

About Brain Utilization Percentage of Human

Le Viet Anh (20170763) Hankyu Jang(20160564)

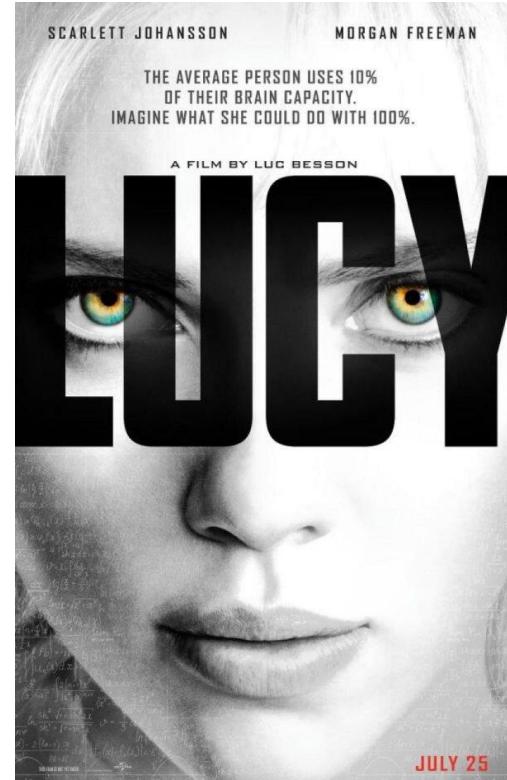
INDEX

- The 10% of the brain myth
 - Movie 'Lucy' is wrong
- 6 evidences refuting the myth
 - Brain damage
 - Brain scans
 - Large energy requirement of brain
 - Localization of function
 - Microstructural analysis
 - Synaptic pruning
- Measurement of brain activity
 - MRI
 - fMRI
 - MRE
- Reference

01

The 10% of brain myth

The 10% of brain myth?



The 10% of brain myth

- Most or all humans only use 10% or less of their brains
- May harness this unused potential and increase intelligence

The Movie 'LUCY'



But it's wrong!

BRAIN POWER



IN THE MOVIES



IN THE REAL WORLD



Neurologist Barry Gordon

'we use virtually every part of the brain, and the most of the brain is active almost all the time'

02

6 evidences refuting
the myth

6 evidences

1. Brain damage
2. Brain scans
3. Large energy requirement of brain
4. Localization of function
5. Microstructural analysis
6. Synaptic pruning

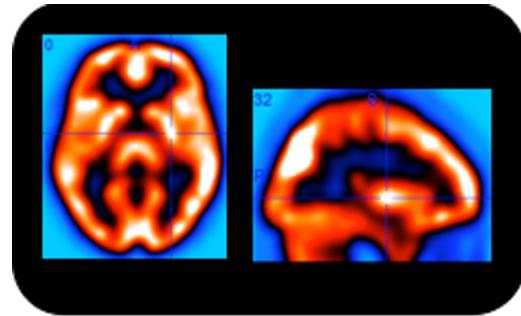
#1 Brain damage

- if 10 % myth is true
 - the damage to unused area?
- slight damage to small areas of brain -> profound effects

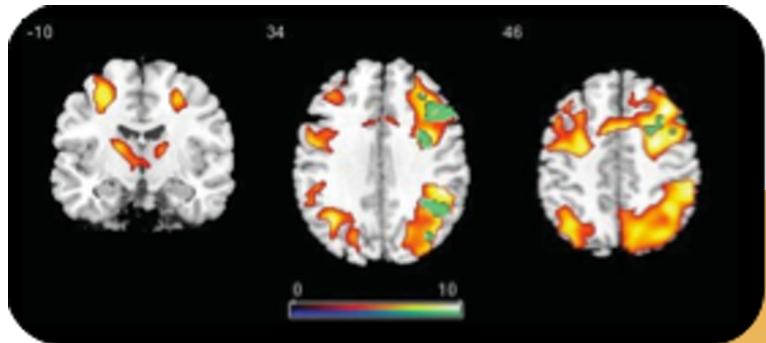


#2 Brain scans

- All brain areas are always active
- Depends on task, specific areas of brain are more active



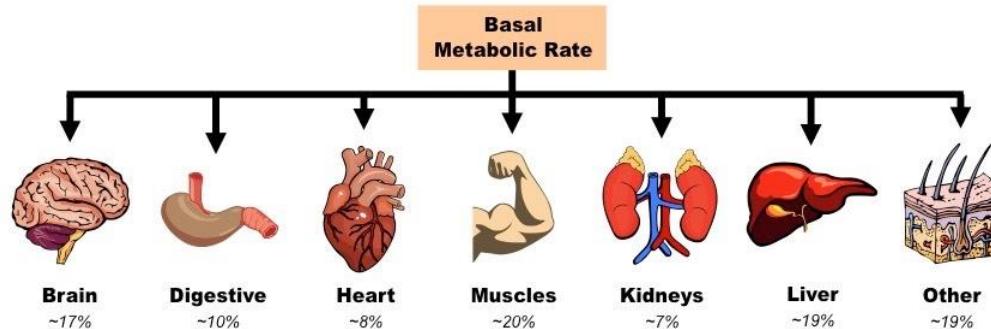
* PET scan at resting state



* fmri image when someone is performing task

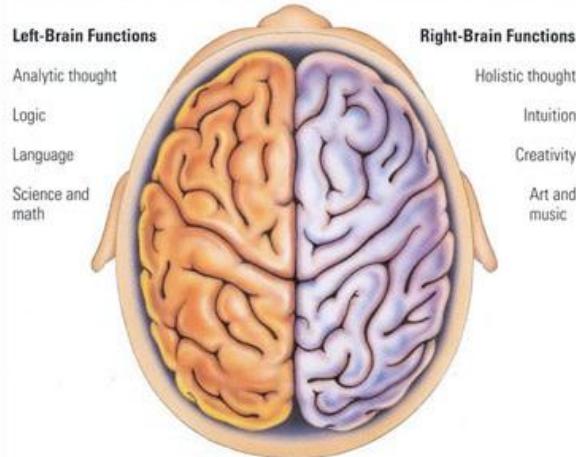
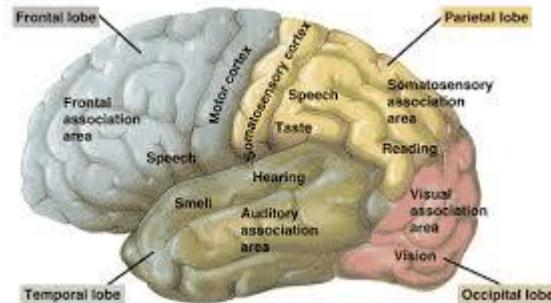
#3 Energy requirement

- consumes ~20% of the body's energy(Glucose), making up ~2% of body's mass
 - brain's rate of energy consumption varies little
- used to sustain neurons and brain processes
 - maintain a resting state
 - synthesize neurotransmitters to facilitate neuronal communication



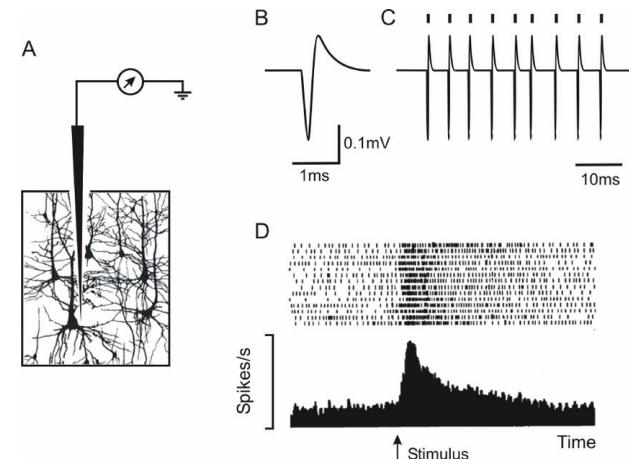
#4 Function localization

- distinct regions for different kinds of information processing
- no function-less areas



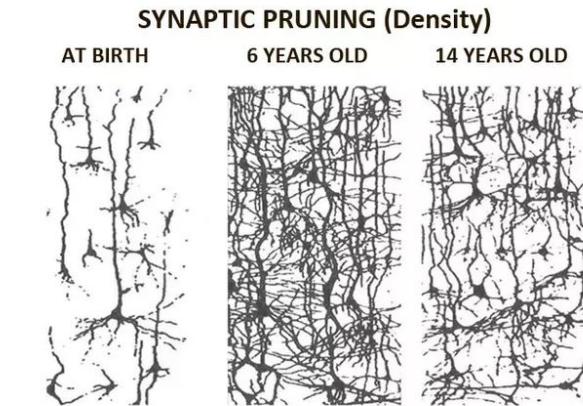
#5 Microstructural analysis

- single-unit recording
 - insert a tiny electrode into the brain
 - monitor the activity of single cell



#6 Synaptic pruning

- a phase in the development of synapse
 - formation
 - pruning
 - maintain & synaptic plasticity
- extra neurons and synaptic connections are eliminated
 - to increase the efficiency of neuronal transmissions



Synapses (neural connections) are created with astonishing speed towards 7 years old, the "synaptic growth spurts" become dense. By teenage years, pruning occurs to remove excess connections in order to make a more refined and efficient adult brain.

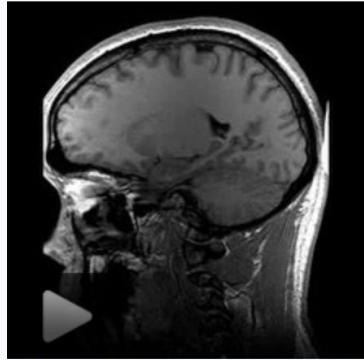
03

Measurement of brain activity

MRI

- Magnetic Resonance Imaging
- Use 2 magnetic fields and radiofrequency (RF)
 - permanent magnetic field
 - gradient magnetic field
- RF is used to change nuclei's magnetization levels
- Measuring the energy emitted by the nuclei

Magnetic resonance imaging



Para-sagittal MRI of the head, with aliasing artifacts (nose and forehead appear at the back of the head)

Synonyms nuclear magnetic resonance imaging (NMRI), magnetic resonance tomography (MRT)

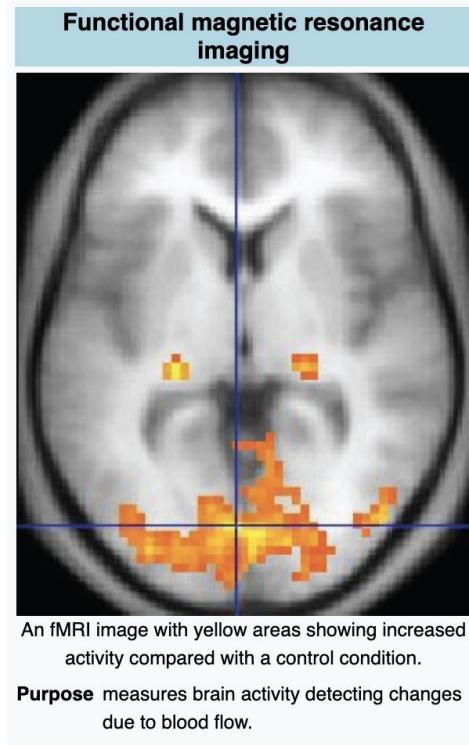
ICD-9-CM 88.91 ↗

MeSH D008279

MedlinePlus 003335

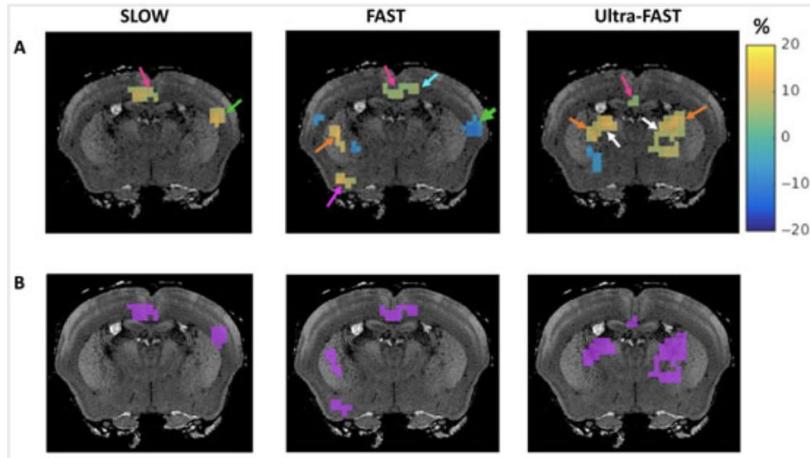
fMRI

- Functional magnetic resonance imaging
- fMRI concept builds on the earlier MRI scanning technology
- Changes in blood flow and blood oxygenation in the brain
- A lot of vital brain activities information is lost using fMRI because blood oxygen levels take about six seconds to respond to a stimulus.



MRE

- Magnetic Resonance Elastography
- Vibrations move faster through stiffer tissues, while vibrations travel through softer tissue more slowly.
- Different impacts cause different parts of brain stiffen
- Diagnosing and understanding multiple sclerosis, epilepsy, Alzheimer's and other forms of dementia, and even psychiatric disorders.



The brain images correspond to tissue stiffness in response to a slow, fast, or ultra-fast stimulus. The arrows indicate parts of the mouse brain that are activated. Faster stimulus rates activated additional brain regions. The data indicates that brain tissue changes its stiffness synchronously with brain activity as fast as every 100 ms. *Reprinted with permission from Patz, Samuel, et al. Sci Adv. 2019.*

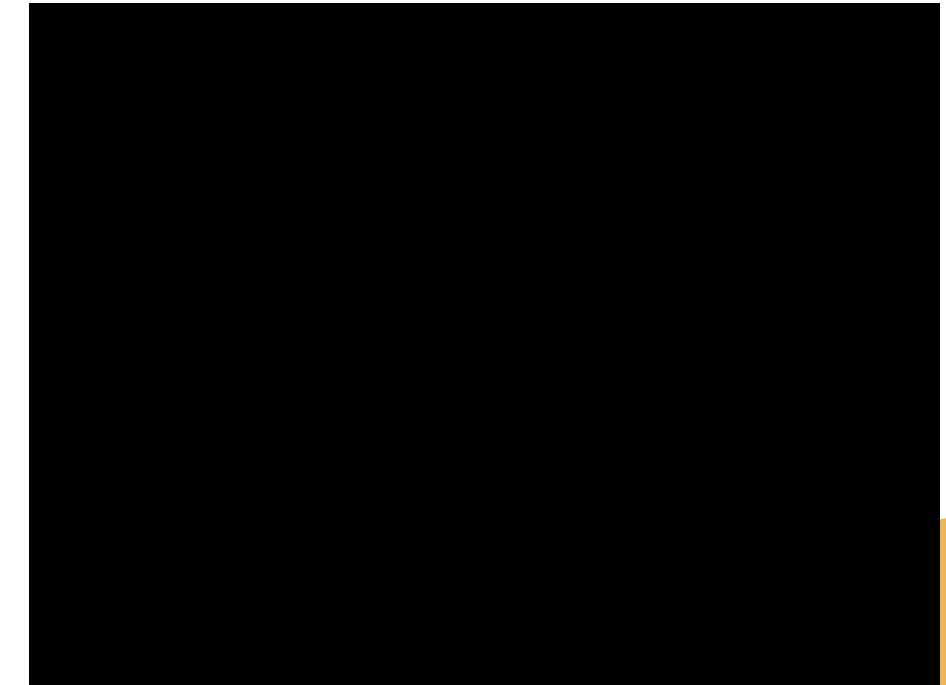


Is our brain still **working** when we sleep?



Brain “washed”

- When we go to sleep at night, our brains are wiped clean of harmful toxin
- This is the process of liquid cerebrospinal fluid (CSF) washing over the brain in pulsing waves to rid it of the day's toxins
- To capture this, 13 patients fall asleep inside of an MRI machine while wearing an electroencephalogram cap to measure brain activity.





04

REFERENCES



References

- <https://theconversation.com/mondays-medical-myth-we-only-use-10-of-our-brain-1613> - brain scan
- <https://www.nature.com/scitable/blog/mind-read/lucy-is-wrong-we-use/> - lucy is wrong
- https://en.wikipedia.org/wiki/Ten_percent_of_the_brain_myth - 10% myth overview
- <https://www.ncbi.nlm.nih.gov/books/NBK22436/> - brain energy requirement
- <https://ib.bioninja.com.au/options/option-a-neurobiology-and/a2-the-human-brain/brain-metabolism.html> - brain energy requirement
- <https://www.healthline.com/health/synaptic-pruning> - synaptic pruning
- https://www.researchgate.net/figure/Single-unit-recording-A-Schematic-showing-the-placement-of-the-tip-of-an-electrode-fig4_269517554 - singleunit recording

THANKS

Do you have any questions?

