Neurostimulants after a Brain Injury: What do we know?

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- Thank you to our federal sponsor, the National Institute on Disability and Rehabilitation Research (Department of Education)
- OT Department for their beautiful classroom

Effects of Traumatic Brain Injury – problems with regulation

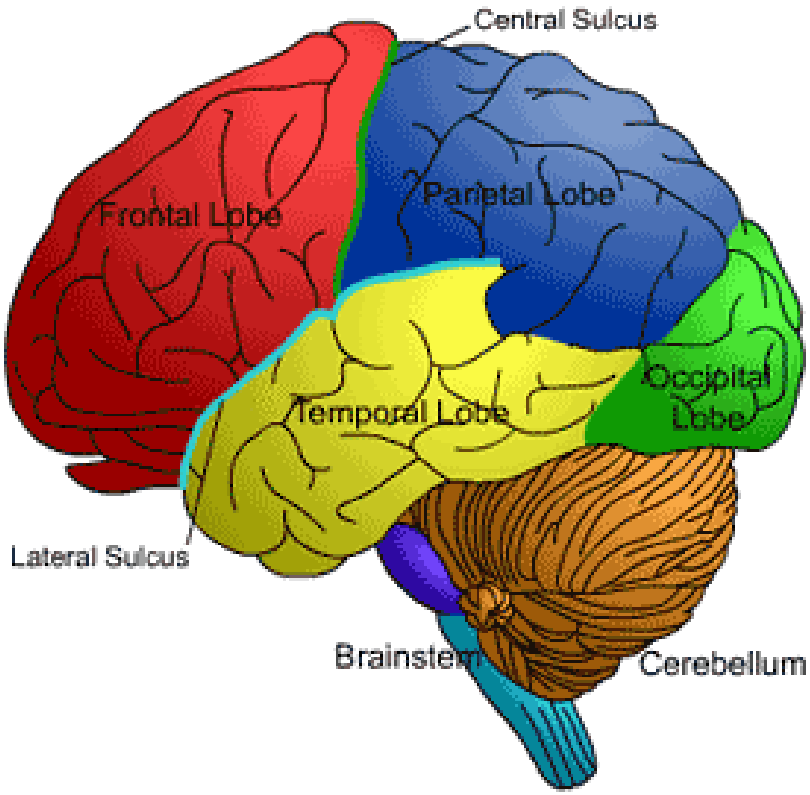
TOO MUCH

- Irritability
- Impulsivity
- Mood ups/downs
- Mania
- Psychosis
- Aggression
- Increased sexual behavior

NOT ENOUGH

- Apathy
- Akinetic mutism
- Poor memory search
- Poor flexibility in thinking
- Problems with staying on task
- Memory impairment

The Major Sections of the Brain



Medial Frontal Cortex

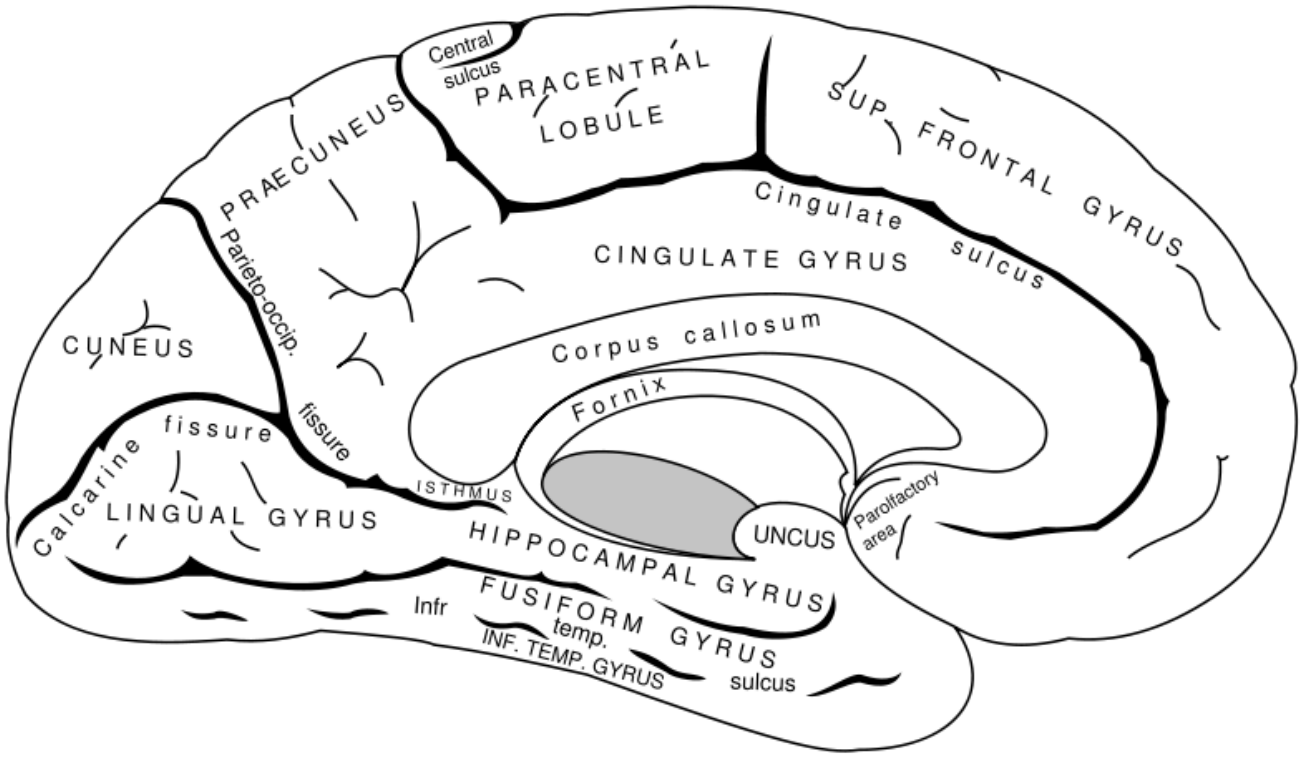
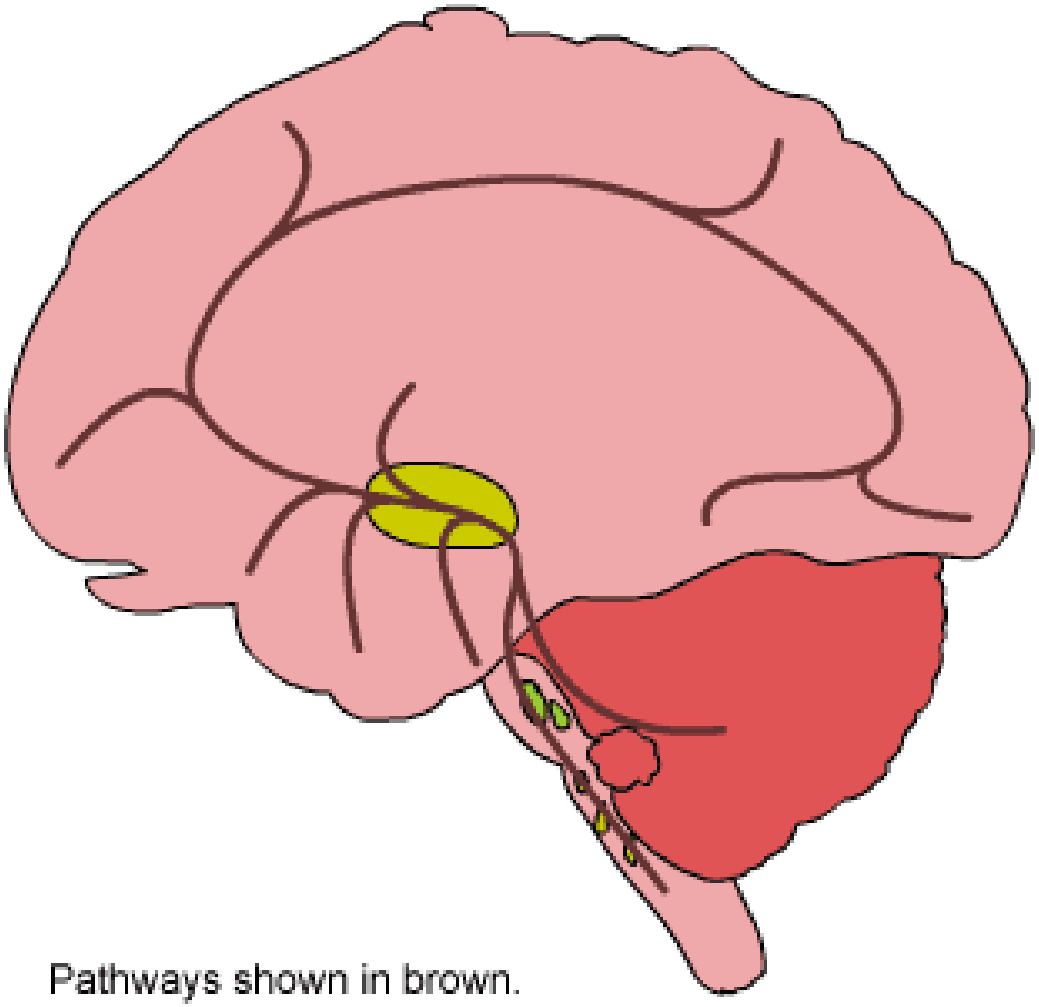


Figure AB-24: Reticular Activating System



Pathways shown in brown.

Neurotransmitters

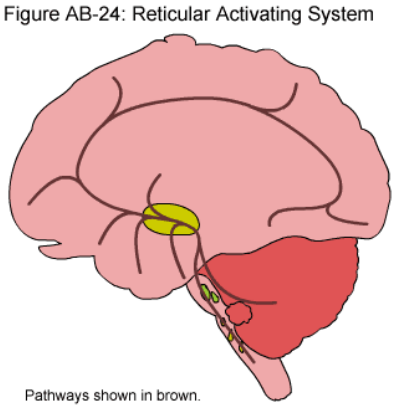
- Dopamine
- Norepinephrine (noradrenaline)
- Acetylcholine

Speed, Attention and Memory

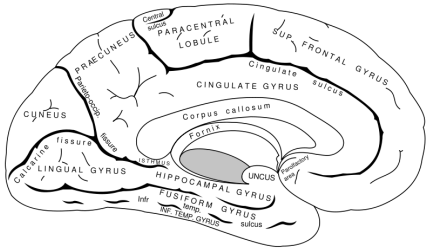
Neurostimulants can affect:

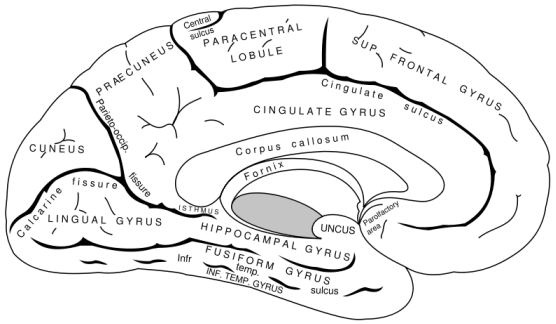
- How fast you think
- How well you can pay attention (how <u>really</u> awake you are)
- How much/well you can remember

Attention

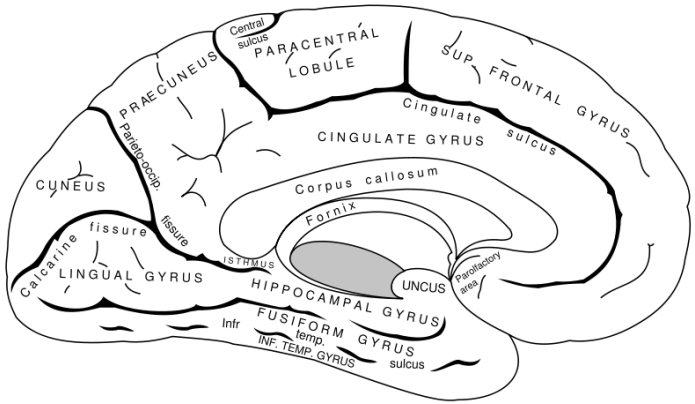


- Neural network
  - Ascending reticular activating system (brain stem) working *from the bottom-up*
    - Global attention
  - Prefrontal, parietal, and limbic cortices working *from the top-down*
    - Attention specific to context, motivation, significance, and conscious volition





- Lesions of this area result in
  - Amotivational apathetic state
    - Less talking and gesturing
    - Decreased curiosity
    - Less vocal inflection and facial expression
    - Reduced social interest, diminished affection
    - Reduced initiation and poor maintenance of activities



- Lesion in superior medial frontal cortex – slowed response time
- Lesion in the Dorsolateral Prefrontal Cortex – no problems initiating but lots of errors (unable to switch sets)
- Lesion in the caudate nucleus – Might have both slowed processing time and perseverative errors

Memory

- Temporal lobe or diencephalon (hippocampus) – actual storage of memory
- Frontal lobe damage
  - Impaired recall that depends on self-initiated cues, organization, search selection, and verification of stored information

Neurostimulants

amphetamine
Norepinephrine (TCAs)
methylphenidate, dextroamphetamine
amantadine
L-dopa/carbidopa
bromocriptine
pergolide
physostigmine
donepezil
selegiline
apomorphine
caffeine
phenylpropanolamine
Naltrexone
atomoxetine

Methylphenidate (Ritalin)

- Dopaminergic agent
  - Small studies that indicate that MPH improves processing speed, and levels of attention (which may improve memory)
  - In rats, improves dopamine transmission between nerve cells as well
  - Probably true for amphetamines as well

Rivastigmine

- Cholinesterase inhibitor – stops the breakdown of acetylcholine in the brain
- Seems to have promising results in patients with specific memory impairments
- (donepezil – Aricept, tacrine – Cognex, memantine – Namenda, galantamine – Razadyne)

Other Dopaminergic Drugs

amantadine

L-dopa/carbidopa

bromocriptine

How to decide whether to prescribe or use?

- Helps to have a specific behavior in mind that you want to improve
  - Is it speed, alertness, or memory that is the issue

How to decide whether to prescribe or use?

- Are there any reasons NOT to take the drug?
  - Heart problems
  - Other medications that might interact
  - History of addiction
  - Irritability

How to decide whether to prescribe or use?

- When to take the drugs?
  - No one really knows

IF you and your doctor decide to try a neurostimulant:

- Be your own research project
  - Figure out what your desired results are
  - Begin a dose of the drug
  - Observe and keep records
  - May need to increase the dose of the drug
  - May need to go back off the drug to see if it was really working or not

Questions?