

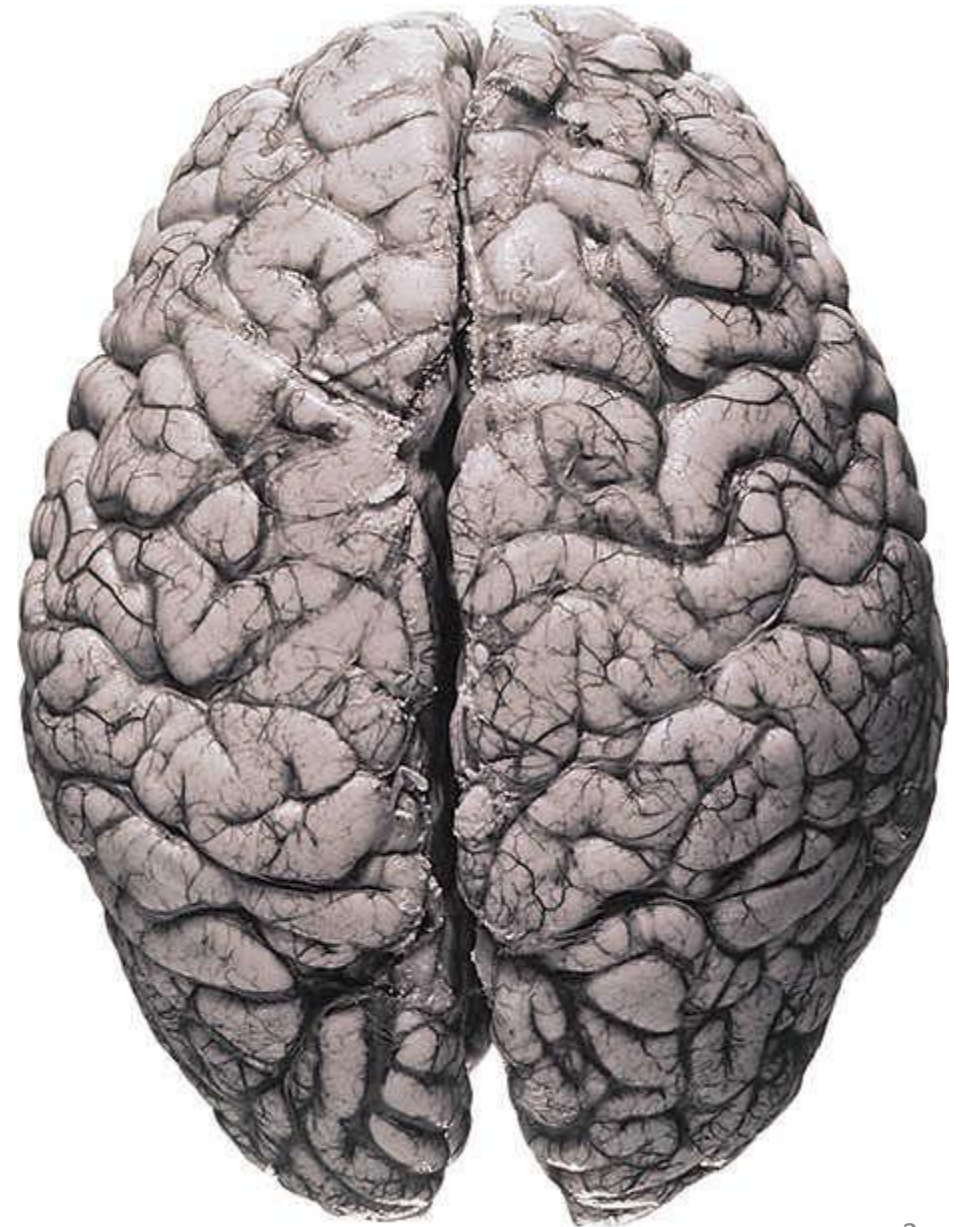
Chapter 1

Biopsychology as a science

What is biopsychology, anyway?

Defining biopsychology

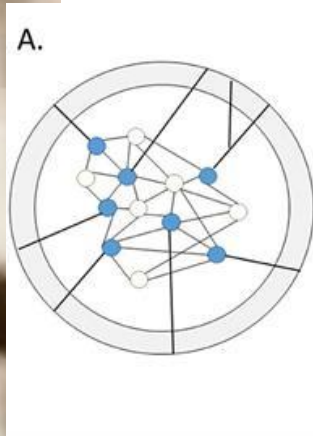
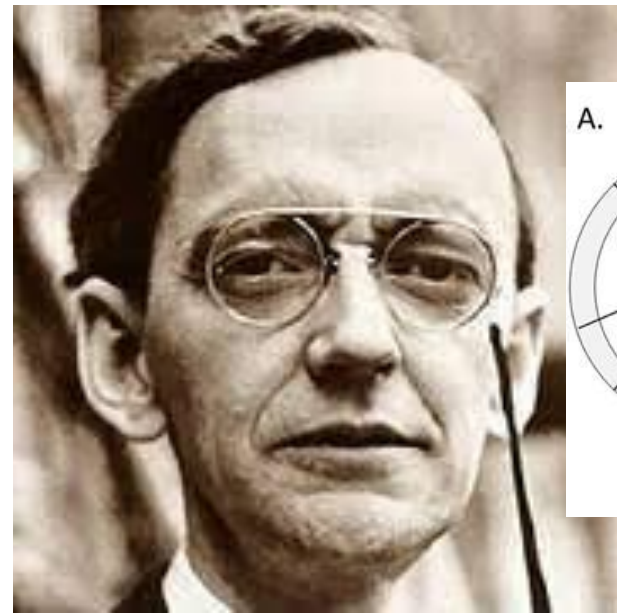
- Biopsychology is the scientific study of the biology of behaviour
- Biopsychology is the link between neuroscience and behaviour – biopsychology is also called “behavioral neuroscience”
- How does the brain act to orchestrate behaviour?
- How is sensory information integrated by the brain to create perception?



What are the origins of biopsychology?

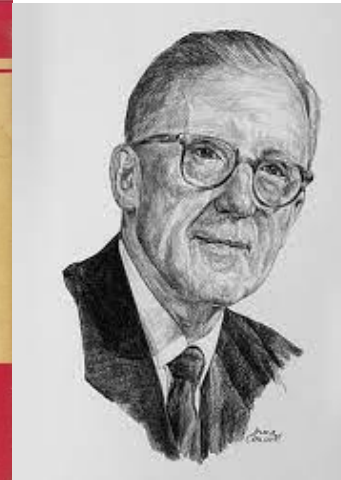
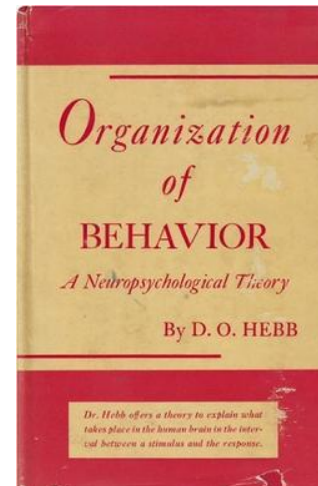
- Very new discipline. Emerged in the late 19th century and was formalized in the early 20th century.

Karl Lashley



1950

Donald Hebb

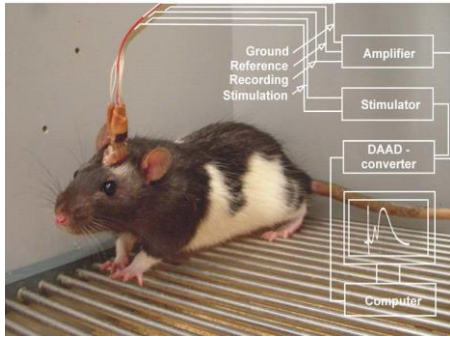


1949

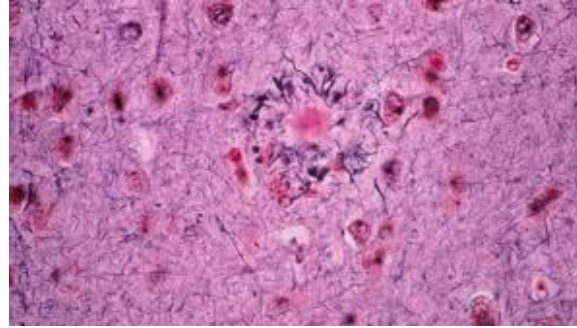
Marian Diamond



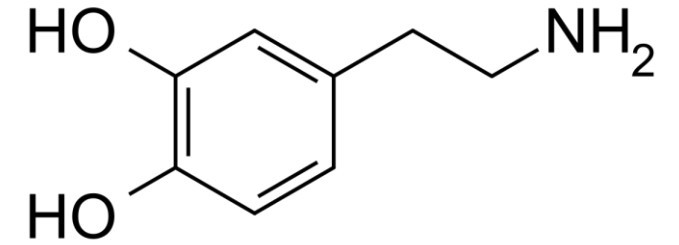
Neurophysiology



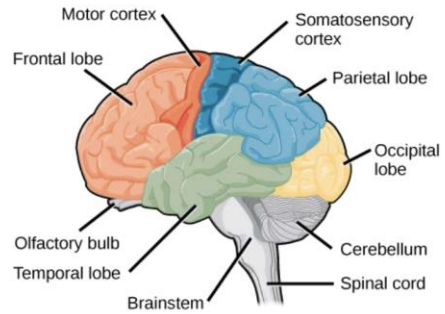
Neuropathology



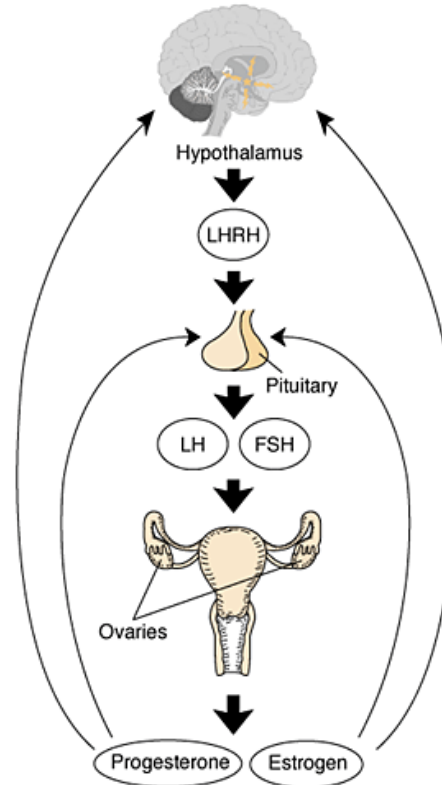
Neuropharmacology



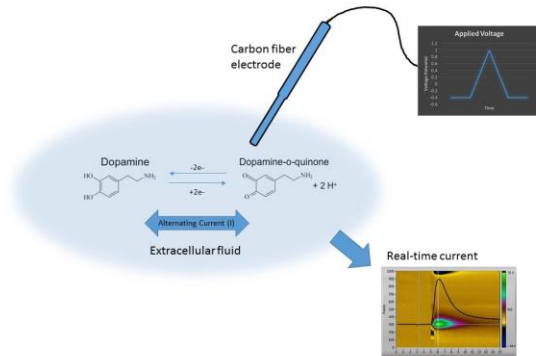
Neuroanatomy



Neuroendocrinology



Neurochemistry



The 6 divisions of neuroscience

Humans or non-human animals?

Mouse brain



Human brain



VS

- Expensive
- Invasive
- Model
- On time
- Inference
- Complicated

- Cheap
- Non-invasive
- Real thing
- Always late
- Ask/tell them
- Benign

To get a full answer, you inevitably have to “break some eggs”

Ethics in animal research



- ACC & IAUPs

Investigative methodologies in biopsychology

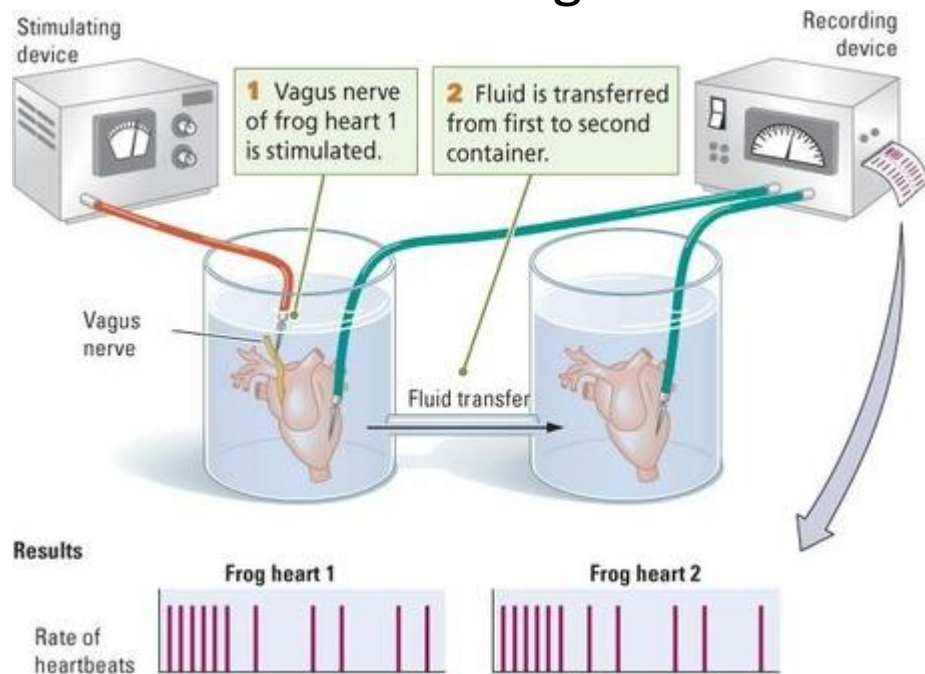
- Experiments
 - Can establish cause and effect relationships
 - Between-subjects design
 - Within-subjects design
 - Independent variables
 - Dependent variables
 - Confounding variables
- Quasiexperimental studies
 - Used when controlled experiments are impossible
 - Self-selected subjects
 - Can't control confounds
- Case studies
 - Used when conditions are rare
 - Single-subject design
 - Not generalizable

Non-experiments



Pure vs. Applied Research

- Pure research
 - Driven by curiosity of the researcher
 - Focus on acquiring knowledge



- Applied research
 - Some direct benefit to humankind
 - Translational: Pure research into applications

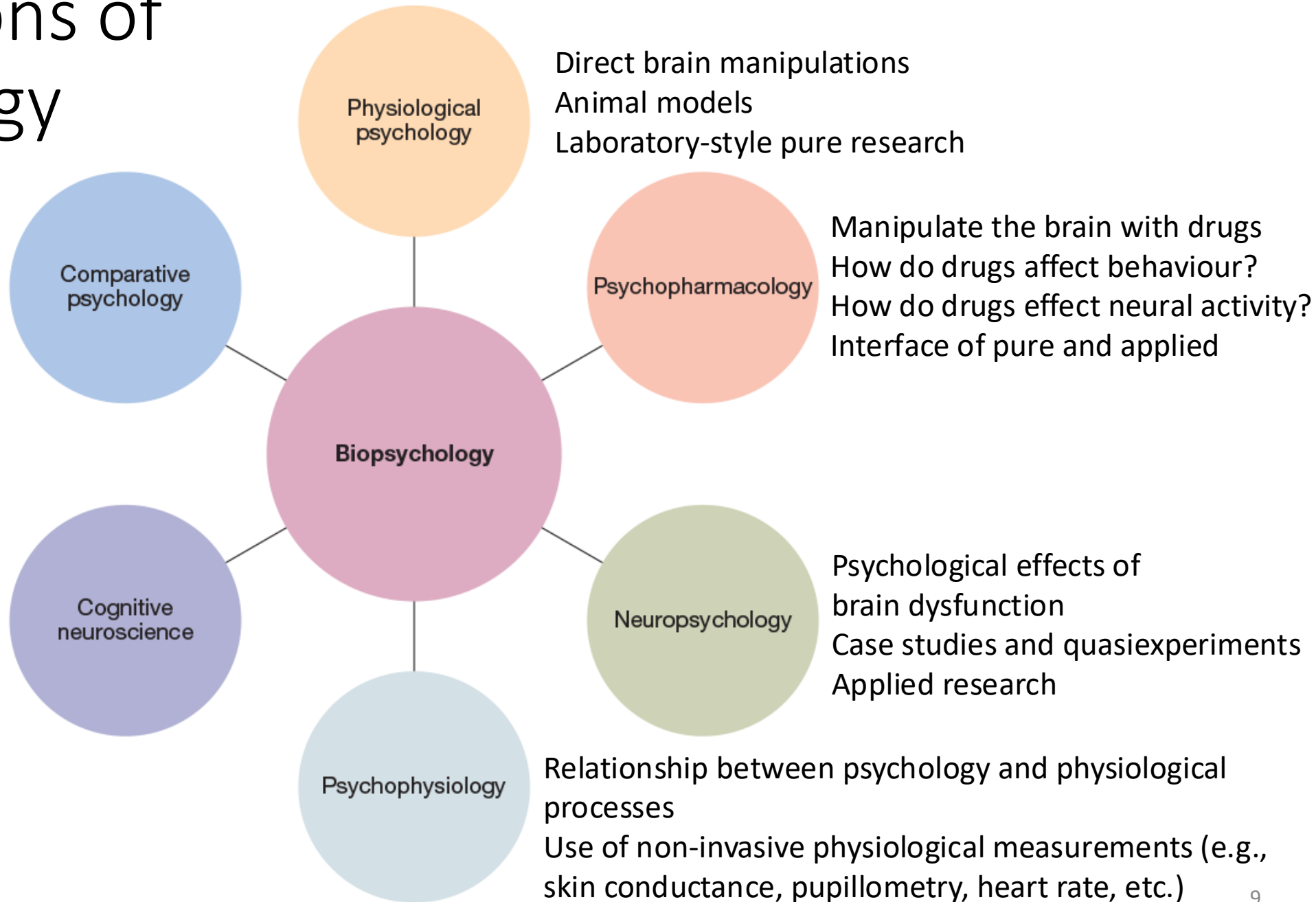
System	Potential Impact on Symptoms			Commentary
	xanomeline	+ tropium	= KarXT	
Central Nervous System	↑	N/A	↑	Improvement in psychosis and cognition
Salivation Glands	↑	↓	↔	Tolerability from neutralization of peripheral activation
Sweat Glands	↑	↓	↔	
GI Tract	↑	↓	↔	
Bladder	↑	↓	↔	

↑ Increase Activity ↓ Decrease Activity ↔ Offsetting Effect

The 6 divisions of biopsychology

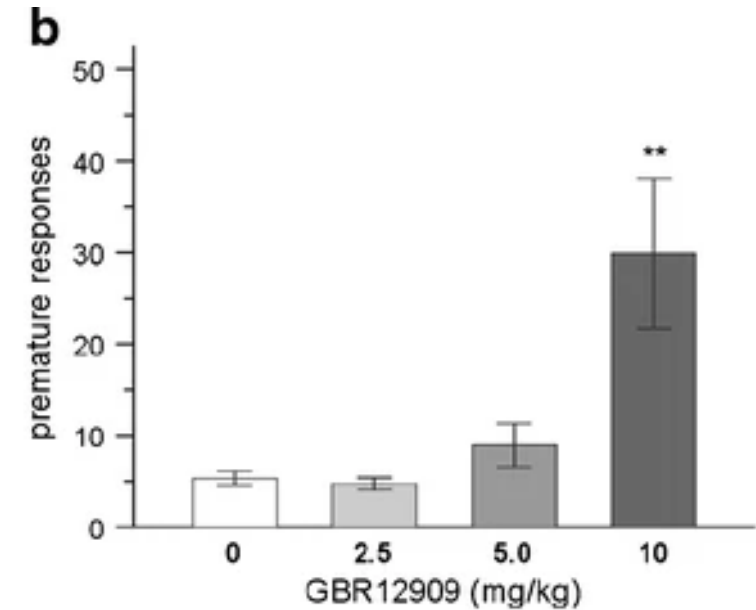
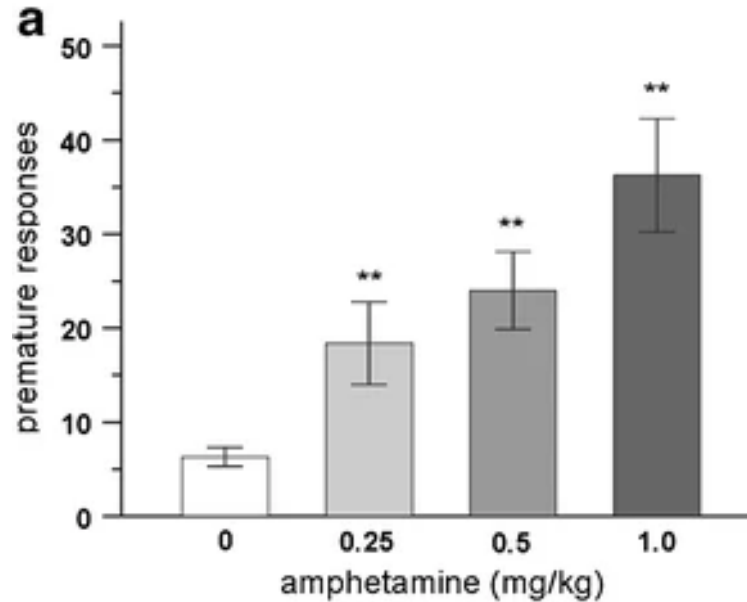
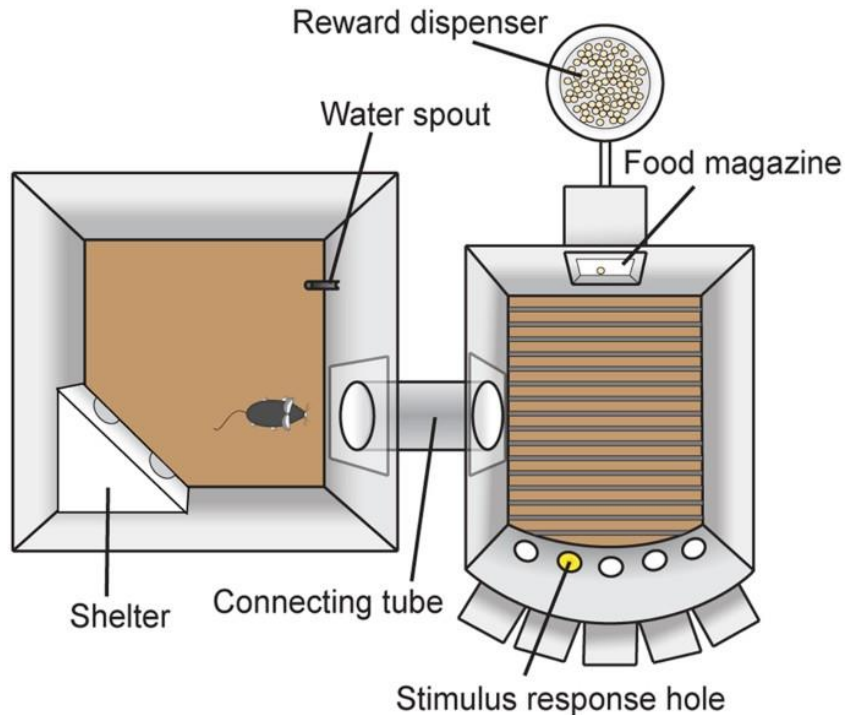
- Comparative and functional
- Laboratory and ethological
 - Interdisciplinary
- Evolution and behavioural genetics

- Youngest division
- Noninvasive brain imaging
 - Interdisciplinary
- Neural basis of cognition (e.g., learning & memory, attention, perceptual processes, etc.)



Psychopharmacology

- Example: The psychological construct of impulsivity

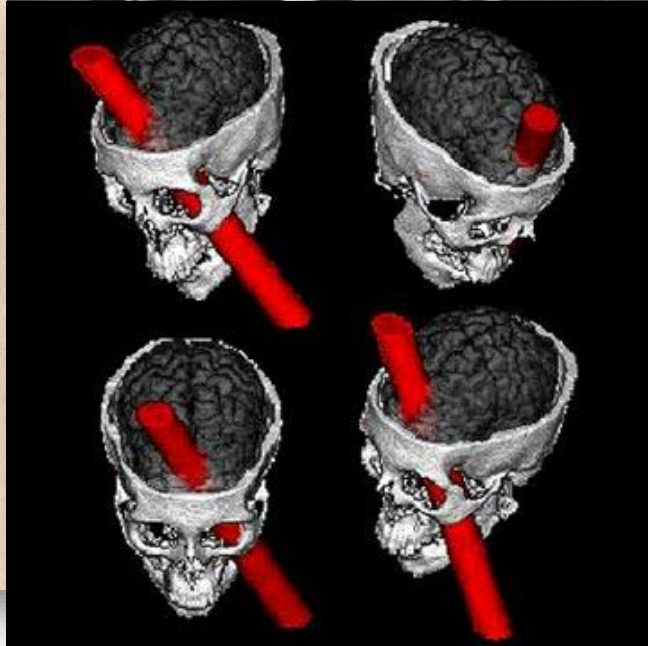
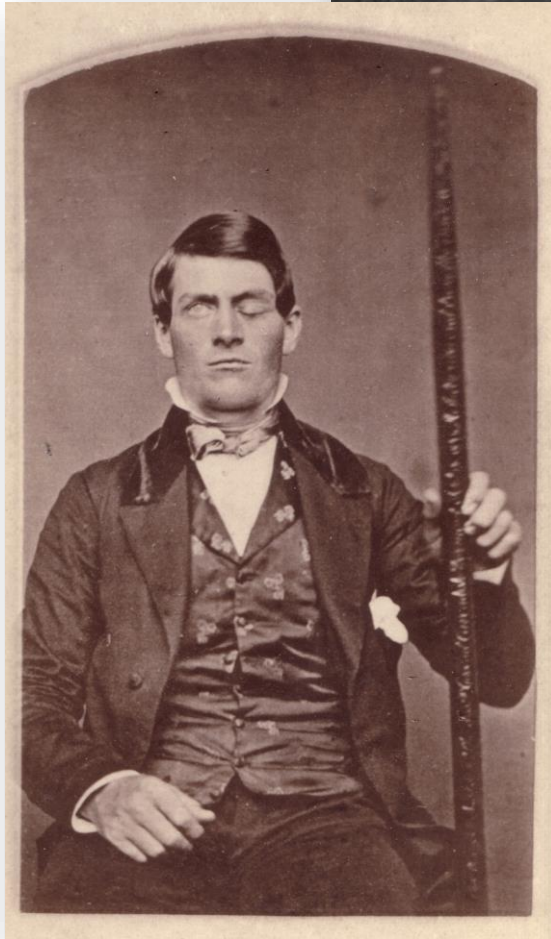


(Remmelink et al, 2017)

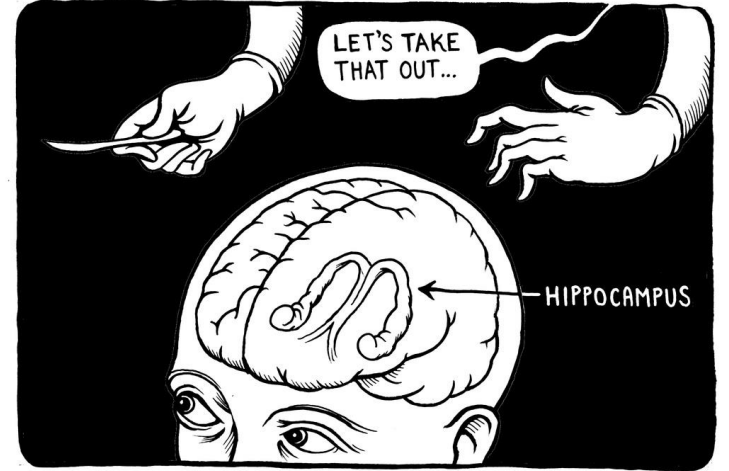
(Baarendse & Vanderschuren, 2012)

Neuropsychology

Phineas Gage

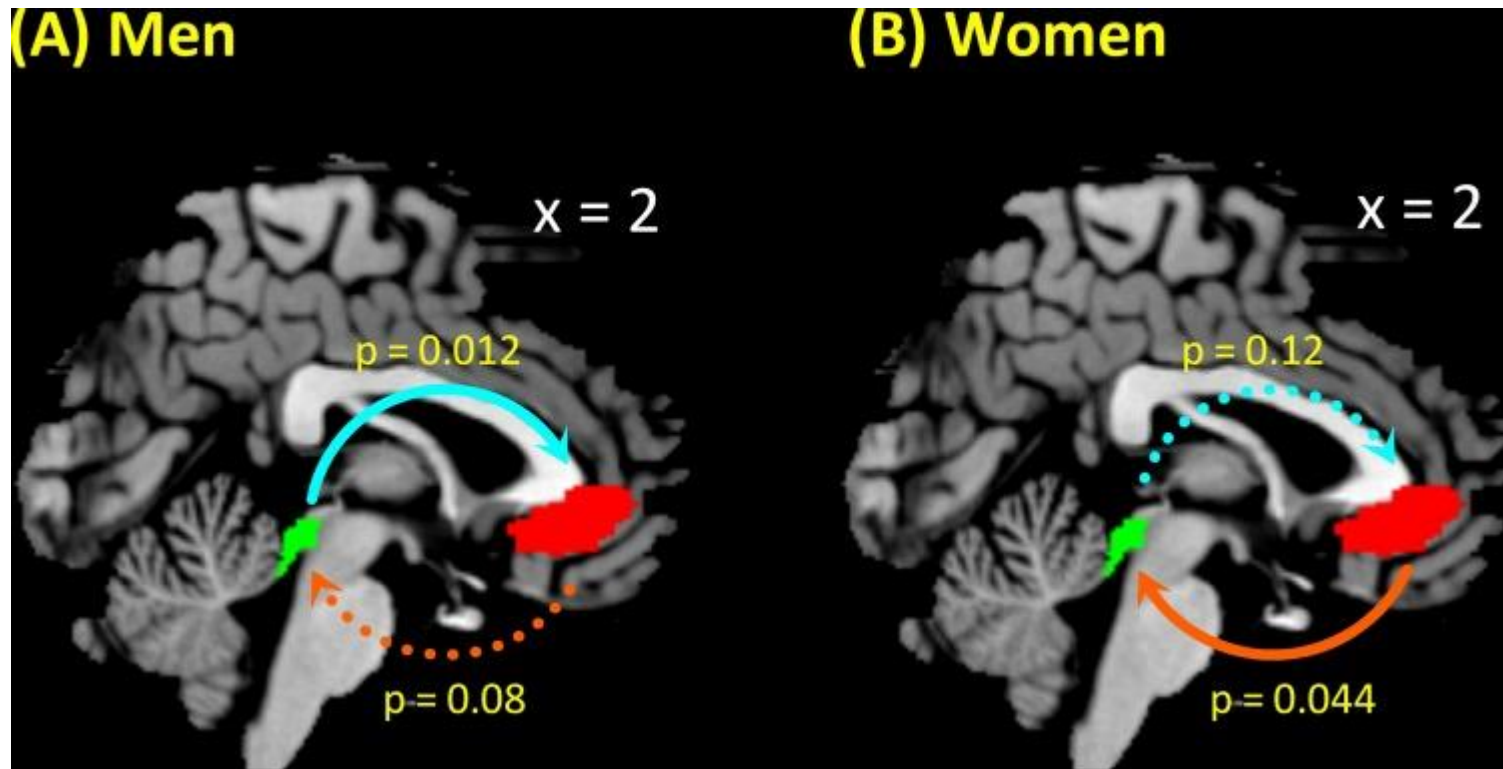


Henry Molaison (HM)



Dr. Brenda Milner – Longitudinal Study of HM (e.g., amnesia)

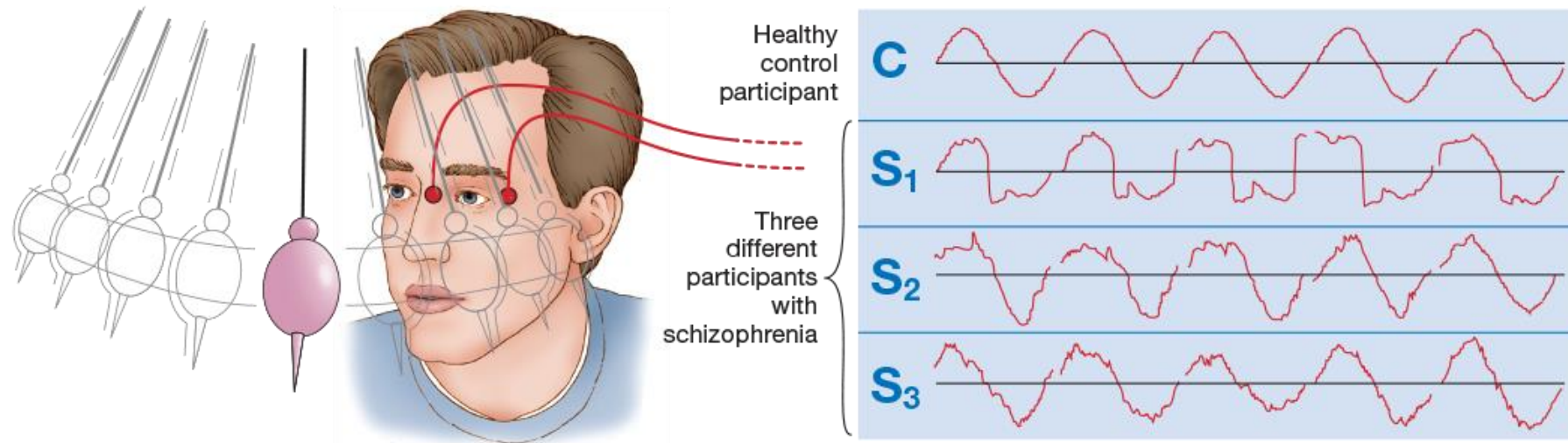
Cognitive neuroscience



(Zhang et al., 2020)

- Cocaine craving is mediated by connectivity between vmPFC and periaqueductal gray
- Functional Neuroimaging
- BOLD Signal

Psychophysiology



Visual tracking of a pendulum by a healthy control participant (top) and three participants with schizophrenia (adapted from Iacono & Koenig, 1983.)

Other techniques such as electroencephalogram (EEG) or measure of autonomic activity (e.g., skin conductance, pupil dilation, blood pressure, heart rate, etc.)

Comparative Psychology

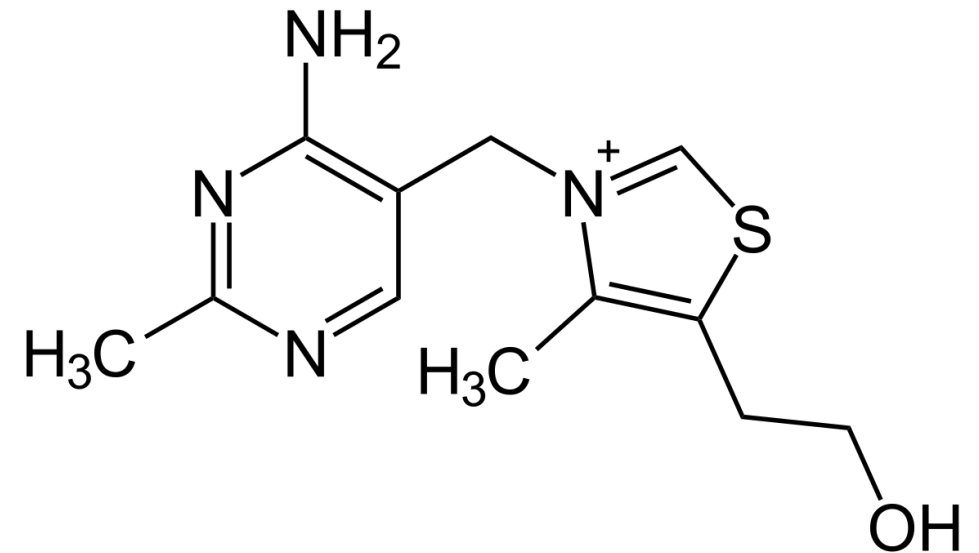
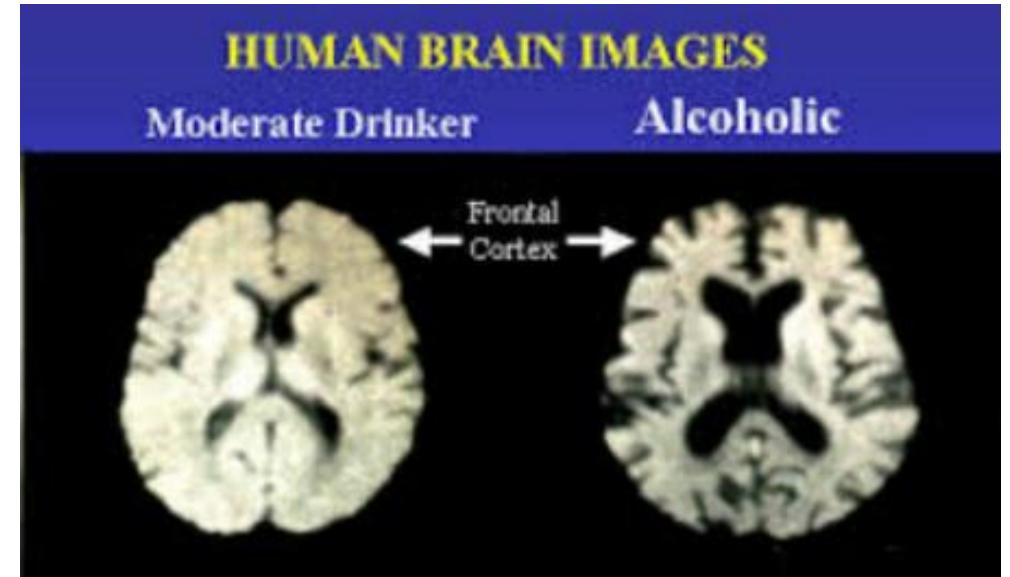


- Observation of animal behaviour in the natural environment
- Ethology
- Integrates elements of evolutionary theory
- Lorenz's "imprinting"



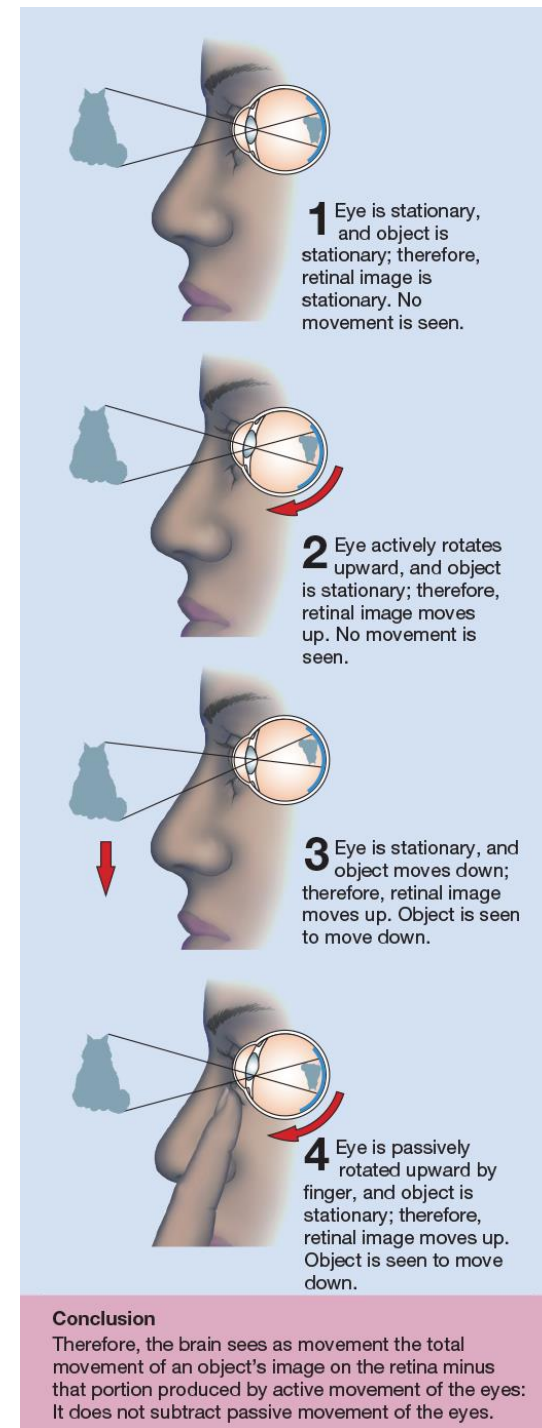
“Converging Operations”

- Each area of biopsychology has a weakness
- Biopsychologist must work together to push the field forward
- Collaboration can help one division make up for the shortcomings of another
- e.g., Korsakoff’s Syndrome
 - Quasiexperiments in heavy drinkers
 - Controlled experiments in rats



Scientific Inference

- Science is empirical
- The brain cannot be observed directly
- Scientists must therefore *infer* what is reflected in the brain and behaviour
- Psychology is no different than any other science in this regard



Jose Delgado and The Bull

- José Delgado faced a large, angry bull
- Delivered an electrical stimulation when bull charged
- This stopped the charge
- Delgado claimed he found caudate taming center
- Morgan's Canon (see also Occam's Razor) dictates a simpler explanation should be supported



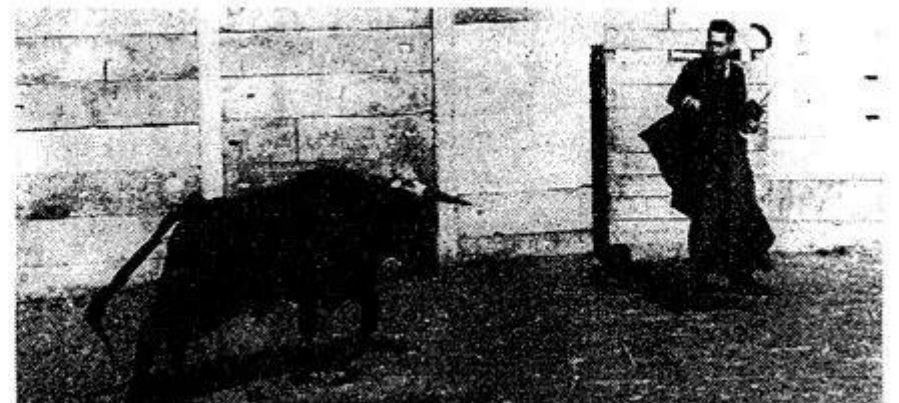
'Matador' With a Radio Stops Wired Bull

Modified Behavior in Animals Subject of Brain Study

By JOHN A. OSMUNDSEN

Afternoon sunlight poured over the high wooden barriers into the ring as the brave bull bore down on the unarmed "matador" — a scientist who had never faced a fighting bull.

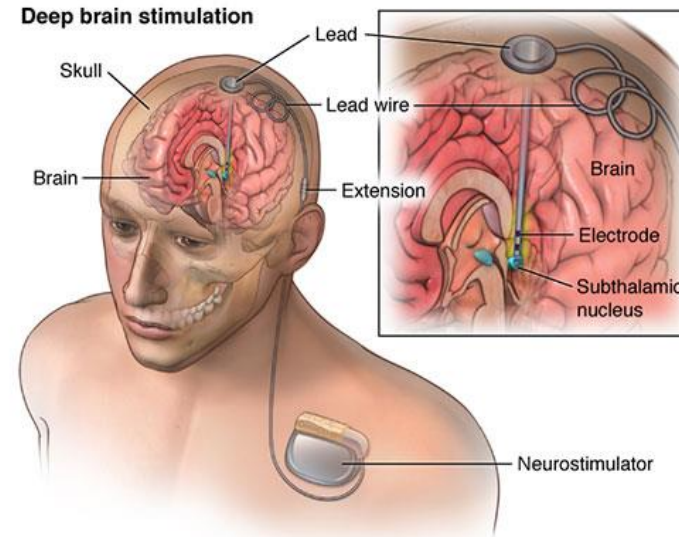
But the charging animal's horns never reached the man behind the heavy red cape. Moments before that could happen



Psychosurgery



Depiction of “trepanation” from Bosch’s
Extracting The Stone of Madness



NEUROSURGICAL
FOCUS

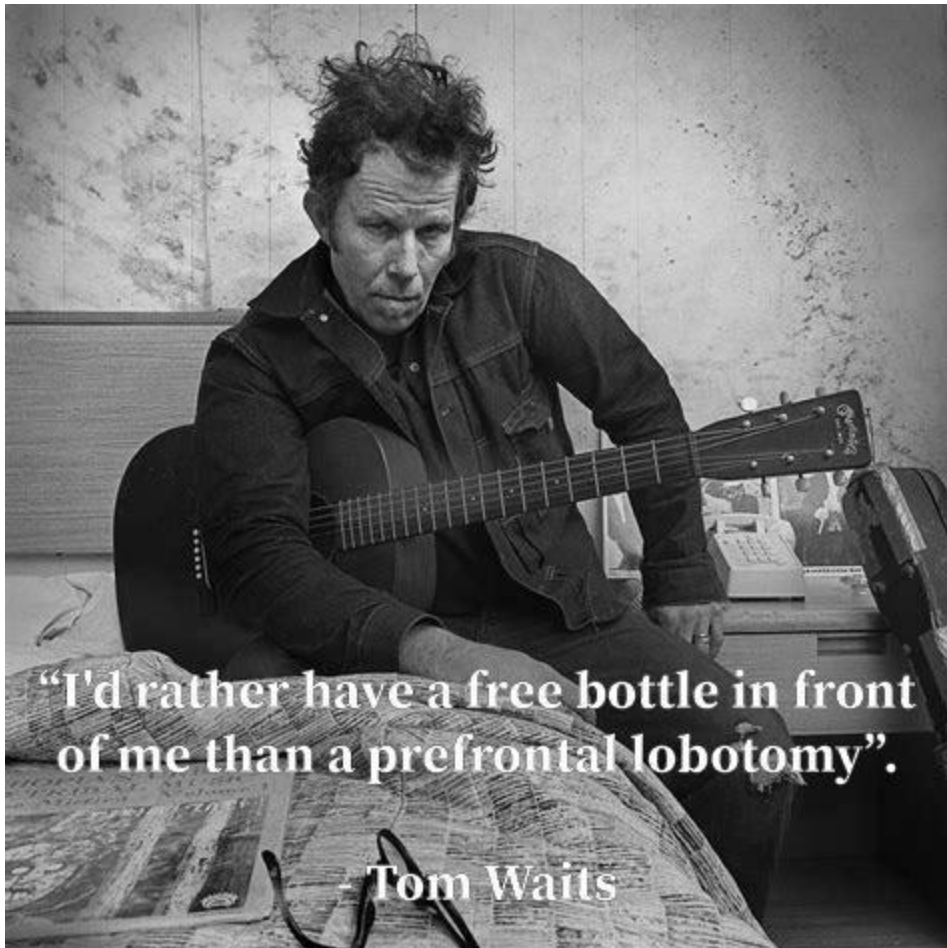
Neurosurg Focus 45 (2):E11, 2018

Deep brain stimulation for the treatment of drug addiction

Tony R. Wang, MD,¹ Shayan Moosa, MD,¹ Robert F. Dallapiazza, MD, PhD,² W. Jeffrey Elias, MD,¹ and Wendy J. Lynch, PhD³

¹Department of Neurological Surgery, University of Virginia, Charlottesville, Virginia; ²Division of Neurosurgery, Toronto Western Hospital University Health Network, Toronto, Ontario, Canada; and ³Department of Psychiatry and Neurobehavioral Sciences, University of Virginia, Charlottesville, Virginia

Two chimps, Muoniz, and the frontal lobotomy



- Moniz wins Nobel Prize in 1949
- Based on research with chimpanzees
- Spurred a psychosurgical renaissance
- Following reports of success, lobotomy freely applied to humans
- The case of Howard Dully

Variations on the prefrontal lobotomy?

