

Intro to Behavioral Neuroscience (B)

Lecture 1: Introduction to Course

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<https://youtu.be/Q6aU6cxMiiA>

Lecture video at above link.

Contact Me

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My Offices (please tell me before you come):

- Medical Campus -- E Building 109 (1st floor)
- Medical Campus -- C Building 406 (4th floor)

This course is ONLINE fall 2020 (due to COVID-19)

→ So, email me.

Meet your Professor

→ USAian, raised in Europe

→ Education Background:

Computer Science (Robotics, Artificial Intelligence)

Cognitive Science (Developmental, Linguistic)

Neuroscience (especially computational)

→ Education etc.

Ph.D., predocs: Indiana University, Tufts University

Postdoc: National Institute for Physiological Sciences

Now: Asst. Professor @ Kyoto University

Hobbies

Ultimate Frisbee

Cycling

Skiing

Reading...



2018 US
Open



Ultimate Frisbee
“Osaka Spirits”



Me, sister, mom
@ Patagonia

What is: Behavioral Neuroscience B?

Behavioral Neuroscience A covered:

- Cells in the nervous system
- Methods for investigating the nervous system
- Neuroscience of perception (sight, sound)
- Neuroscience of motor control (movement)

What is: Behavioral Neuroscience B?

Behavioral Neuroscience A covered:

- Cells in the nervous system
- Methods for investigating the nervous system
- Neuroscience of perception (sight, sound)
- Neuroscience of motor control (movement)

What is missing?

Neuroscience A ↔ Neuroscience B

Behavioral Neuroscience A covered:

- Cells in the nervous system
- Methods for investigating the nervous system
- Neuroscience of perception (sight, sound)
- Neuroscience of motor control (movement)

What is missing?

Higher Cognitive Functions

Neuroscience B

In this course, we focus on ***cognition***:

- Motivation
- Learning
- Emotion
- Language
- Navigation

Neuroscience B

In this course, we focus on ***cognition***:

- Motivation
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I will post the slides and videos from Neuroscience A.

Neuroscience A

I will upload the Neuro A lecture slides on PANDA under RESOURCES.

Minimum *Recommended* Lectures to Watch:

2: Anatomy

3: Brain Cells

4: Nerve Transduction

5: Neurotransmitters

Course Schedule

Unit	Date	Content
1	2020/10/02	Introduction to higher brain functions
2	2020/10/09	Motivation
3	2020/10/16	Learning
4	2020/10/23	Memory
5	2020/10/30	Spatial memory and navigation
6	2020/11/06	Executive functions and planning LIVE SESSION
7	2020/11/13	Emotions
8	2020/11/27	Reproductive behavior
9	2020/12/04	Communication and language
10	2020/12/11	Human language and language disorders LIVE SESSION
11	2020/12/18	Social interaction
12	2020/12/25	Evolution and development of behavior
13	2021/01/08	Neurological and psychiatric disorders LIVE SESSION
14	2021/01/22	Feedback (personal)
15	2021/01/29	Feedback (optional LIVE SESSION)

Grading

- (a) 40% : 10 short tests on PANDA (not every lecture has a quiz!)
→ due 2 weeks after lecture
- (b) 30% : Live Zoom Session (Attendance and Preparation)
→ You will be called on 1 time during semester to give your answer
- (c) 30% : Final Project (1-2 pages on a Neuro B topic)
→ due 22 Jan 2021

Schedule

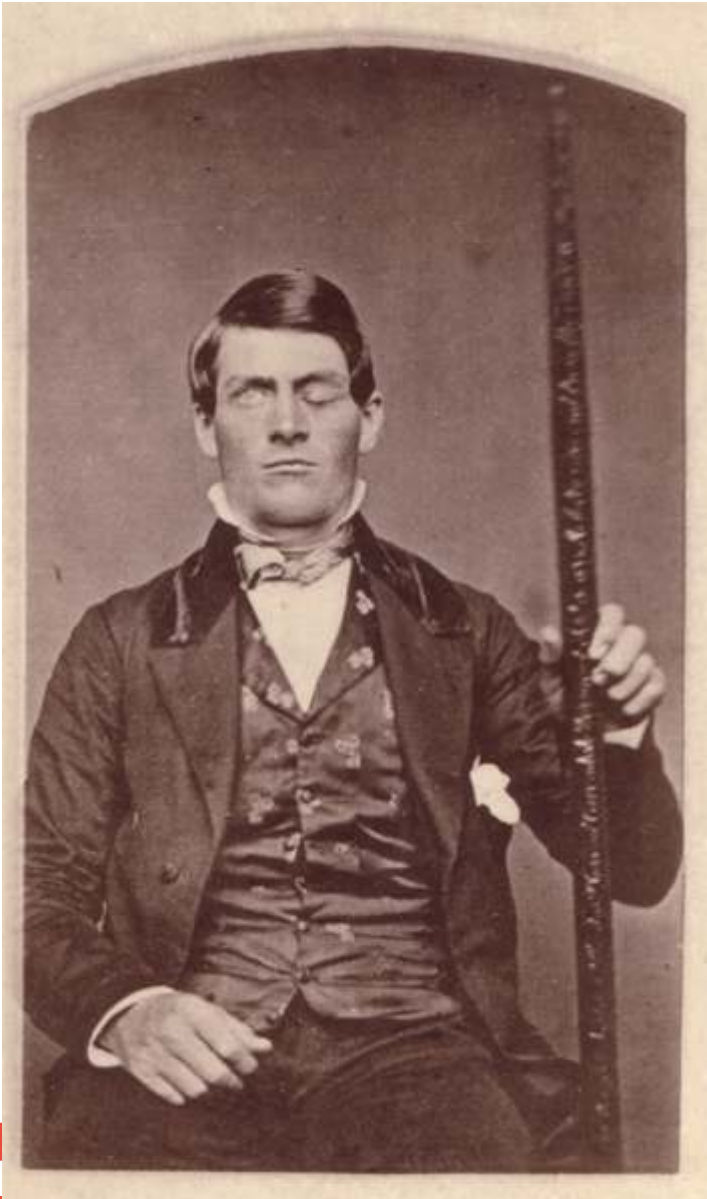
Lectures

I will upload lecture slides (like this one) with a link to a youtube video of the lecture. Watch the lecture and complete the lecture quiz (if there is one) by 2 weeks after the date the lecture is initially uploaded.

Live Sessions

At the class time (16:30 PM Friday) we will have 3 live sessions (11/06, 12/11, 01/08). I will upload questions to think about – you should prepare responses.

Example: The case of Phineas Gage



1848: Phineas P. Gage
25 years old railway construction
foreman in Vermont
experiences an accident

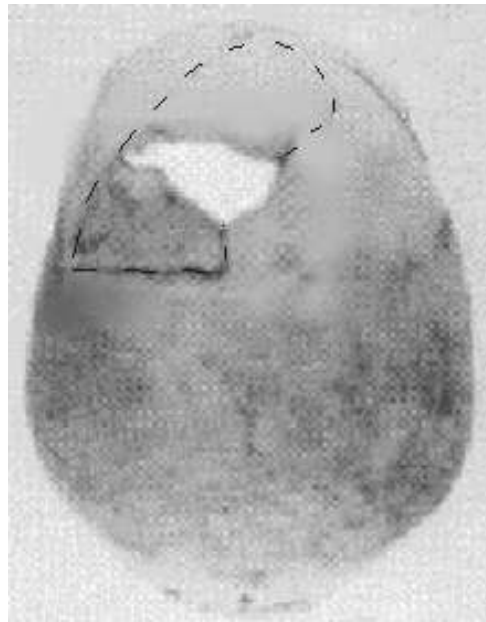
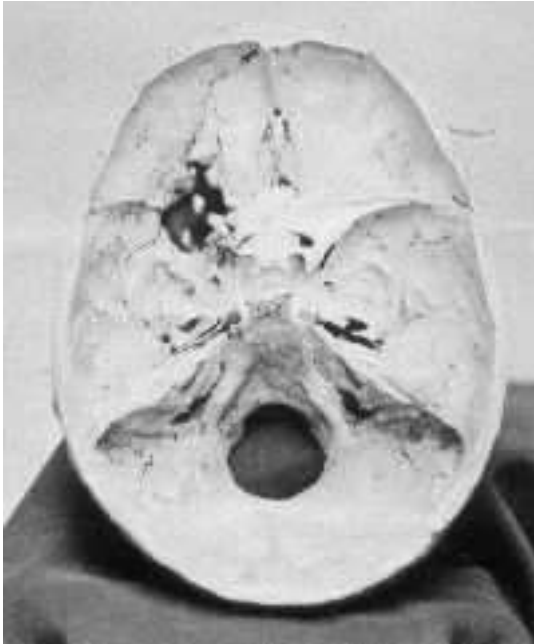
A tamping iron used to pack charges
(~1.1m long, 7kg) blew straight through
his skull, landing 30m behind him.

He was brought to his hotel, awaiting
Dr. Williams saying on his arrival:
“Doctor, here is business enough for you.”

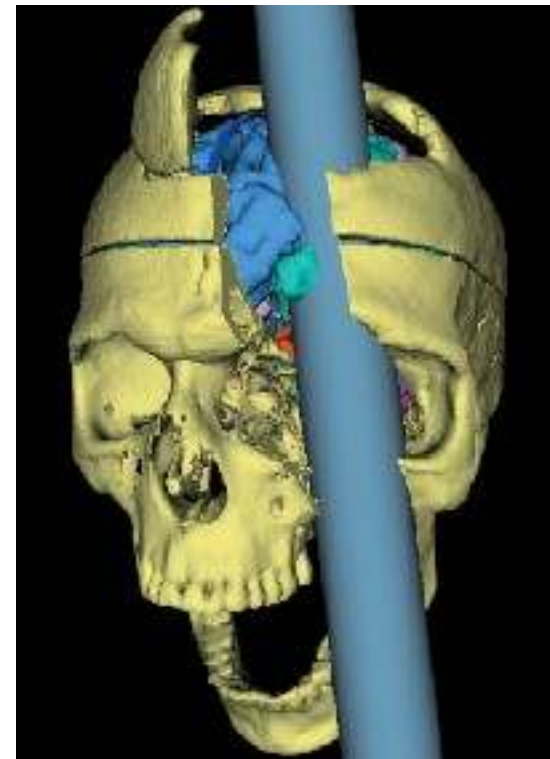
He was later treated by a Dr. Harlow

Malcolm Macmillan
In *Classic cases in neuropsychology*, 1996

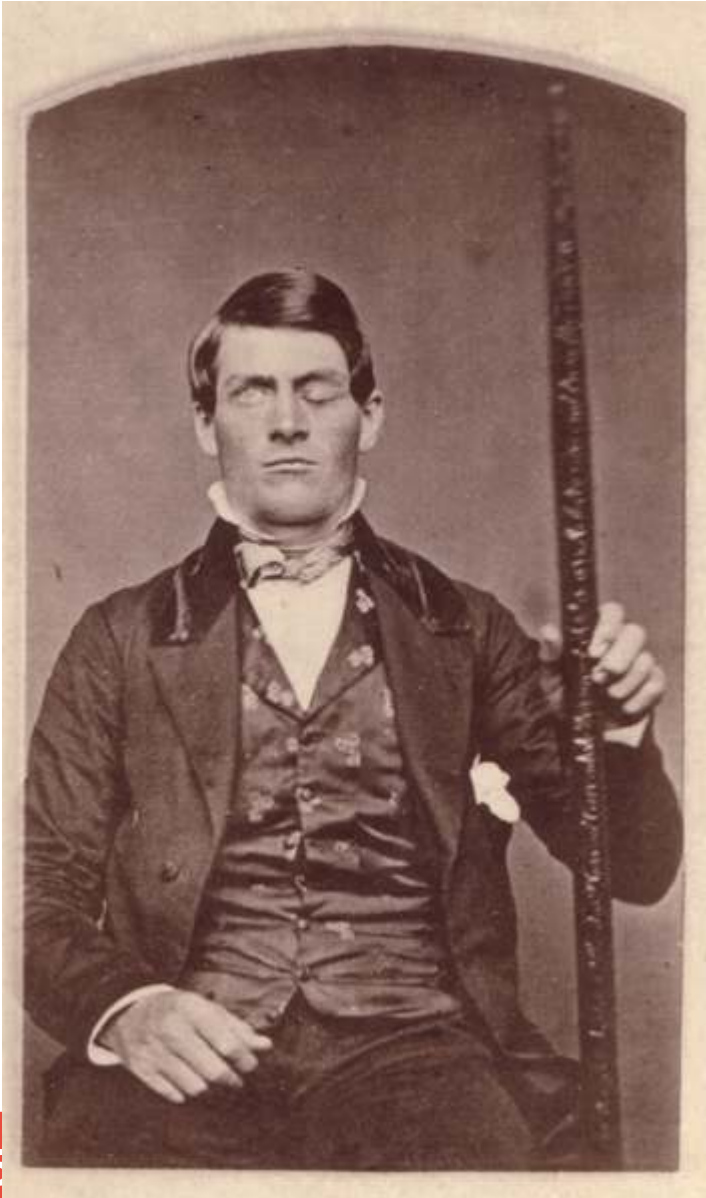
Damage to Brain



Skull bone and 3D
reconstruction



Change in Behavior after Brain Damage



Dr. Harlow:

Before the accident

“temperate habits, ...considerable energy of character.”

“...well-balanced mind...very energetic and persistent in executing all his plans of operation.”

~after about three weeks:

“more wakeful...calls for his pants...appears demented...”

~after about four weeks:

“intellectual faculties brightening”

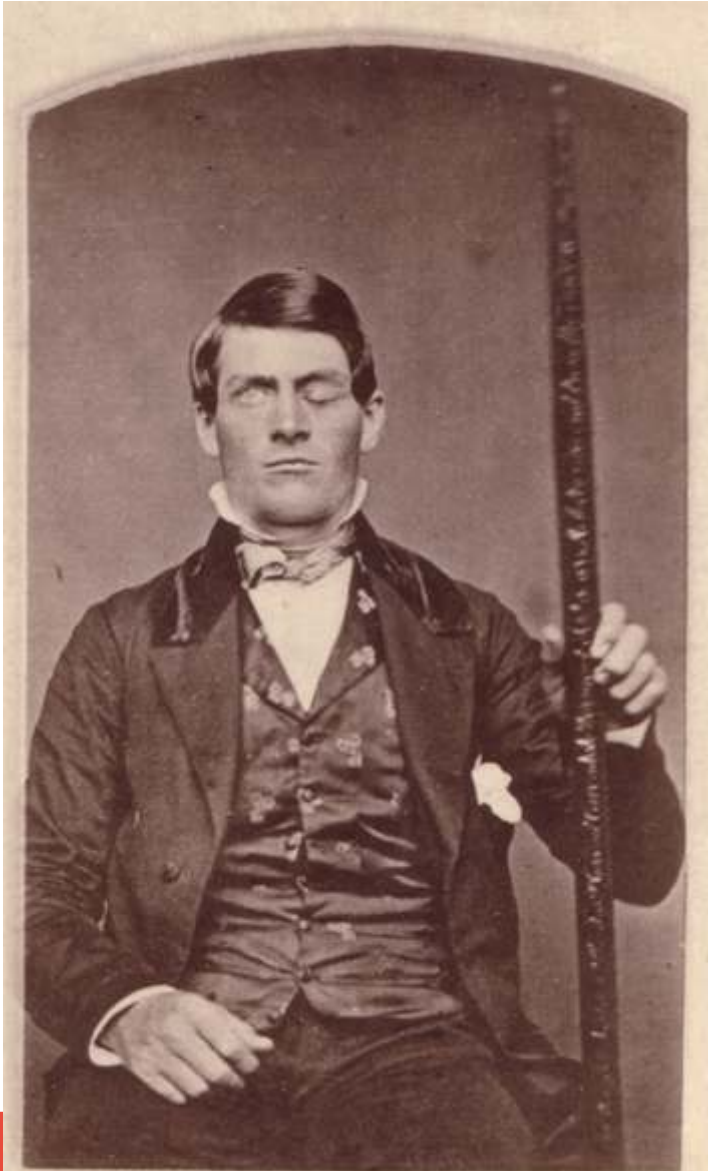
but “does not estimate size or money accurately”,

“exceedingly capricious and childish”

Malcolm Macmillan

In Classic cases in neuropsychology, 1996

Phineas Gage: Epilogue



Never became foreman again.

was employed from 1851 caring for horses,
driving a stage coach (USA, 7 years in Chile).

died in 1860 (epilepsy?, age 37)

The American Phrenological Journal, 1851:
“gross, profane, coarse, and vulgar...”,
wanting in “respect and kindness”

Brain Damage changes Behavior!

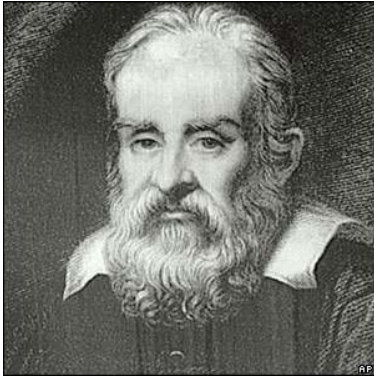
This may not seem surprising to you now, but it means that “privileged” topics such as:

- Personality
- Decisions
- Self-control

Are **not** the domain of some abstract, ideal “spirit” or “consciousness” – **Your mind is not transcendental**

Rather, everything is at the mercy of our physical body.

Three Humiliations for Humankind



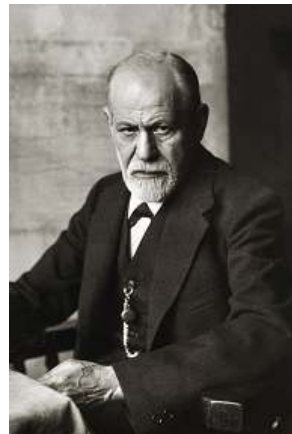
1) Galileo Galilei

Our planet is not the center of the universe.



2) Charles Darwin

We as humans are part of the animal kingdom.



3) Sigmund Freud

We are not masters in our own house (mind).

Human-caused behavior changes: Psychosurgery in Schizophrenia

Severe psychiatric disease
affects ~ 1% of the general population

Positive Symptoms: hallucinations, delusions

Negative Symptoms: flat affect, lack of
pleasure, initiative, communication

Disorganized speech/behavior

Catatonic behavior (maintaining a bizarre
posture for a long time)

Treatment before 1930s was rather cruel:
restraint, long baths, insulin coma.



Strait jacket, chains, covered
bath tub (www.nobelprize.org)

Psychosurgery: Lobotomy

Developed prefrontal leucotomy in 1936 as a treatment for schizophrenia

It was based on studies on chimpanzees that became less aggressive after frontal lobe surgery (Jacobson, Wolfe, Jackson, 1935).



Egas Moniz, 1874-1955

Nobel prize 1949

VOL. 82

JULY, 1935

No. 1

The Journal of Nervous and Mental Disease

AN AMERICAN JOURNAL OF NEUROPSYCHIATRY, FOUNDED IN 1874

ORIGINAL ARTICLES

AN EXPERIMENTAL ANALYSIS OF THE FUNCTIONS OF
THE FRONTAL ASSOCIATION AREAS IN PRIMATES *¹ ²

BY CARLYLE F. JACOBSEN, PH.D.
J. B. WOLFE, PH.D., and
T. A. JACKSON, PH.D.

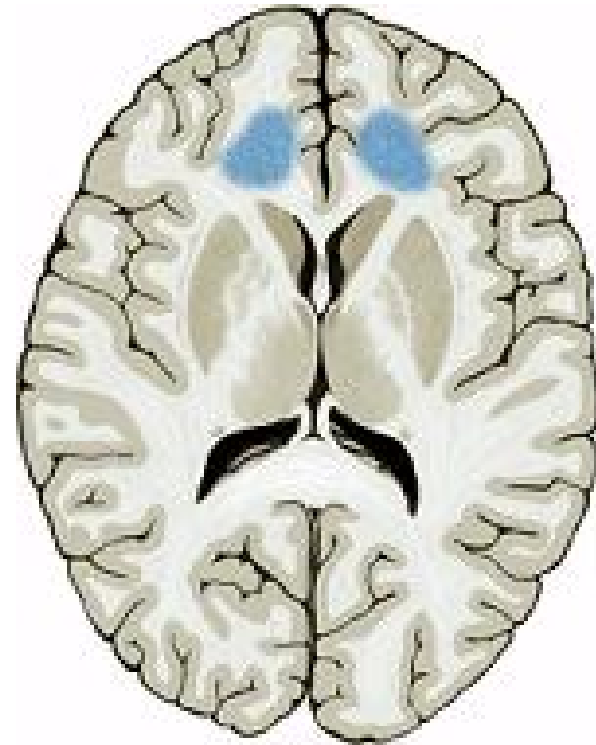
OF NEW HAVEN, CONN.

Psychosurgery: Lobotomy



leucotome

Areas operated on:



Psychosurgery: Lobotomy



Dr. Walter Freeman
performing lobotomy (with “ice pick”)

Frontal lobe psychosurgery was also used for affective disorders (depression), obsessive-compulsive disorders, etc.

England & Wales, 1942-1954:
~11,000 cases

United States, -1949: ~10,000 cases

(www.nobelprize.org)

Side Effects of Lobotomy

Mother of a Swedish patient after surgery:

“She is my daughter but yet a different person. She is with me in body but her soul is in some way lost.”

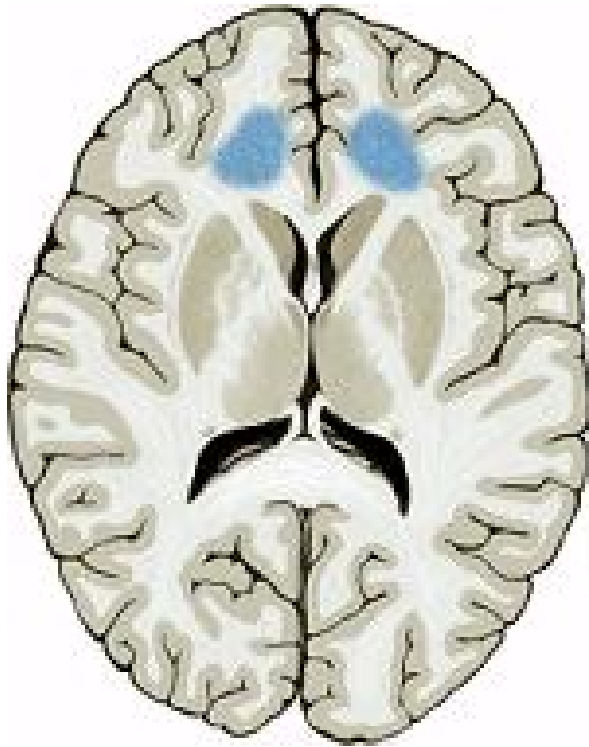
Hoffman, 1949:

“...these patients are not only no longer distressed by their mental conflicts but also seem to have little capacity for any emotional experiences - pleasurable or otherwise. They are described by the nurses and the doctors, over and over, as dull, apathetic, listless, without drive or initiative, flat, lethargic, placid and unconcerned, childlike, docile, needing pushing, passive, lacking in spontaneity, without aim or purpose, preoccupied and dependent.”

What can this tell us about how the brain works?

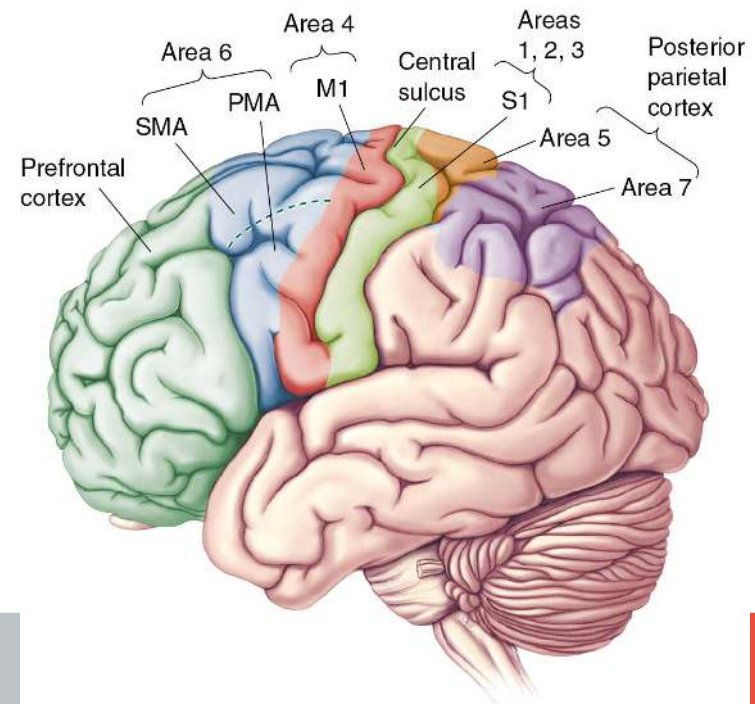
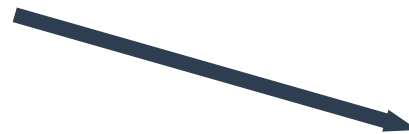
Lobotomy

Areas removed:



Much more “accurate” damage to specific part of brain than Phineas Gage

Actually this type of “lesion study” (often in animal models) is often *still* used to study the brain.

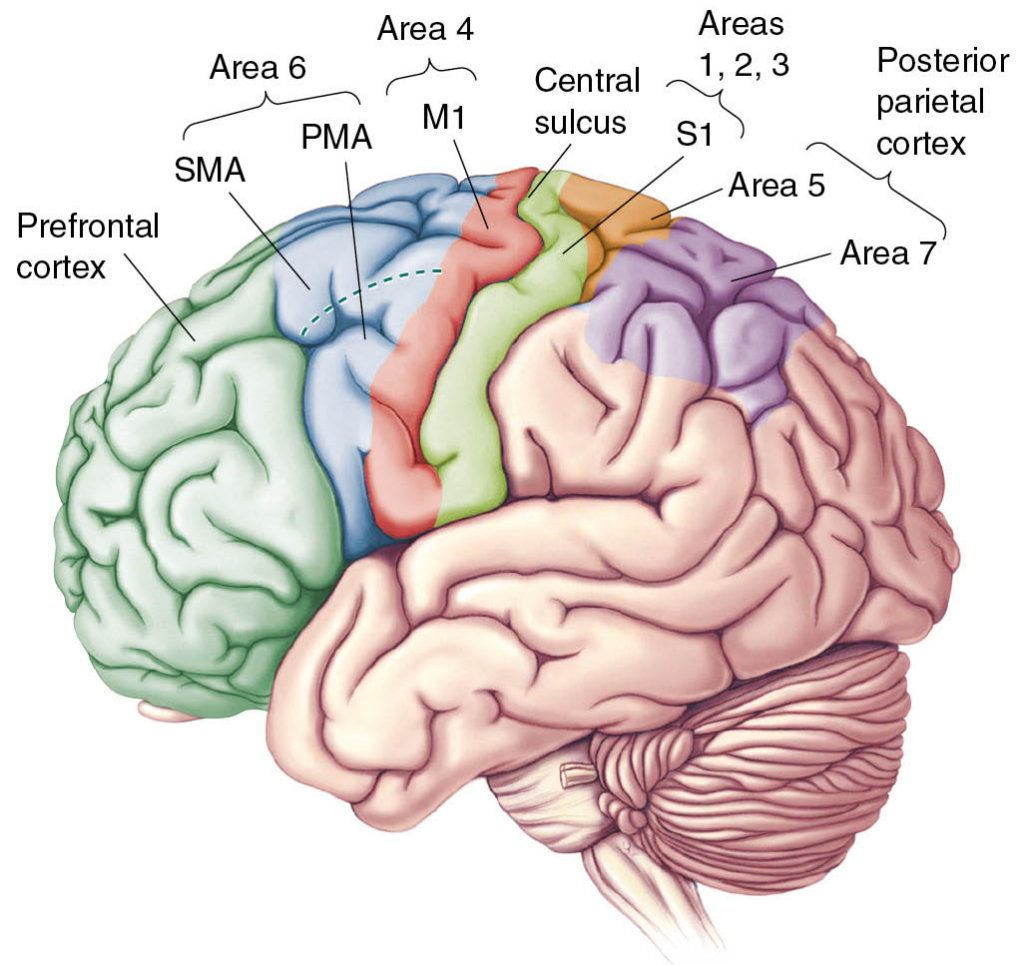


Major effects of brain lesions

Lesions -> Deficits

M1, Premotor area (PMA) ->
loss of fine movement, strength, poor
movement programming

Prefrontal cortex ->
Loss of divergent thinking
Poor control of behavior
Poor temporal memory
Changes in social / sexual behavior



Frontal Lobe Functions: Divergent Thinking

Convergent thinking concerns solving problems that require one answer (facts, arithmetic problems, etc.), divergent thinking is about generating multiple, original solutions.

Divergent thinking: For example, what are possible uses for a coat hanger?

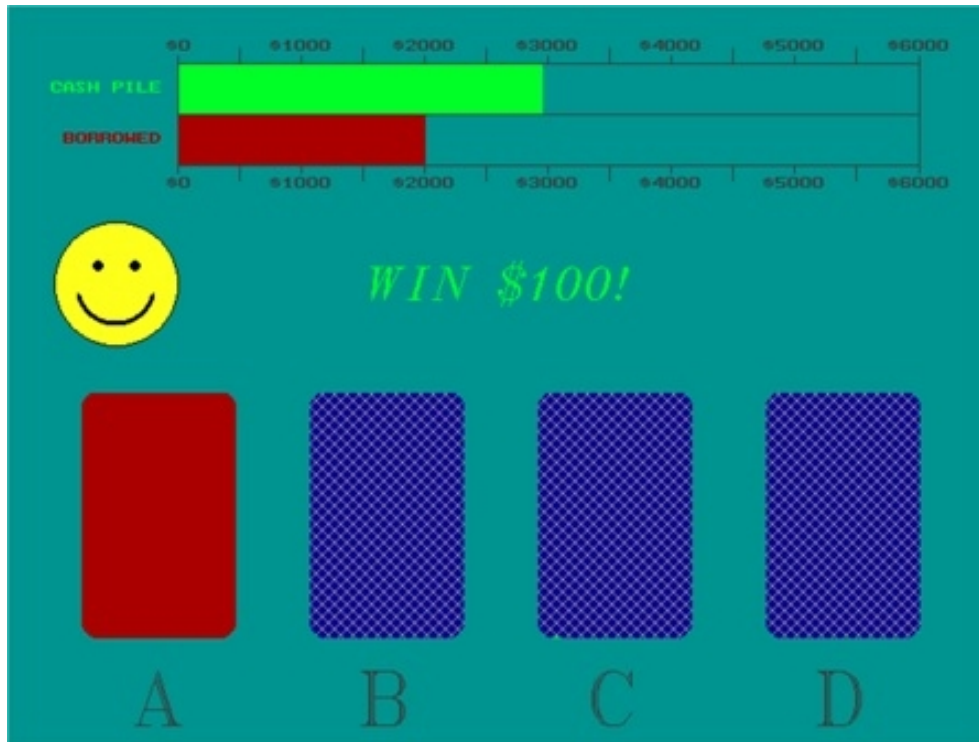
For example, Thurstone Word fluency test:

In 5 minutes, write as many words as possible starting with **S**

In 4 minutes, write as many 4-letter words as possible starting with **C**

Frontal Lobe Functions: Poor Control of Behavior

For example: Risk taking and Rule breaking



Iowa Gambling test:
Players start with 2000\$ and
should get maximum amount

Four decks (A, B, C, D) of 40
Cards: 20 black, 20 red
Rewards are different depending
on the deck, i.e. there are good
and bad decks.

Players can freely choose the deck
to draw a card from.

Patients with orbito-frontal lesions show deficits in the Iowa
Gambling test (Bechara et al., 2003)

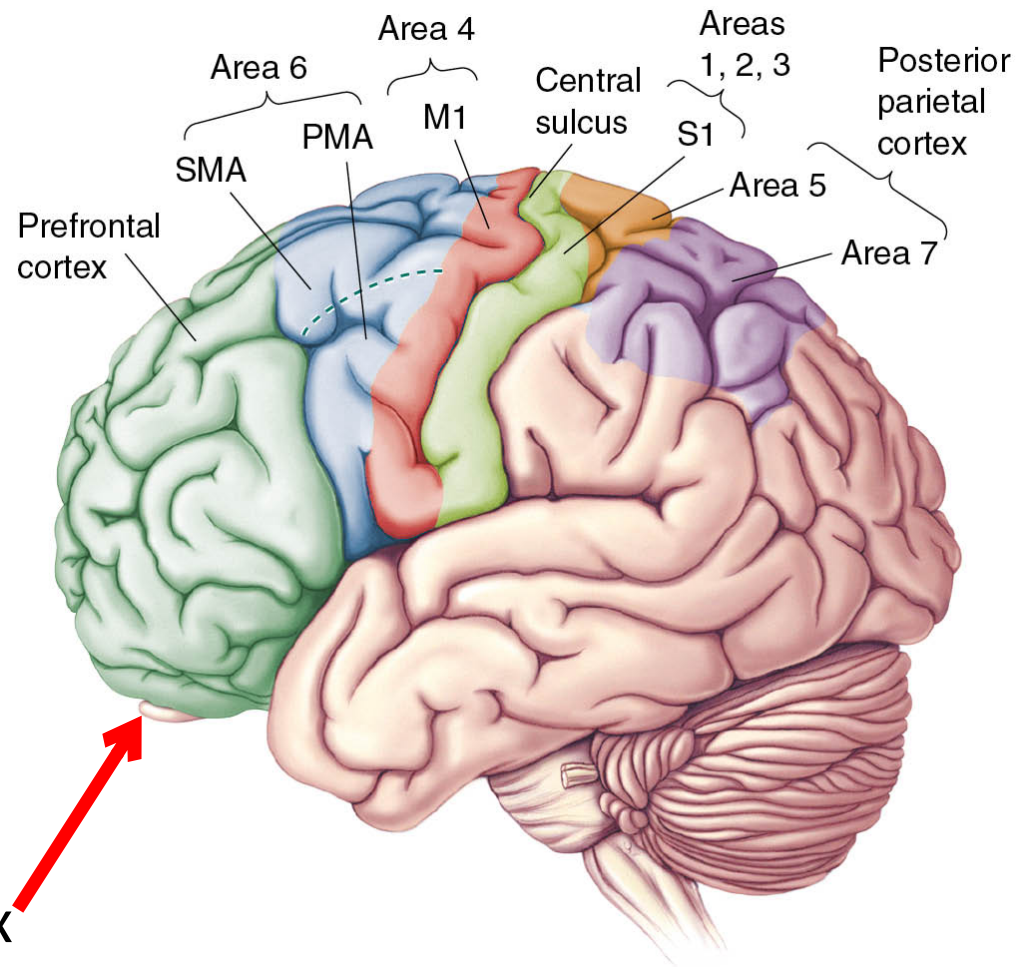
Summary:

Brain Damage causes Behavior Changes

Lesions -> Deficits

M1, Premotor area ->
loss of fine movement, strength, poor
movement programming

Prefrontal cortex ->
Loss of divergent thinking
Poor control of behavior
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Medical Psychology (Fridays 1300-1430)

Topics in Medical Psychology

Psychological Tests and Psychophysiology,
Intelligence and Learning, Personality,
Sleep,
Emotions, Stress,
Anxieties, Chronic pain, Depression,
Addiction,
Behavioral therapies, Neurofeedback

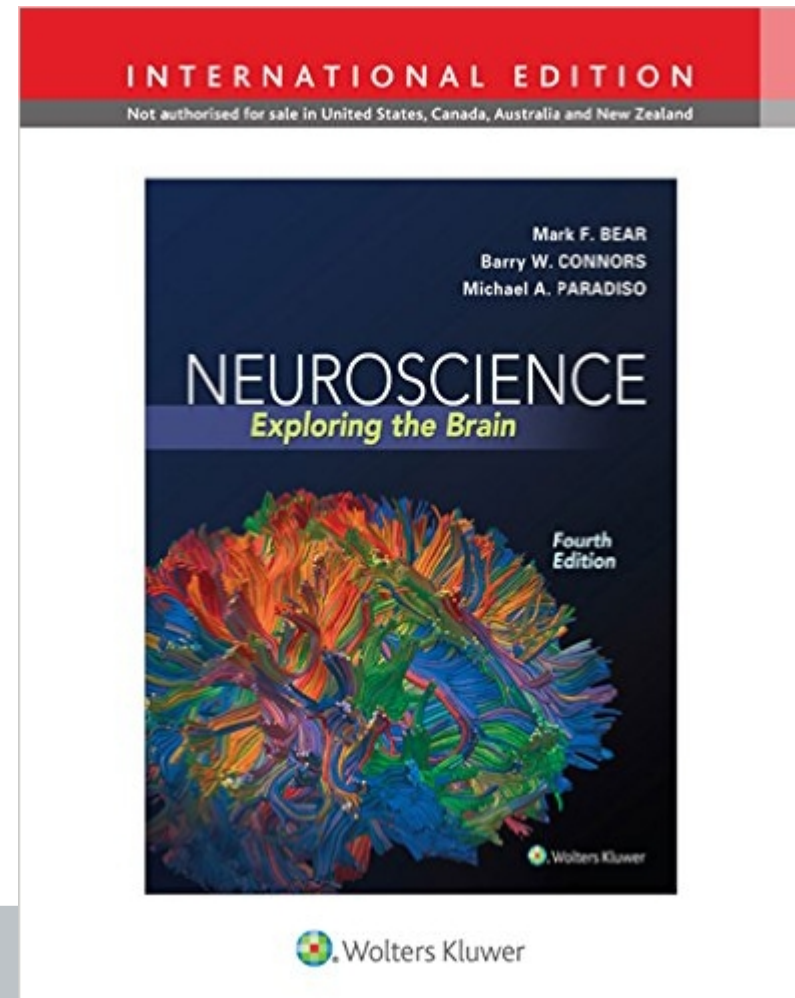
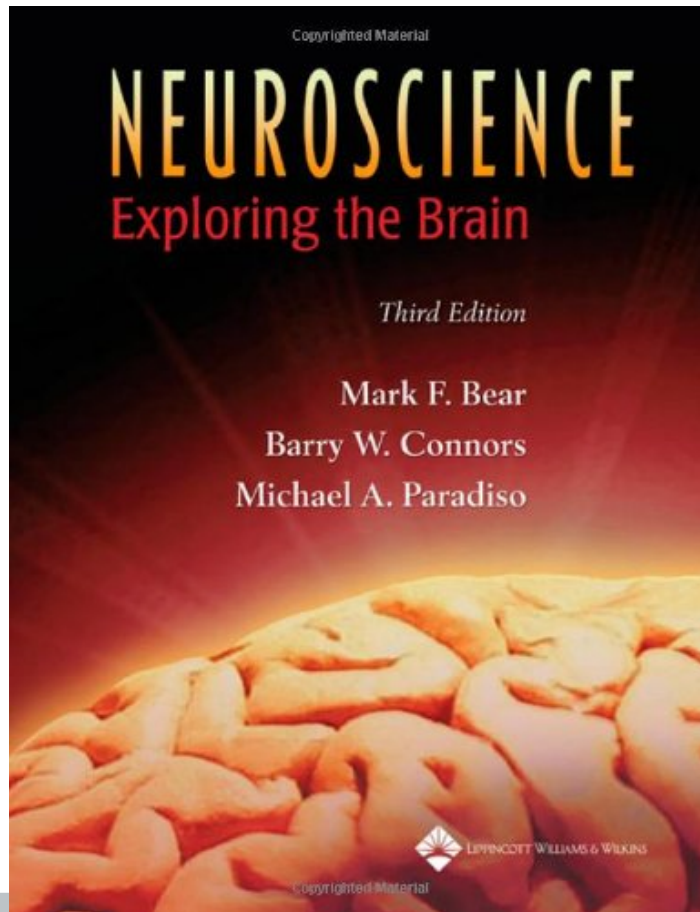
→ Some overlap with this course

But: Medical psychology looks into what psychological knowledge can do for health.

Behavioral Neuroscience looks into the neural mechanisms of behavior.

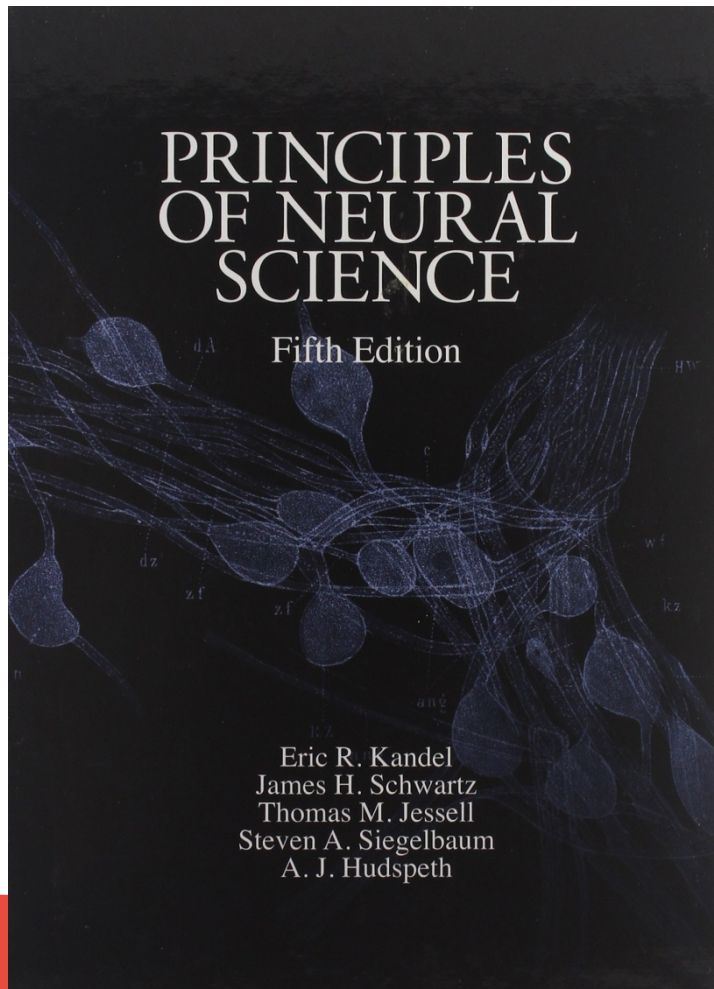
Literature (not required)

Bear, Connors, Paradiso
Neuroscience – Exploring the Brain



Lituratione (not required)

Kandel, Schwartz, Jessell, Siegelbaum, Hudspeth
Principles of Neural Science – 5th edition (2012)



Very detailed!

Further Reading

Kolb, Wishaw, Fundamentals of Neuropsychology, 7th edition, 2005

