Science in Classics
经典中的科学

Eric Kandel (坎特尔)

In Search of Memory (《追寻记忆的痕迹》)

The Emergence of a New Science of Mind

Big questions

- Do I have a soul (灵魂)?
- Do I have a mind (思維)?

Yes? No?

Evidence?

Core Questions

What is the human mind?

[Does the human mind exist?]

[How do we know whether it exists?]

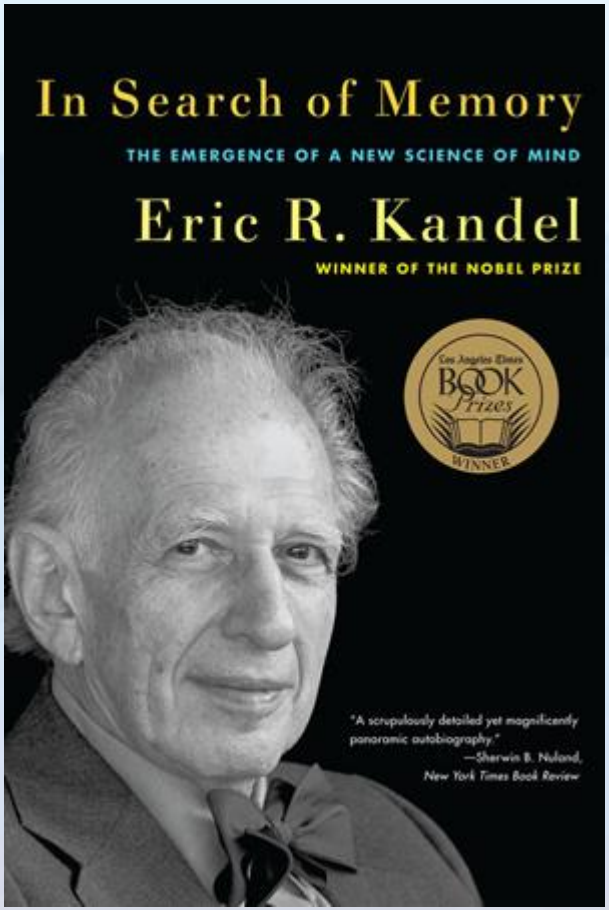
What makes us human and who are we?

- We think, we feel, we remember, we reflect,…
  - How can our mind have these amazing capabilities?
  - How does our mind come into existence? From our brain?

More than 2000 years …

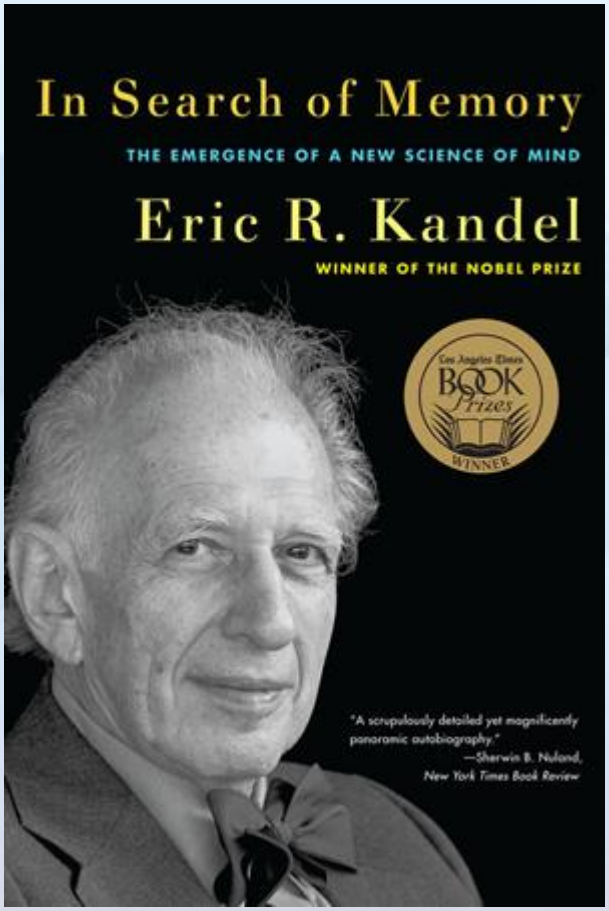
- These questions have been asked for more than 2000 years.
- Poincaré could only speculate (猜测).
- Only until recent decades, scientists are getting ready to tackle (处理) these problems.

Text



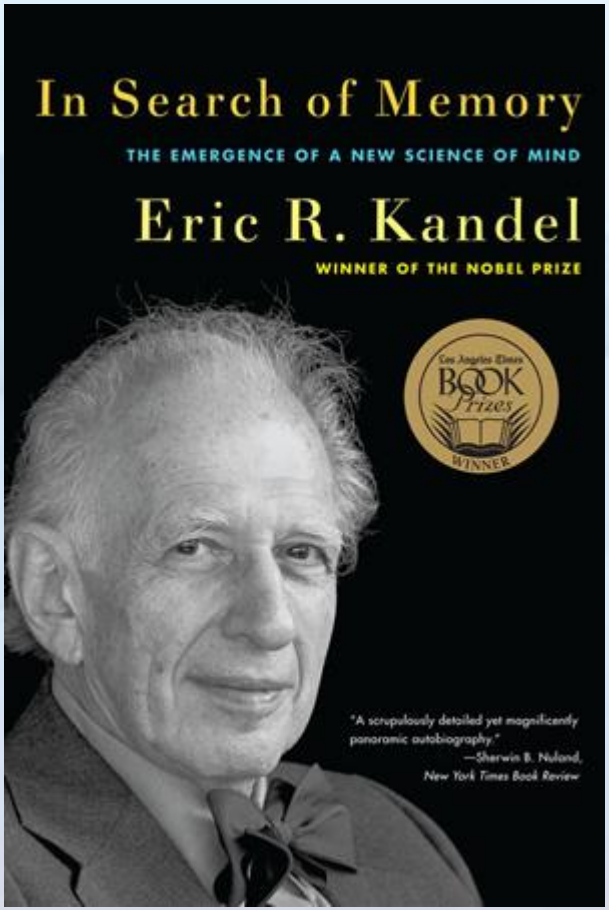
- New York: W.W. Norton, 2006.
- Eric R. Kandel
  - Nobel Laureate in Physiology or Medicine in 2000 for his contribution to the study of memory storage in the brain.
- Selected chapters
  - Ch. 4 “One cell at a time” (selection)
  - Ch. 28 “Consciousness”

In Search of Memory



- "Memory": a pun (相关语)
- Partly autobiography (自传)
- Partly the intellectual history of *the emergence of a new science of mind*
  - Understanding the human mind in biological terms at the levels of cells and molecules.

In Search of Memory



"*In Search of Memory* engagingly recounts Eric Kandel's bold life at the frontier of brain science, where his molecular biological approach has revolutionized human understanding of how information received by our senses becomes hard-wired."

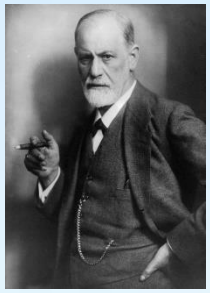
James D. Watson (!)

In Search of Memory (film)

A Film by Petra Seeger (2008)
Trailer: http://www.youtube.com/watch?v=9Yh1odPMgXI

Eric Kandel

- Born 1929 in Vienna, Austria.
- Fled to the U.S. in 1939, one year after Hitler (希特勒) came to power.
- Majored in modern European history and literature at Harvard University.

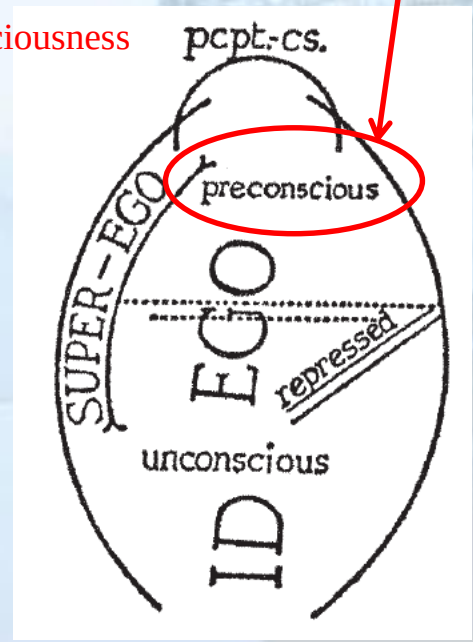


Influence of Sigmund Freud

- Fascinated by psychoanalysis. Entered medical school at New York University.
- Entered Harry Grundfest's laboratory at Columbia University for a 6-month selective period in 1955.
- Chapter 4: "One cell at a time"

Structural Theory

- by Sigmund Freud
- Chapter 4, Para. 2-5
- Mental functions: conscious 意识的 and unconscious 无意识的 (can be known by psychoanalysis 精神分析)
- Psychic agencies (精神媒介):
  - ego (conscious + unconscious) 自我
  - id (unconscious) 本我
  - superego (unconscious) 超我



This lecture

1. The mind-body problem.
2. The biggest problem in science?
   - Easy problem: unity of consciousness
   - Hard problem: subjectivity
3. Free will?

1. Mind-body problem

- Dualism (二元论):
  - mind and body = two kinds of stuff
- Monism (一元论): only one kind of stuff
  - entirely matter, or
  - entirely mind

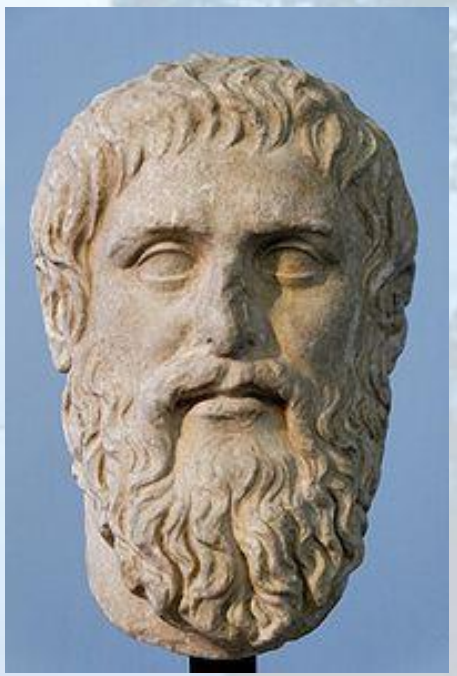
Dualism

“Please use your brain”

[你用脑袋想想好吗？]

Dualism: mind-body dichotomy (二分)

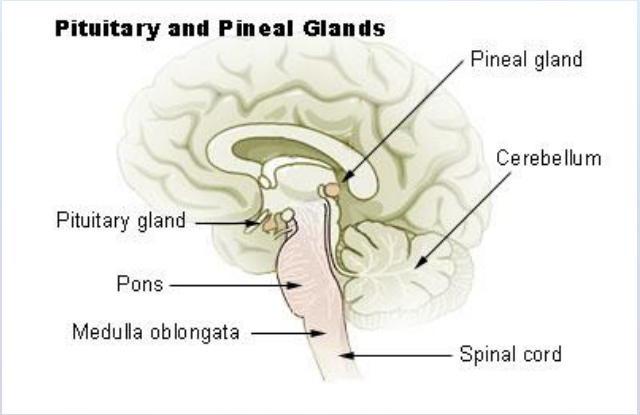
- Plato (Ch. 28, Para. 5) argued that
  - Body: from the material world.
  - Soul: from the world of ideas, immortal (不灭).
- Death: the body dies, the soul goes back to the ideal world.
- "the upward journey of the soul to the intelligible realm" (*Republic*)



René Descartes (笛卡尔)

René Descartes
(1596-1650)

- Ch. 28, Para. 6.
- Mind: nonmaterial.
- Body: material.
- mutual influence.
- Pineal gland (松果体): seat of the soul.



Monism

Entirely mind: a fantasy

Entirely matter: physicalism (物理主义)

Physicalism

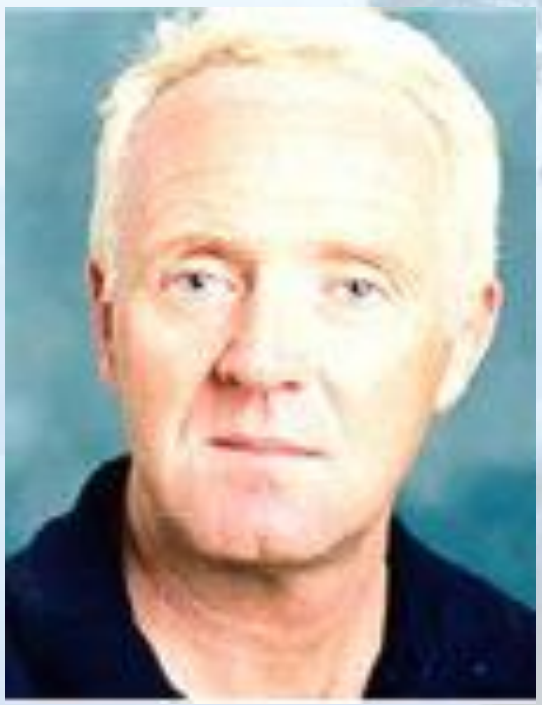
- Consciousness: a result of the physical events in the brain. (Ch. 28, Para. 8)
- Suggests a possibility of *scientific* study (but some disagree).

8 Today, most philosophers of mind agree that what we call consciousness derives from the physical brain, but some disagree with Crick as to whether it

(Chap. 28, Para. 8)

Colin McGinn (Ch. 28, Para. 8)

- The architecture of the brain ⇨ limitations of cognitive capacities
- Consciousness cannot be studied.



Colin McGinn, 1950-

http://www.as.miami.edu/phi/people/faculty.html

Daniel Dennett (Ch. 28, Para. 8)

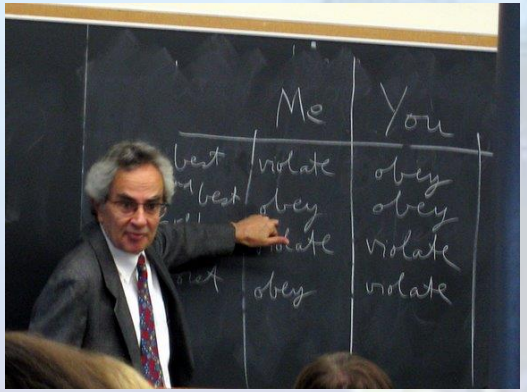
- Consciousness can be understood.
- Result of higher-order areas of the brain working together.

Daniel Dennett, 1942-
(*Wikimedia Commons*)

Searle and Nagel (Ch. 28, Para. 9)

- A middle position.
- Consciousness: biological processes.
- Objective: these processes can be analyzed.
- Subjective: the feelings are too complicated for studying.

John Searle, 1932-
(*Wikimedia Commons*)



Thomas Nagel, 1937-
(*Wikimedia Commons*)

This lecture

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2. The biggest problem in science?

- Chapter 28: “Consciousness” (意识)

“Understanding consciousness is by far the most challenging task confronting science.” (Para. 3, Chap. 28)

Eric Kandel in *In Search of Memory*, 2006

“If you think you have a solution to the problem of consciousness, you haven’t understood the problem.”

Susan Blackmore in *Consciousness: An Introduction*, 2011

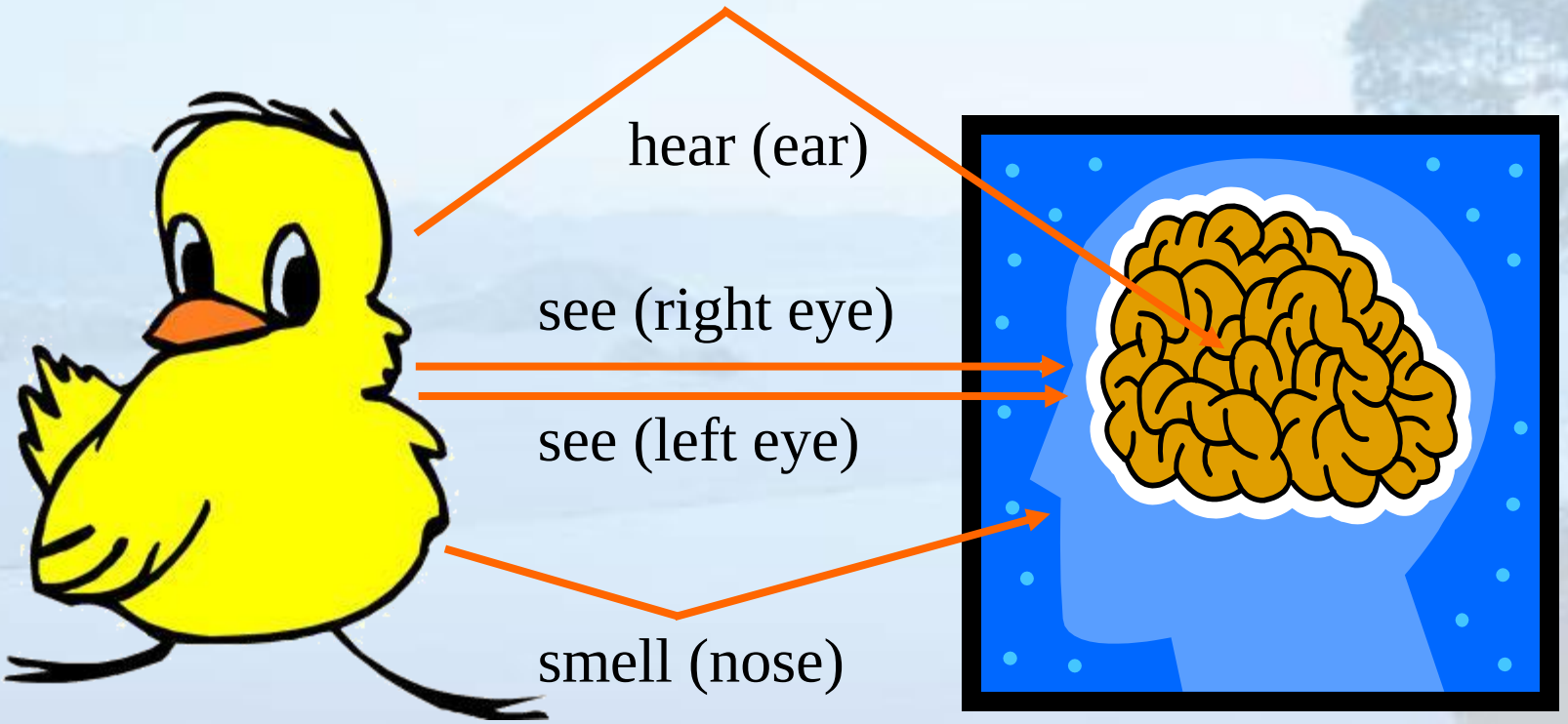
Working definitions (*Wikipedia*)

- Mind
  - The complex (综合体系) of cognitive faculties (官能) that enables consciousness, thinking (思考), reasoning (推理), perception (感知), judgment (判断), and memory (记忆).
- Consciousness (also see Ch. 28, Para. 2)
  - A state of perceptual awareness, selective attention.
  - An awareness of self, an awareness of being aware.
  - Subjective experience, reflection upon those experiences.

The biggest problem in science?

- Why is it so challenging?
- Two characteristics of consciousness
  a. Easy problem: Unity 統一性
  b. Hard problem: Subjectivity 主观性

a. Easy problem: unity of consciousness



- Signals from 4 different channels.
- There are not 4 consciousnesses.

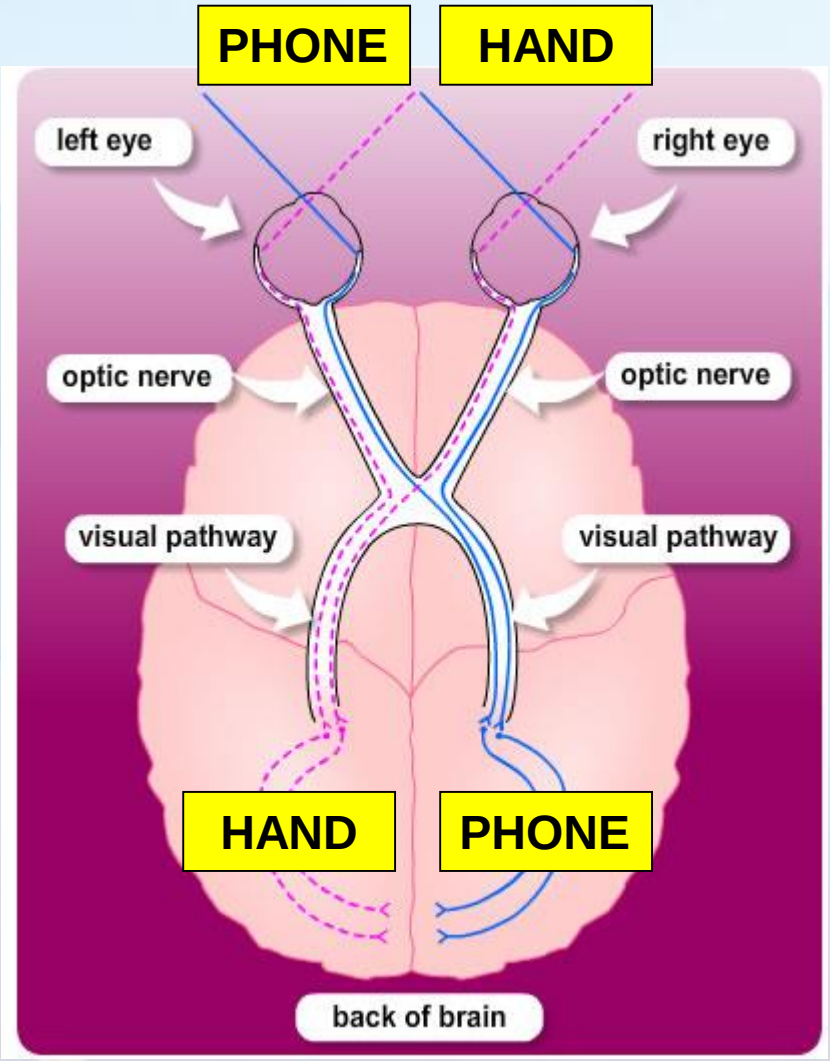
- Our experiences come to us as a unified whole.
- All of the various sensory modalities (感官形式) are merged into a single, coherent (一致), conscious experience.
- Example: from your eyes, unified vision instead of 2 separated streams of images.
- Why do we seem to experience only *one* conscious mind? Not two, three or many?

Two conscious minds?

- “This unitary nature can break down. In a surgical patient whose brain is severed (断绝连接) between the two hemispheres, there are two conscious minds, each with its own unified percept.” (Chap. 28, Para. 11)
- How?

Split brain (From BBC's *Brain Story*)

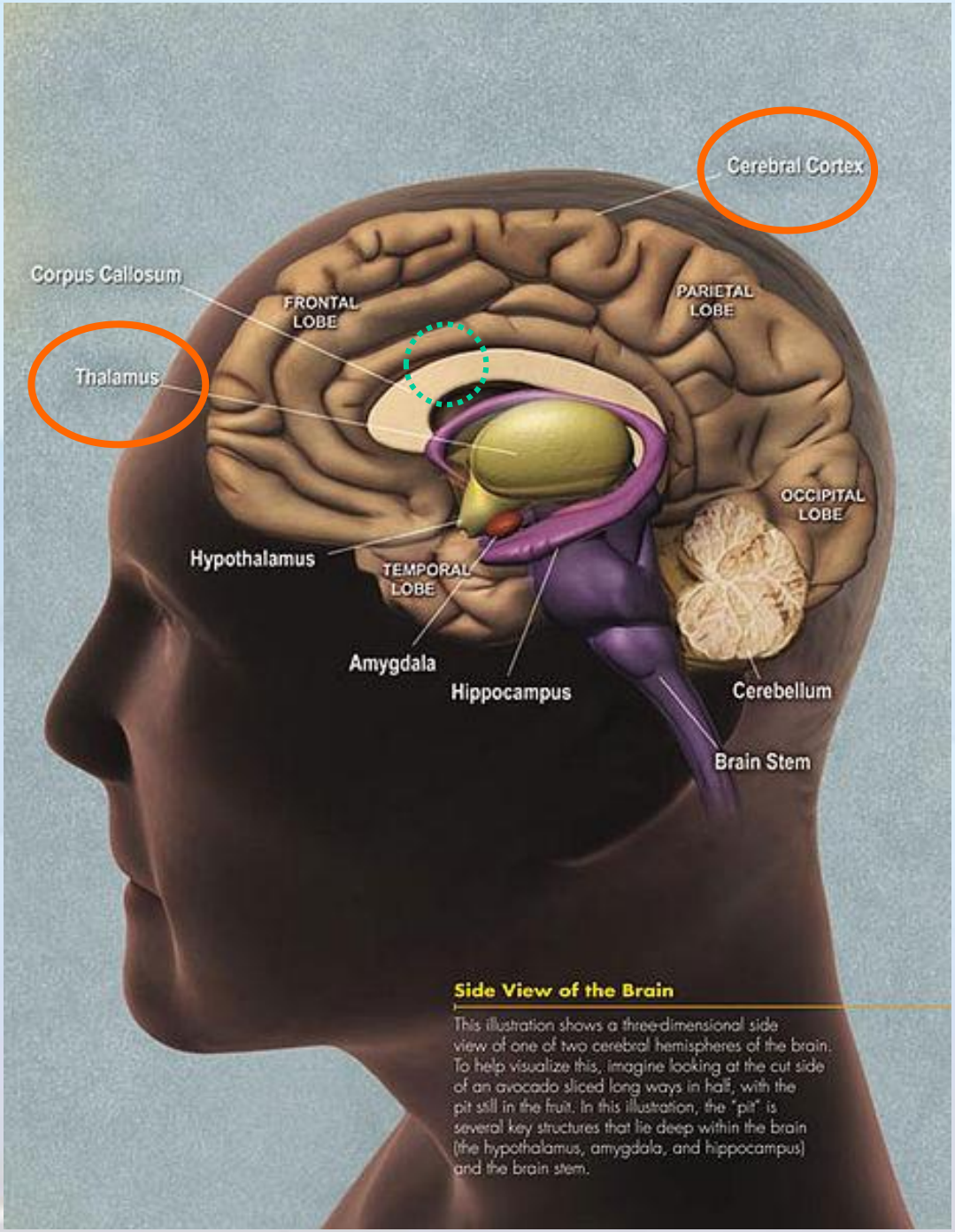
Split brain



- Prevent almost all information from the senses travelling across the two hemispheres.
- Left hemisphere: verbal.
- Right hemisphere: pictorial.
- Draw a phone.
- Each hemisphere with its own percept.

Two theories

- Where does the unity of consciousness take place in the brain?
- Edelman's theory: Widely distributed throughout the cortex (脑皮层) and thalamus (丘脑).



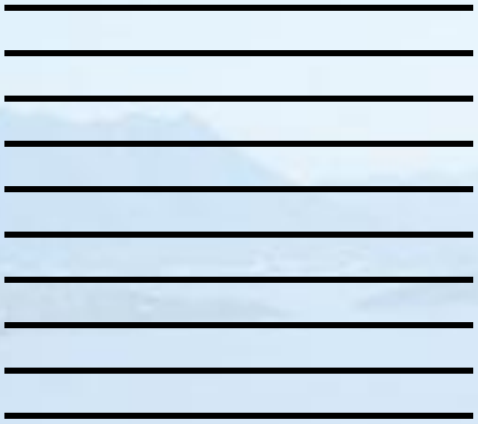
Edelman

Crick and Koch

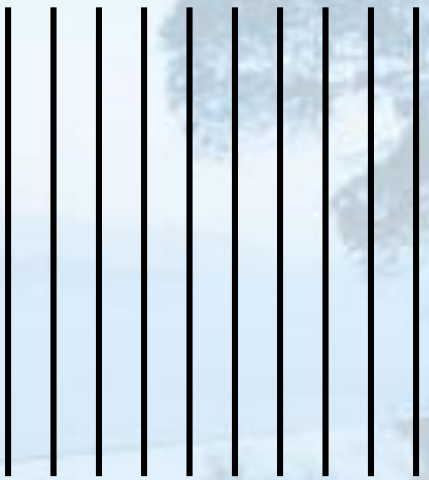
(*Wikimedia Commons*)

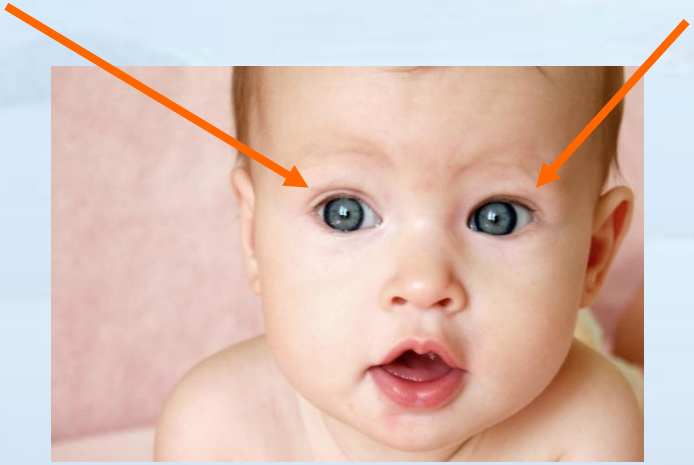
- Crick and Koch's theory
  - Francis Crick (co-discoverer of the DNA structure)
  - A specific set of neurons. Claustrum (屏状核)? (Chap. 28, Para. 23)
  - A sheet of brain tissue below the cortex.

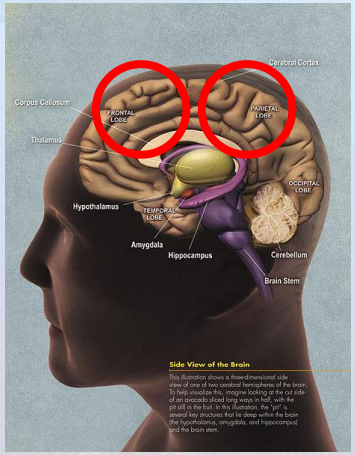
Binocular rivalry (双眼竞争) experiment



switch back and forth







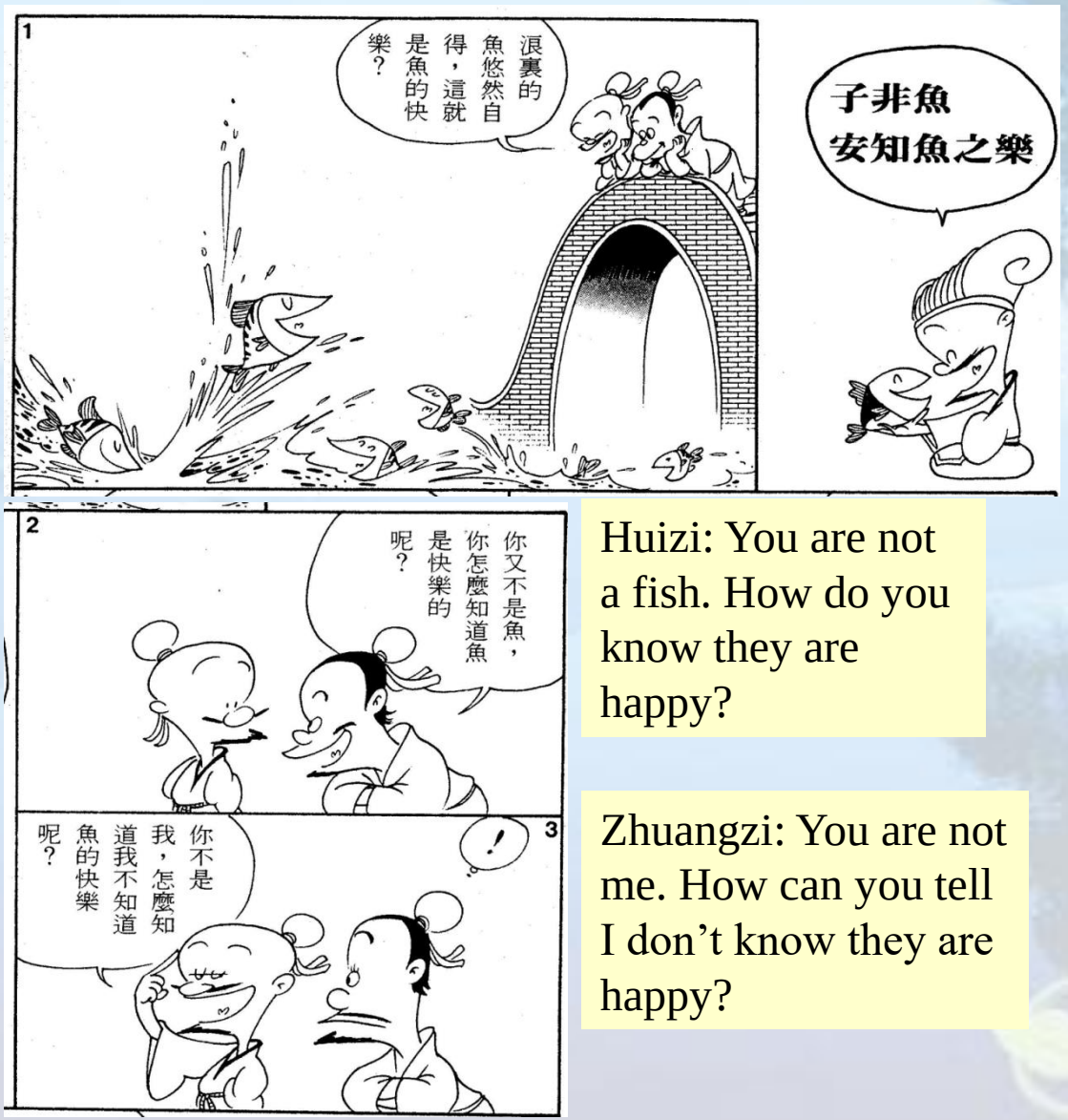
The frontal and parietal (脮顶部) areas of the cortex very active

b. Hard problem: subjectivity

- We experience our own ideas, moods, and sensations directly.
- We can only appreciate another person's experience indirectly, by observing or hearing about it.

Zhuangzi and Huizi are on a bridge over Hao River.

Zhuangzi: The fish are swimming cosily. How happy they are!



Huizi: You are not a fish. How do you know they are happy?

Zhuangzi: You are not me. How can you tell I don't know they are happy?

Hard problem: subjectivity

- Is your response to the salty taste you feel (before you call it salty) identical to my response to the salty taste I feel?
- How does electrical activity in neurons give rise to the "meaning" we ascribe to that taste?
  (We do not understand!)

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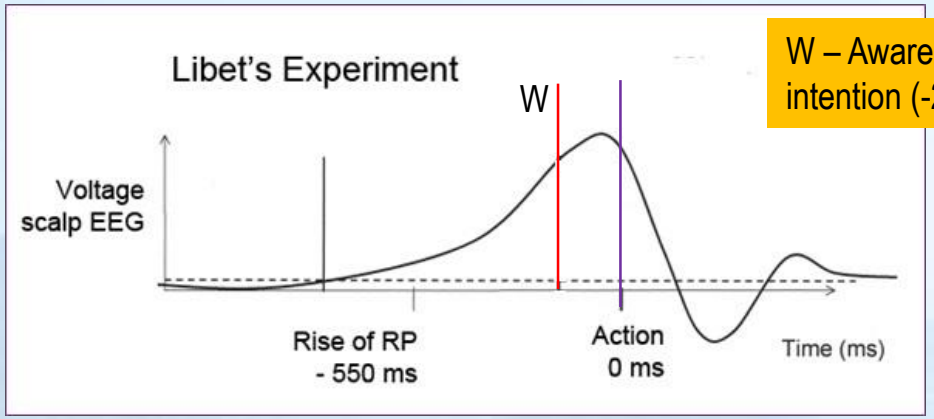
3. Free will (自由意志)?

- Free will
  - The ability to choose for ourselves what to do.
- Libet's experiment.

Libet's experiment



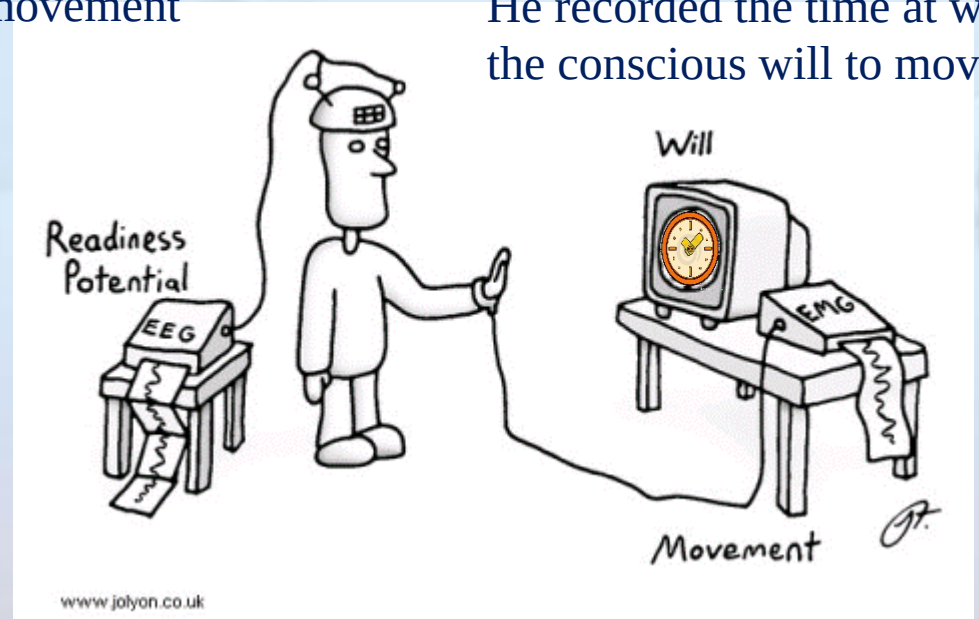
W – Awareness of intention (-200 ms)

His brain appears to prepare for movement long before he consciously decided to move.

Does he have free will?

The brain signal of his movement (pressing a button)

He recorded the time at which he first felt the conscious will to move this finger.



Libet's experiment (From BBC's *Brain Story*)

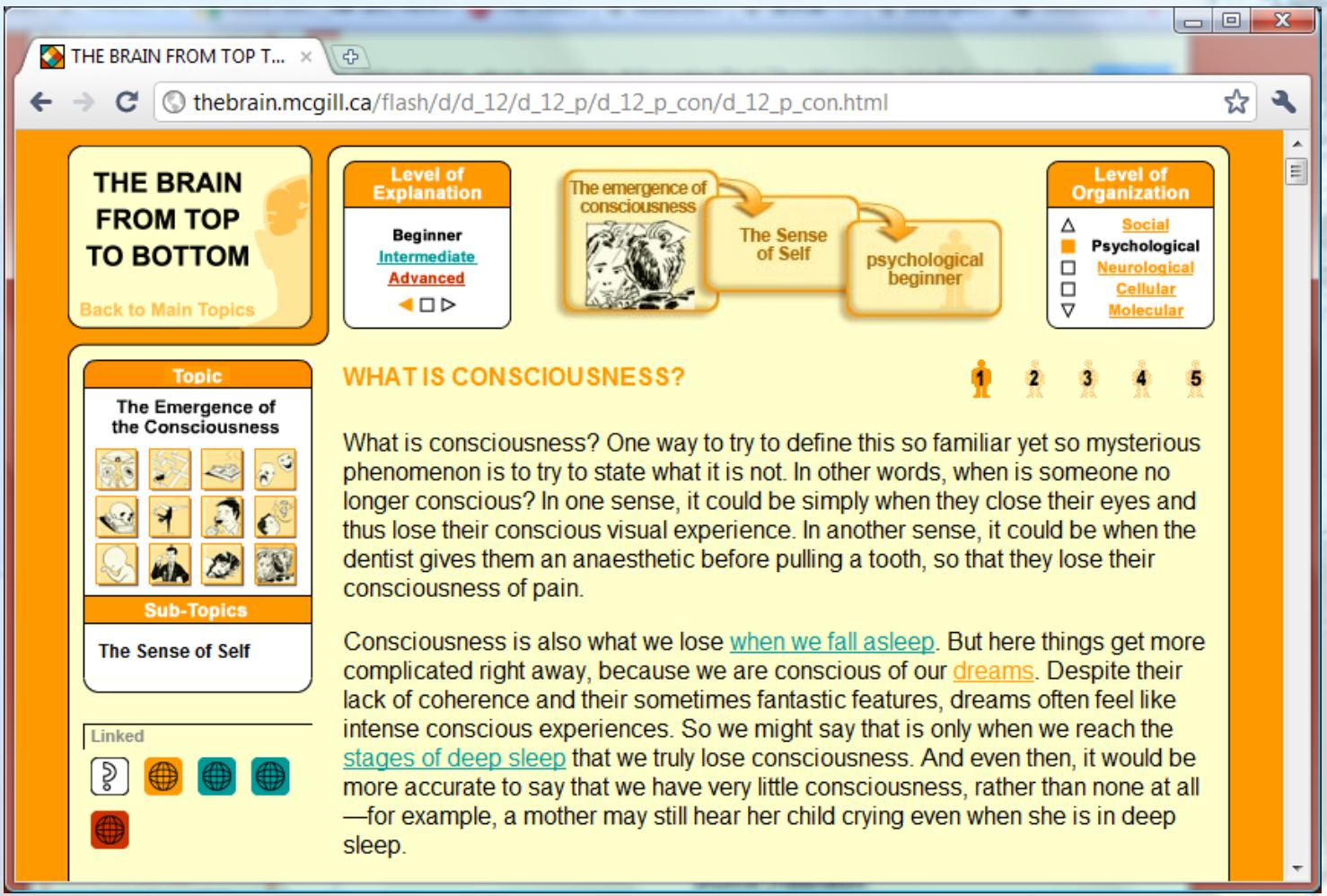
Many questions…

- Dualism or monism?
- How do physical processes in the brain give rise to subjective experience? (Subjectivity of consciousness)
- How do we have a conscious, coherent, unified perception of objects? (Unity of consciousness)
- Can consciousness be studied scientifically?

One more question to ponder on

Who am I?

The Brain From Top to Bottom



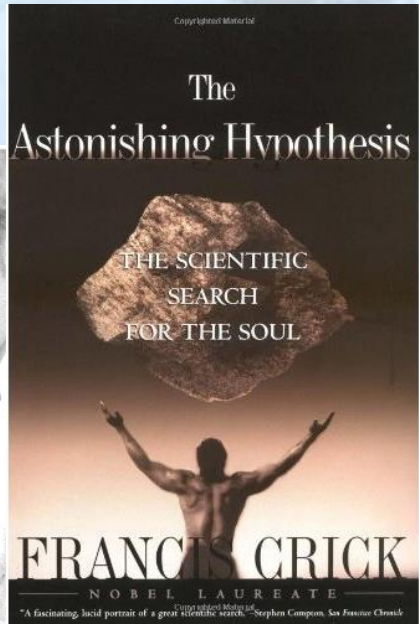
http://thebrain.mcgill.ca/

Crick's "astonishing hypothesis"

"You," your joys and your sorrows, your memories and you 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.

"You're nothing but a pack of neurons."

- Francis Crick, 1994.



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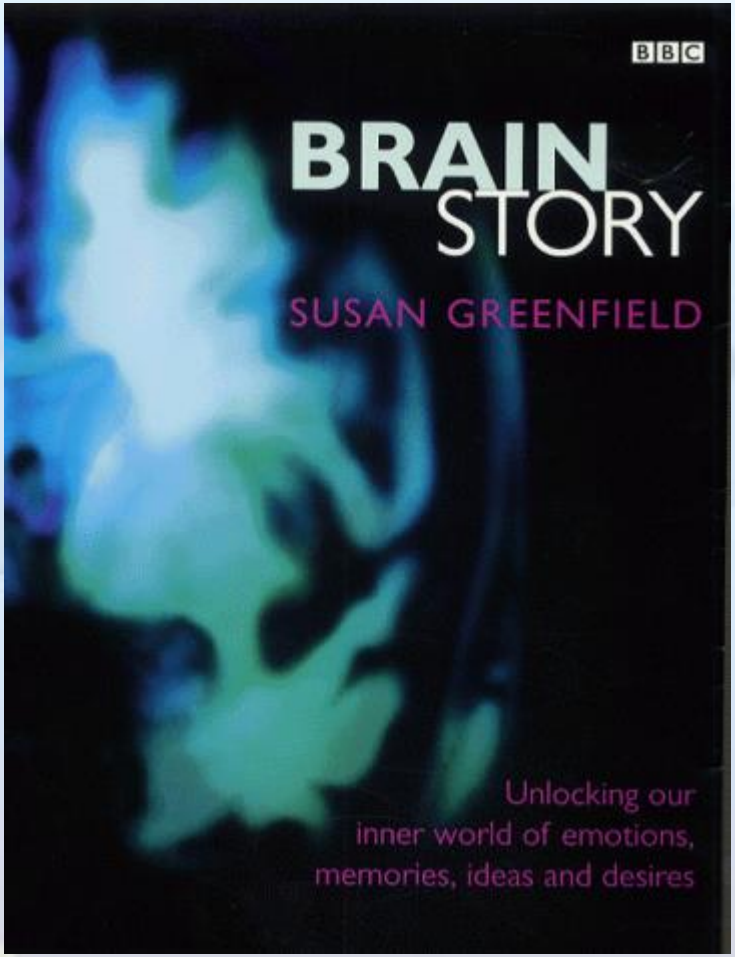
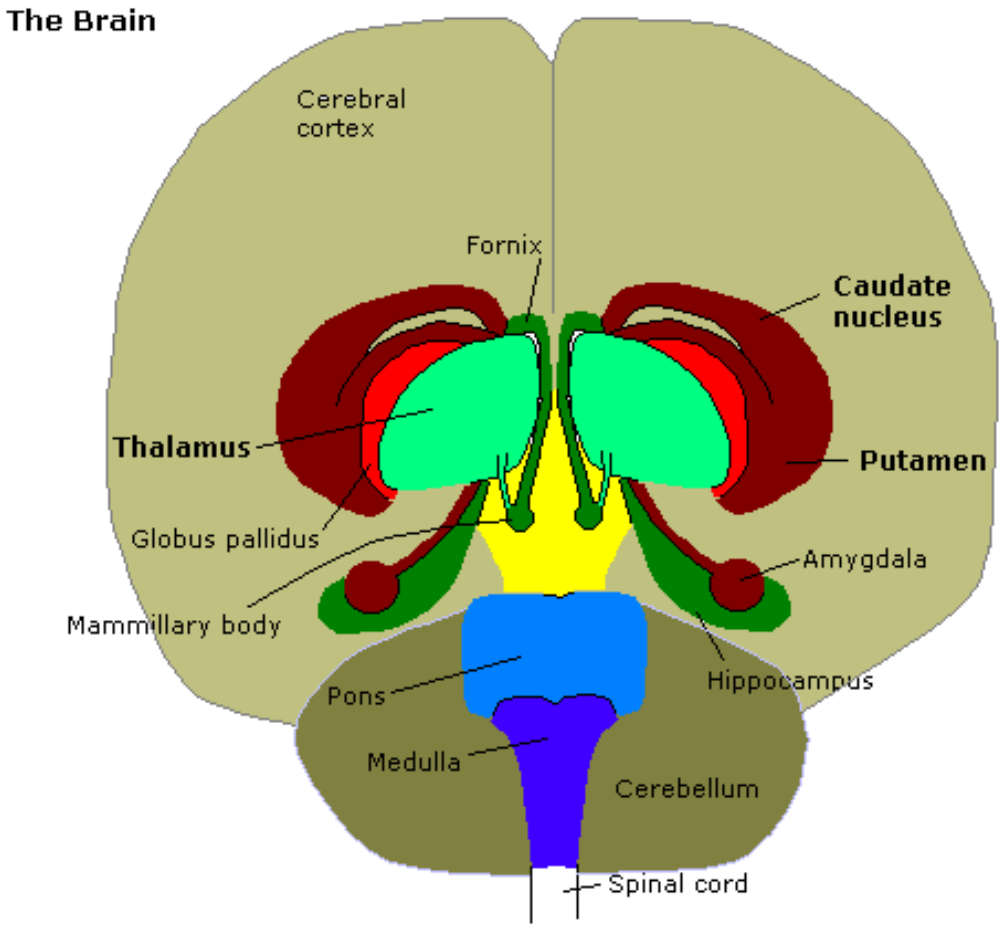


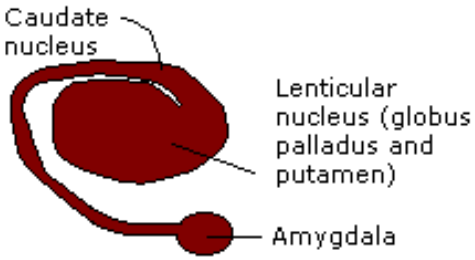
- Documentary: *Brain Story* (BBC)

1. All in the Mind
2. In the Heat of the Moment
3. The Mind's Eye
4. First Among Equals
5. Growing the Mind
6. The Final Mystery



The brain as viewed from the underside and front. The thalamus and Corpus Striatum (Putamen, caudate and amygdala) have been splayed out to show detail.

Corpus Striatum



http://en.wikipedia.org/wiki/Amygdala

Major references

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