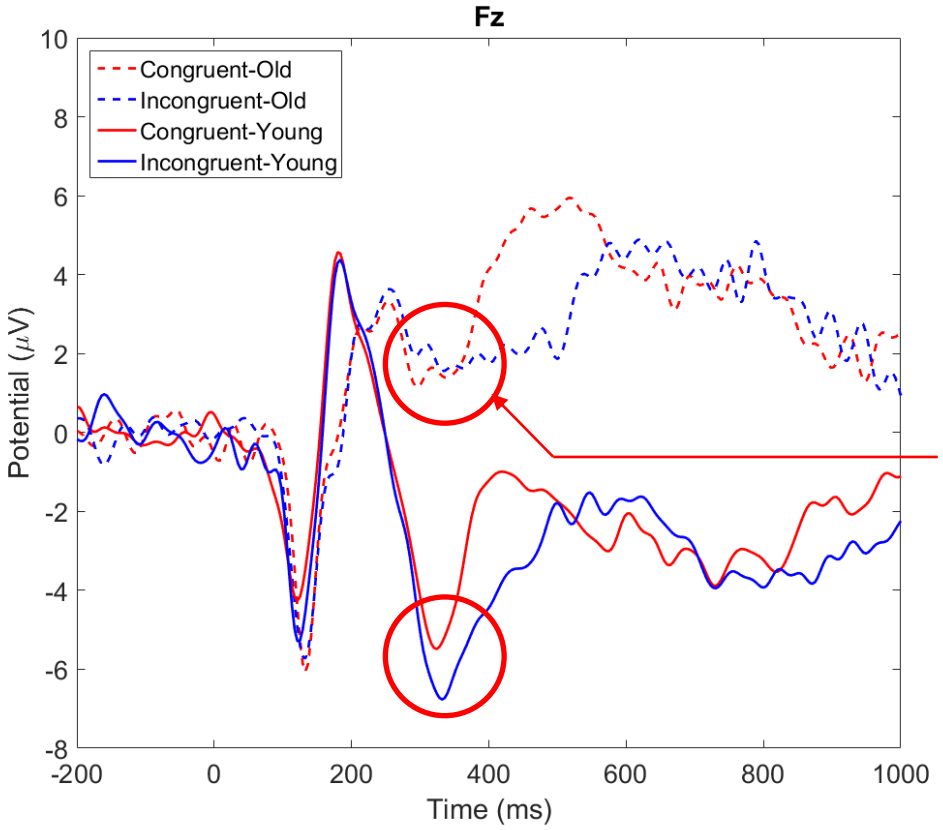
BLUE **PURPLE** **GREEN** **RED**

GREEN **BLUE** **RED** **PURPLE**

紅 紫 綠 藍

藍 綠 紅 紫

Our previous findings



Congruent

Incongruent

N2: inhibitory processes are less effective in older adults

Inhibition Deficit Hypothesis

Q1: In the language domain, what are the behavioral consequences of the decline in inhibitory control?

- Intact automatic semantic retrieval
- Deficits in controlled semantic retrieval

Bilingual Advantage Hypothesis

Q2: What factors contribute to the individual differences?

- Bilingualism
- English proficiency
- Gender
- Age of acquisition of English
- Education

Stroop task

Fong, Hui, Fung, Chu, & Wang (2018). *Neuroscience Letters*.
Fong, Hui, …, & Wang (2020). *Quarterly Journal of Experimental Psychology*.
Fong, Law, Ma, Hui, & Wang (2021). *Brain & Language*.
Hui, Yuan, Fong, & Wang (2020). *International Journal of Bilingualism*.

我們今天的題目是語言與認知，這是個很大的領域，我們只能蜻蜓點水簡略地談其中一小部份的問題。因为時間不多，PPT裡有些圖片我也没能解釋清楚。可是哪些同學有興趣，我會求之不得，非常樂意地把PPT寄給你，讓你們多點時間好好地思考今天的討論。

語言是認知的產物，而認知又建立在意識的基礎上。前面我曾經說過，十幾年前，劍橋大學有一組資深科學家表明，很多不同種類的動物都有意識，包括與我們同屬靈長目的許多其他動物，所以牠們有自我覺知的能力，也能與同伴建立友誼、相互合作來達到共同的目標。認知同時包括了理性和感性兩部分，因此與我們相近的靈長動物，也會感受到不公平的待遇而發怒。可是牠們的大腦還沒有能力充分學會人類語言，因此牠們的認知有明顯的上限。

我們的大腦很獨特，但是直到近幾百年，才開始有系統性的大腦研究。上面探討過的19世紀中葉的幾類病人，讓我們知道大腦損傷怎樣影響行為，有的會導致不同型態的失語症或失讀症，有的是性格大變，完全成了另一個人。目前全球的人口都在老化。 隨著年齡的增長許多神經退化及認知障礙的問題都大量地進入社會。面臨這個迫切挑戰，語言學家也可以用先進的方法，與很多別的學科同心協力應對這個挑戰，把 ‘生老病死’這四個步驟中的「病」減低，讓老人能健康地繼續工作或安享晚年。我們若能結合多學科研究做到這一點，將是非常有意義的事，對社會，對語言學、認知科學、基因學和神經學也都會是莫大的貢獻。

Thank you !!

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