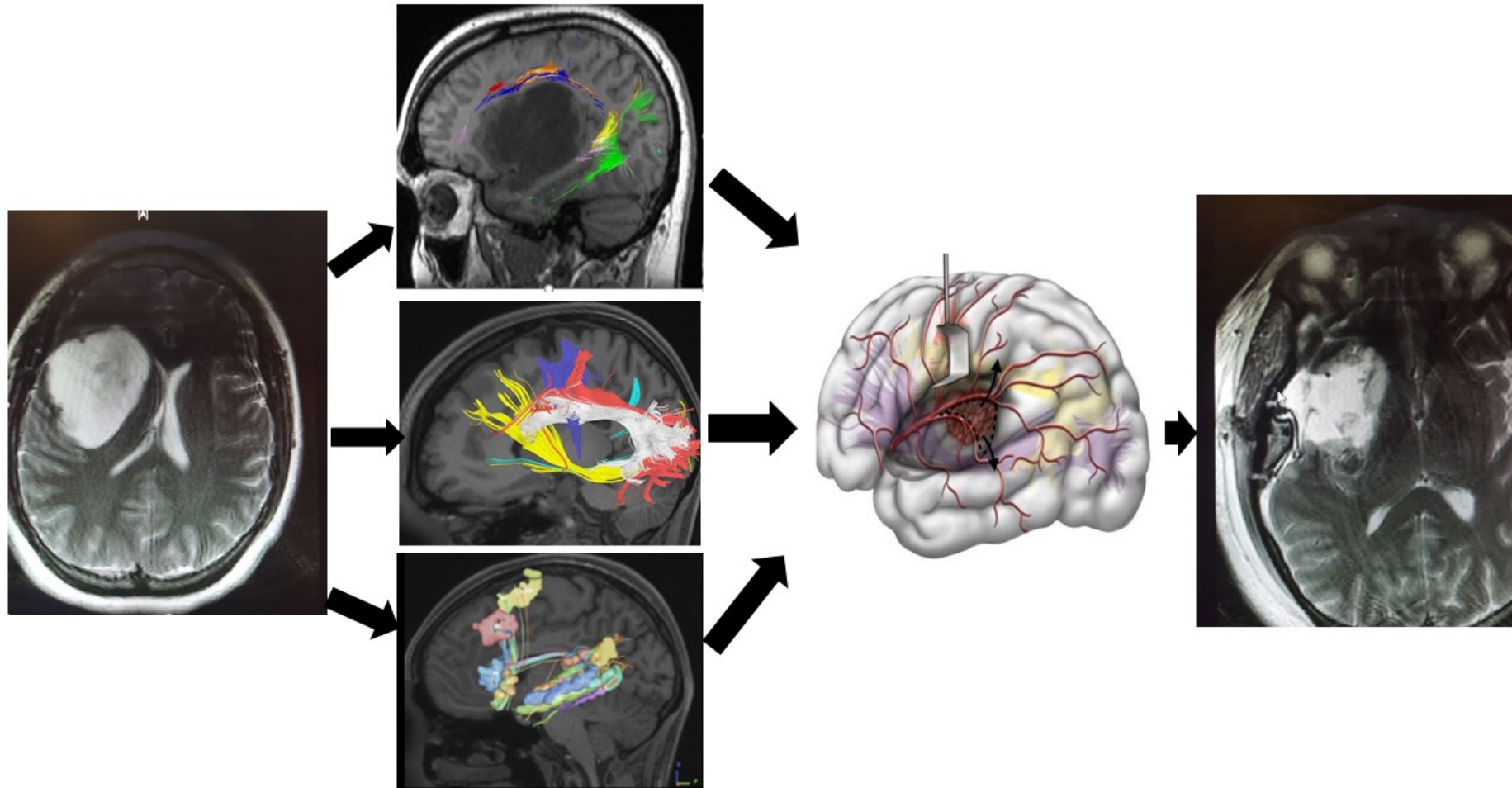


Network Neurosurgery: Disconnection

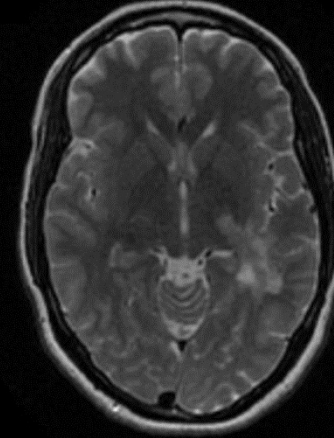
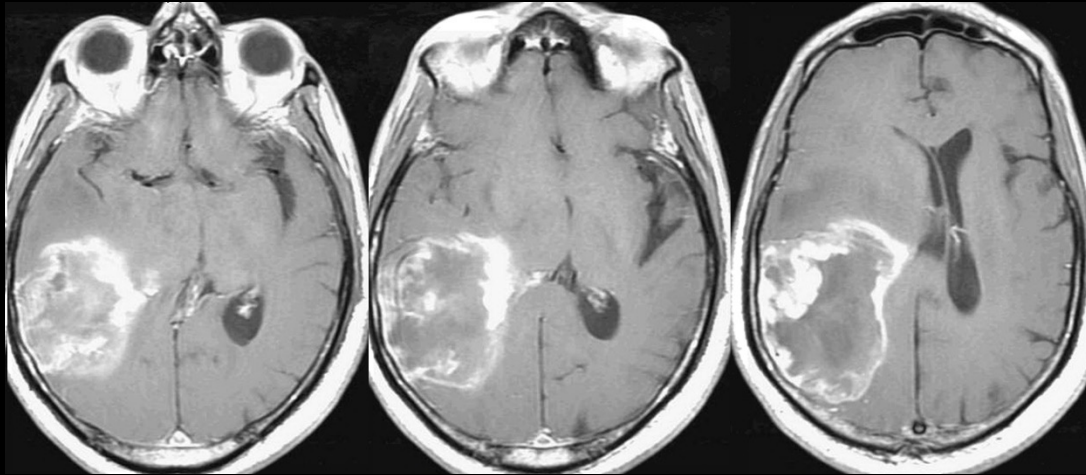
Michael Sughrue, MD

Disclosure

- **Founder and CMO, Omniscient neurotechnology**



Making Oncofunctional Decisions Based on Data



Good advice is in short supply

- “Stay out of Eloquent areas”- Is the rest of the brain a decoration?
- “Everything is Eloquent”- We know this isn’t reality either
- “Cortical stimulation for higher brain functions”

Is it in 1 place?

Do intraoperative tests have clear answers on these functions?

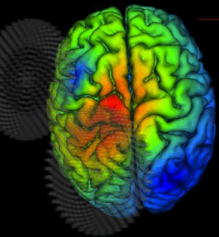
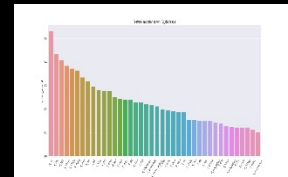
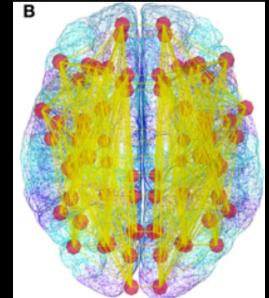
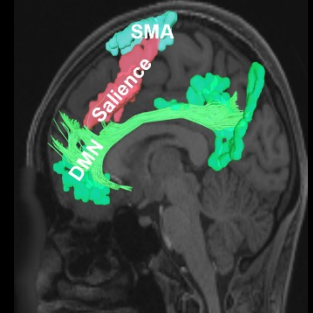
Do we understand what we are trying to preserve?

Is the resolution of a stimulator the size of the structures?

My Advice: Use facts and data to reduce this uncertainty. Adjust our thinking accordingly

Paths towards reducing cognitive footprint

1. Preserve the core of networks whenever possible
2. Consider the full brain ramifications of the action
3. Move our thinking towards individual circuits
4. Consider the possibility that we can change the connectome

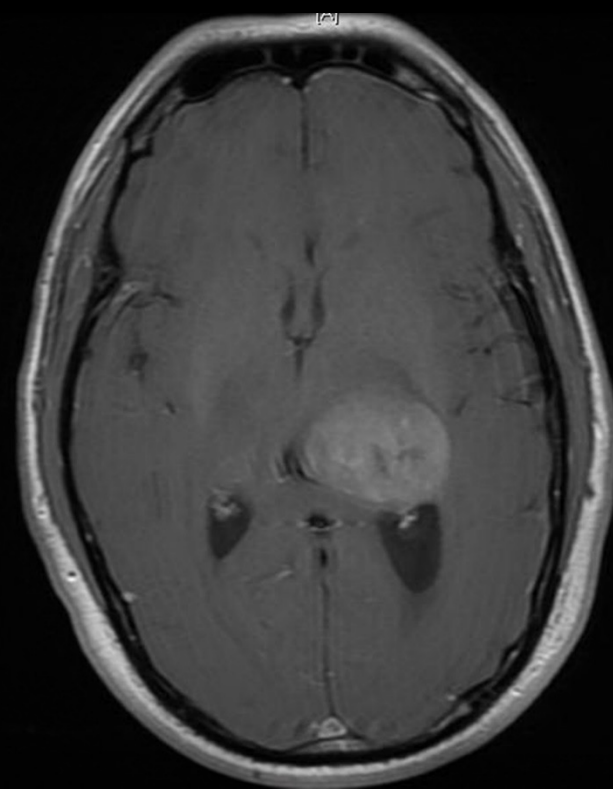


Disconnection vs Trajectory

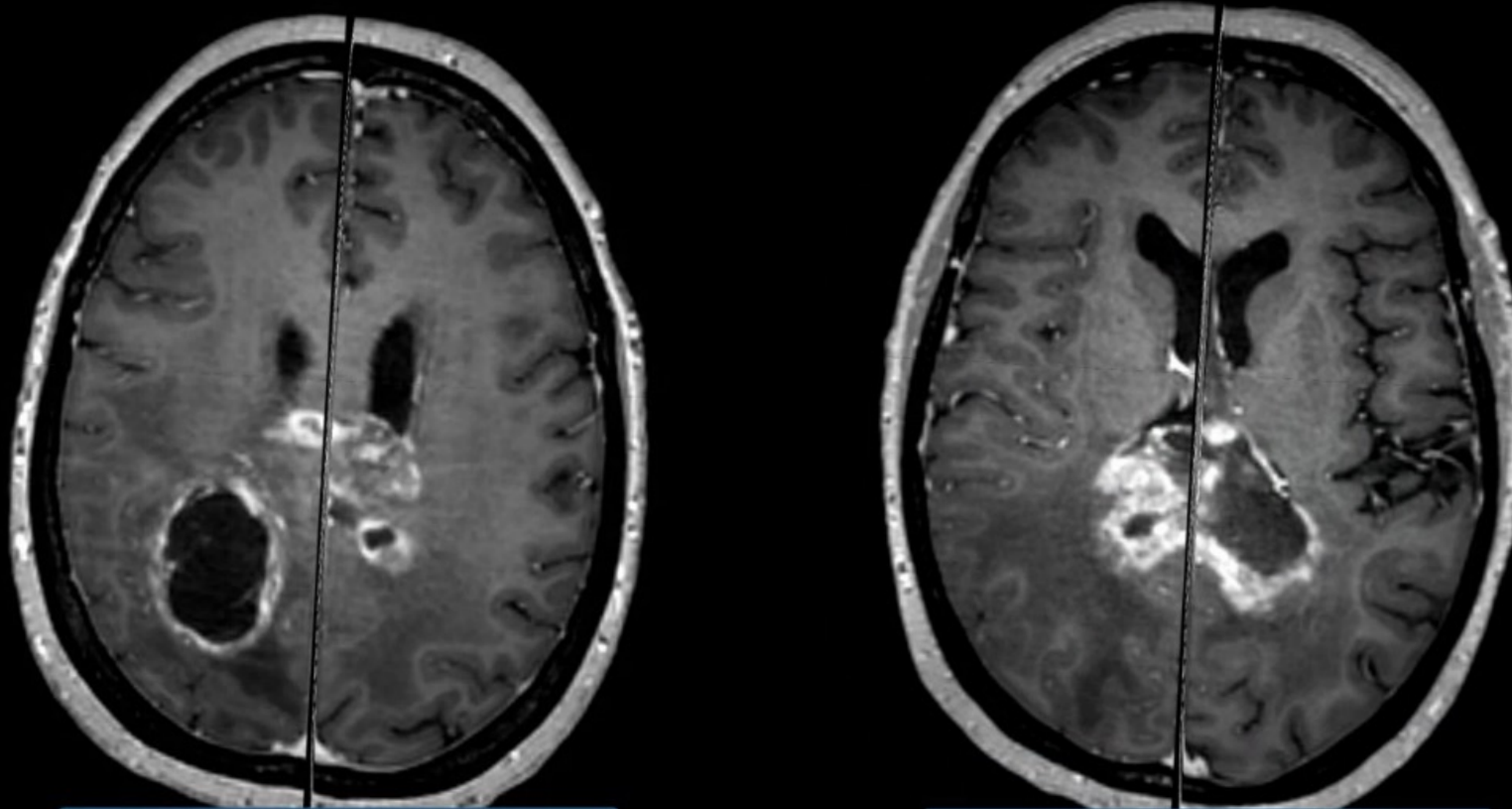
Disconnection

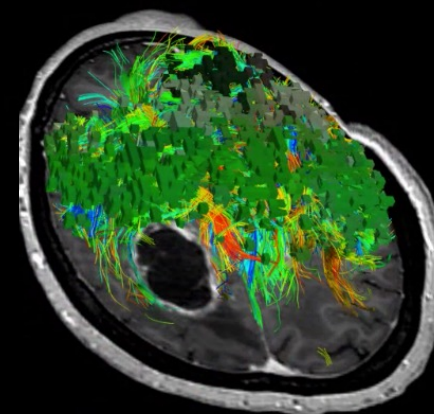
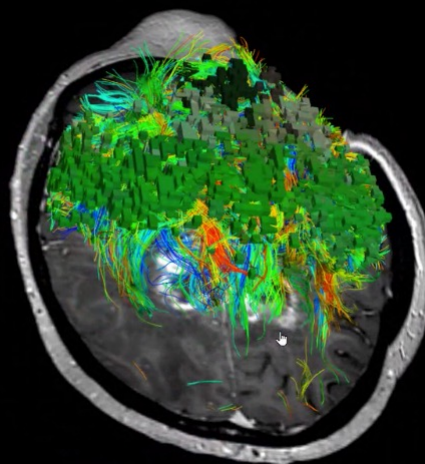
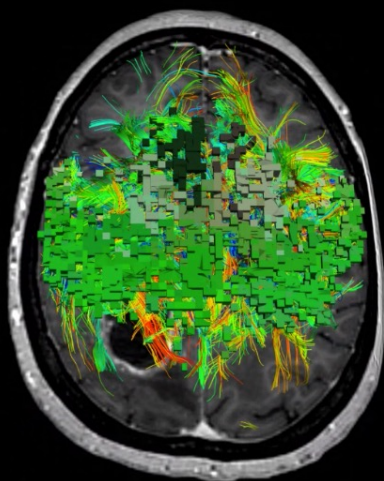
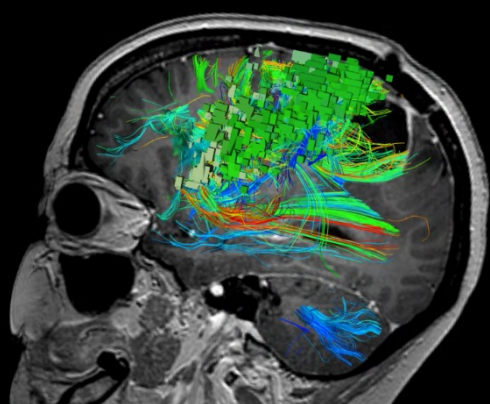


Trajectory

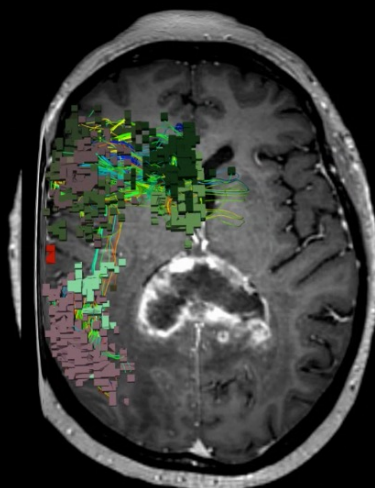
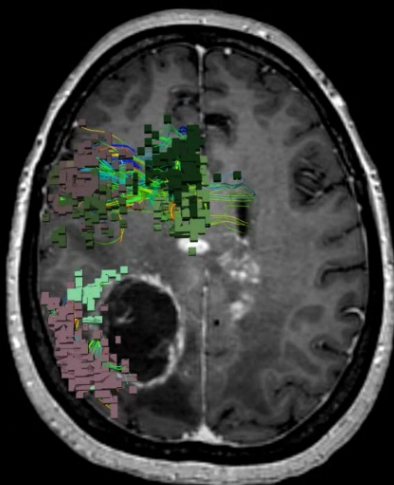
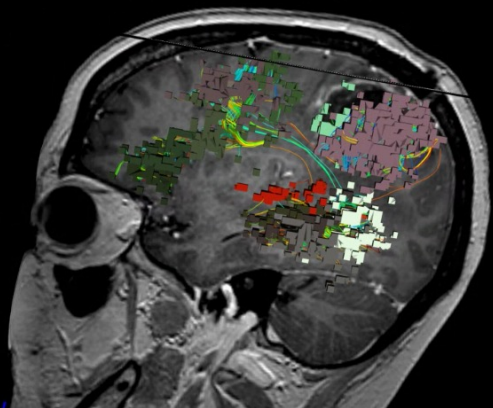


Medial Parietal Disconnection

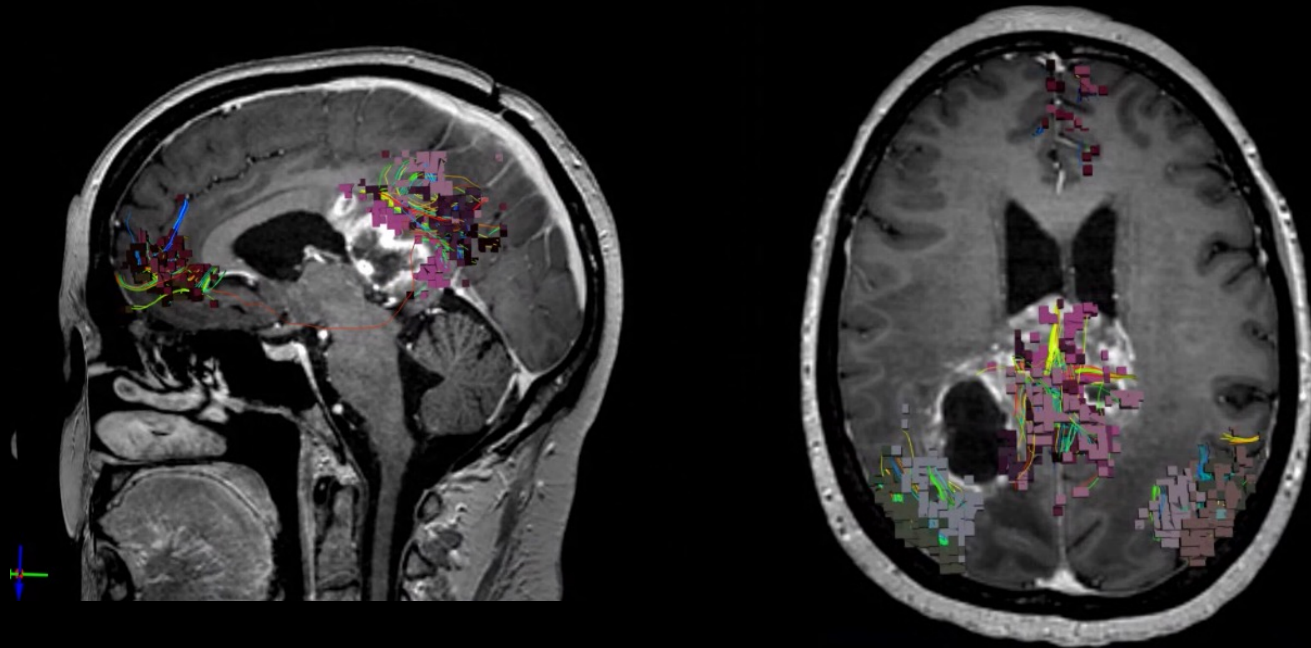




Sensorimotor

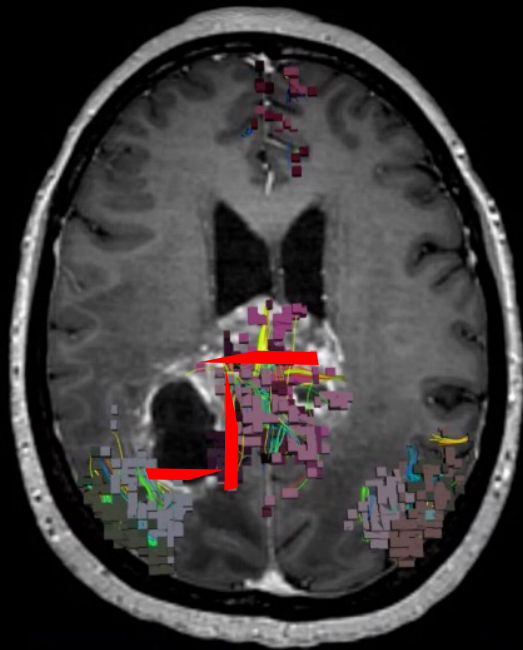


Language

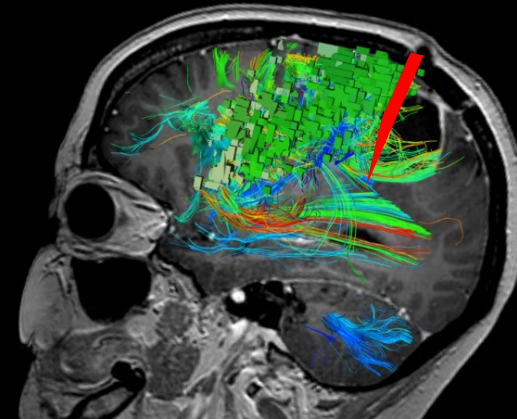
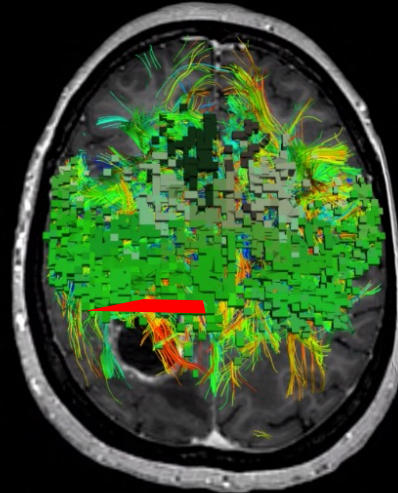


DMN

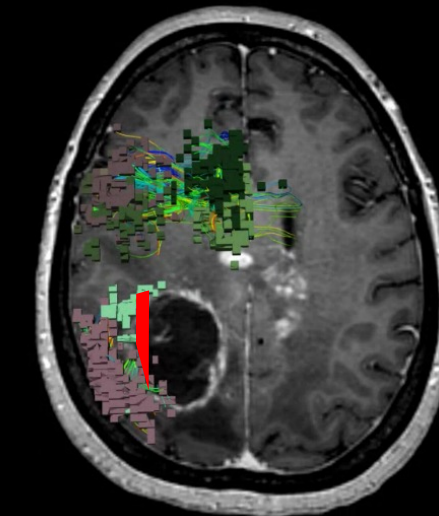
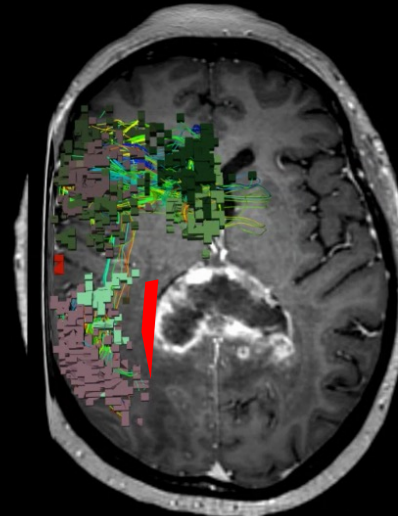
Medial Parietal Disconnection



DMN

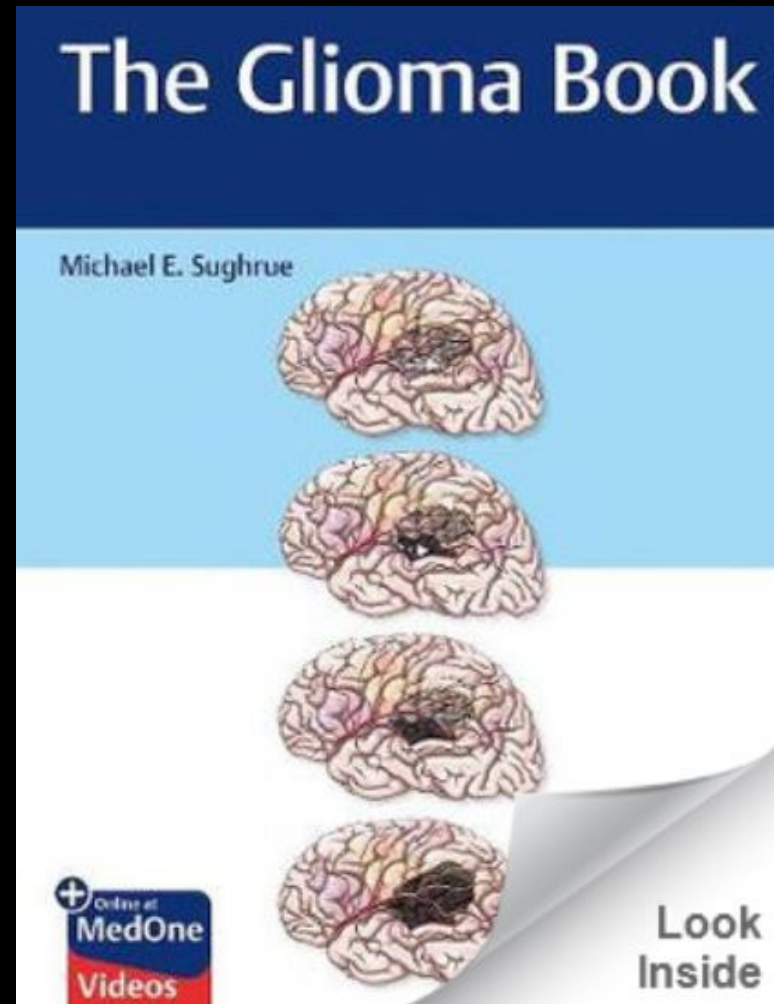


Sensorimotor



Language

Shameless plug



Supratentorial, intra-axial brain surgery

As I learned it

- Eloquence vs noneloquence
- Choose noneloquent entry point
- Stay in “tumor”
- Don’t cut the corticospinal tract

Supratentorial, intra-axial brain surgery

Reality

- Neurological deficits we can't always explain
- More cognitive morbidity than we admit

Whether we admit it or not

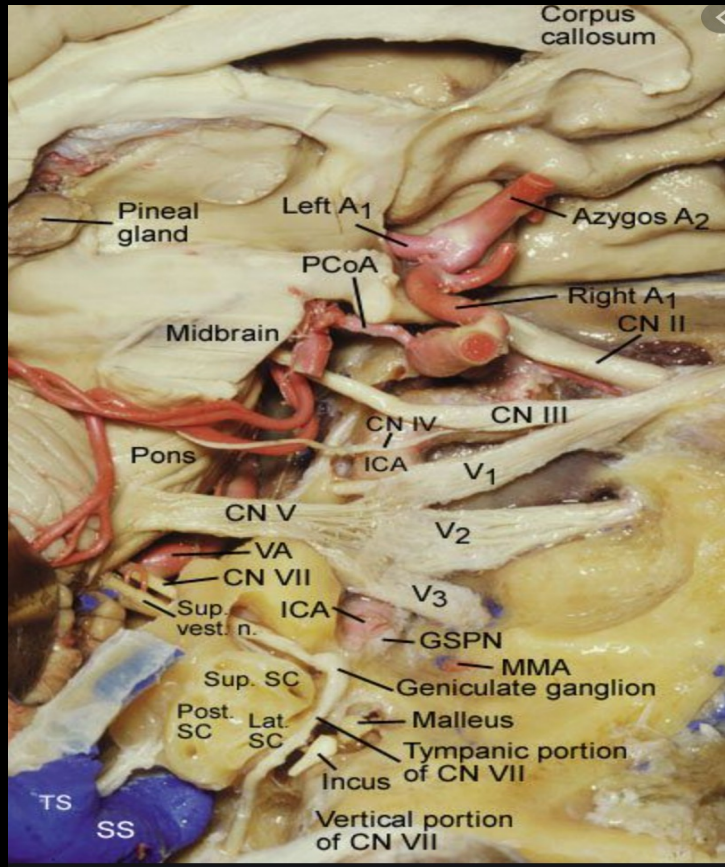
- **We are cutting next to (or through) brain networks**
- **The subcortical space has anatomy**
- **The brain didn't evolve CSF sponges: it all is active**
- **This is all there even if we do not know about it**

Envisioning our goal

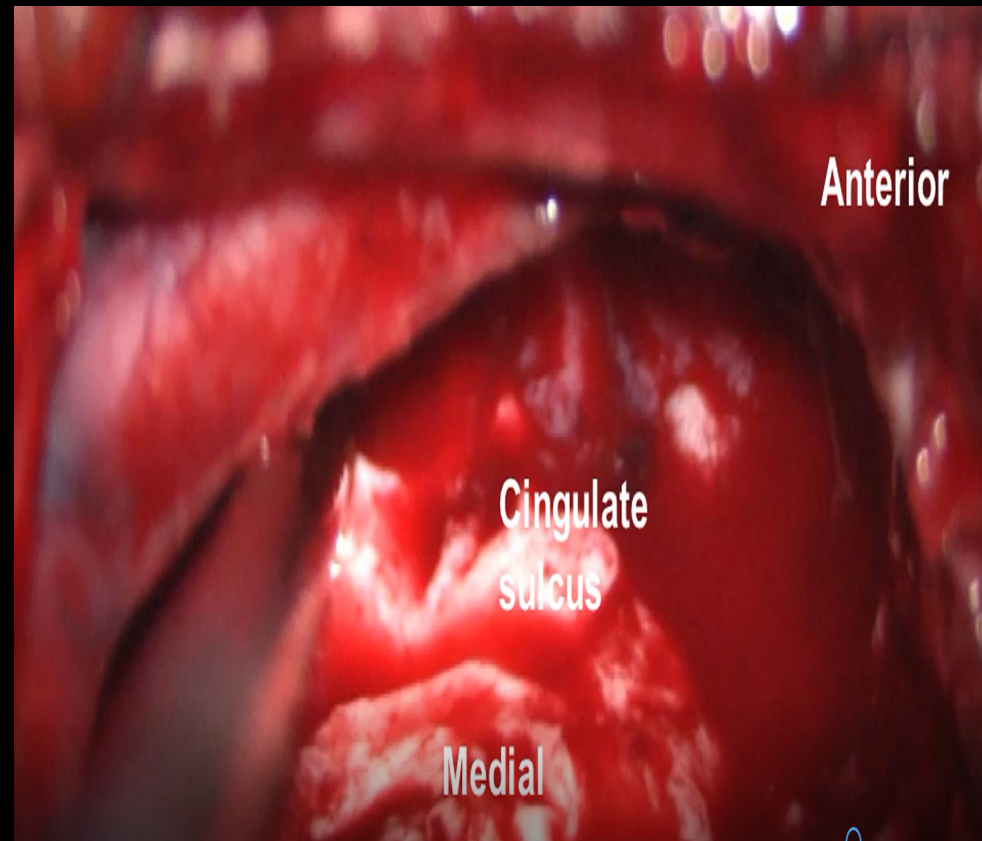
- **Figure what is needed to function**
- **Separate this from as much of the tumor as possible**
- **Remove what is seperated**

Deceptively Simple

Skull Base Surgery



Intra-axial tumors



Montages

Medial Frontal

FAT, SLF, Cingulum

Lateral Frontal

IFOF, SLF, FAT

Posterior Temporal

SLF/Arcuate

Anterior Occipital

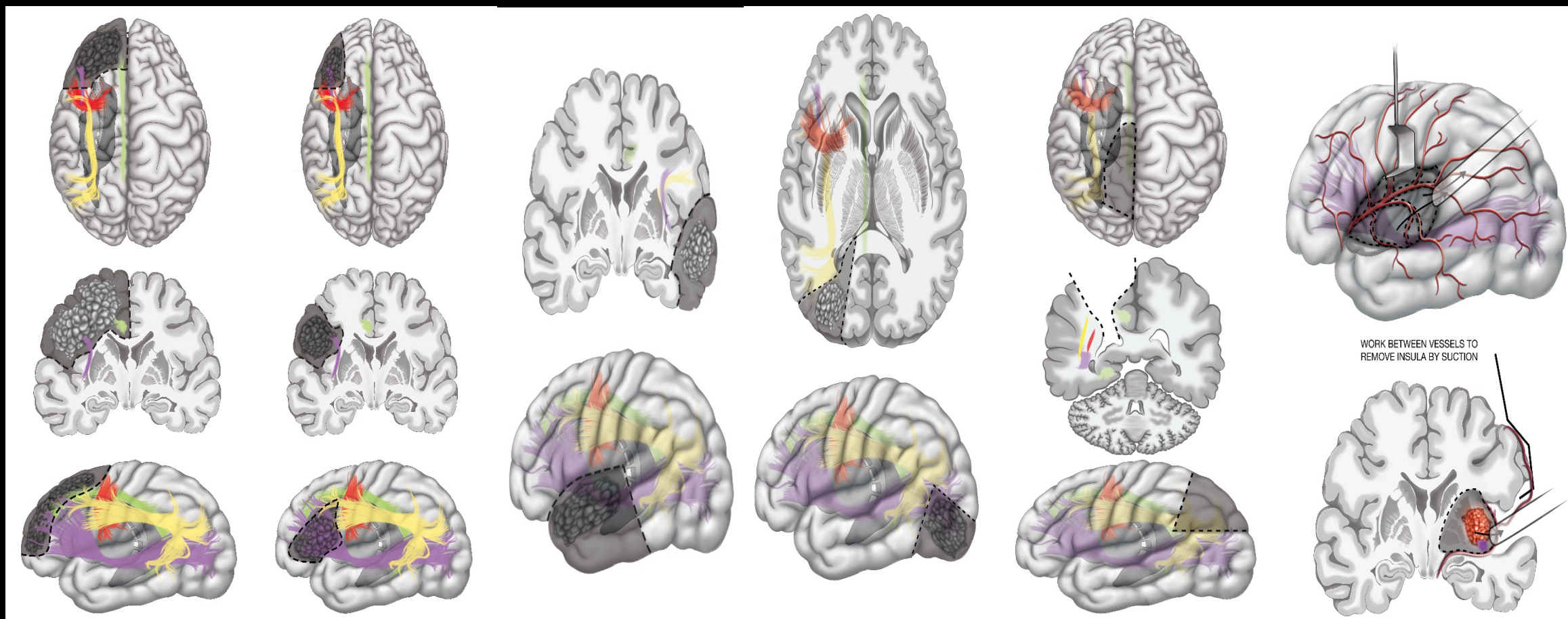
SLF, IFOF, Optic Rad

Medial Parietal

SLF Sensorimotor, cingulum

Transinsular

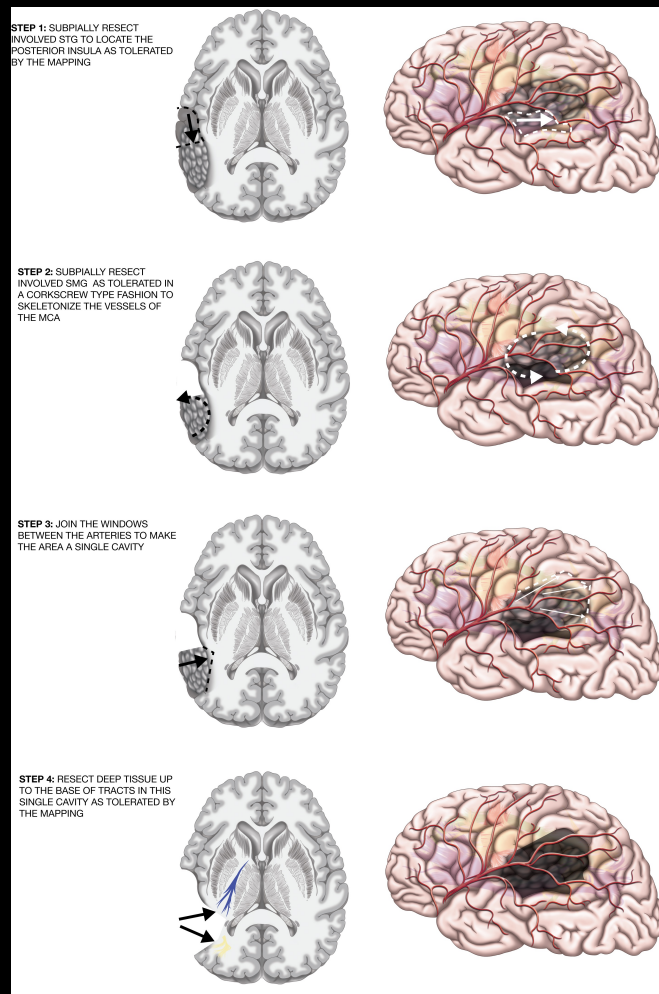
SLF IFOF, Internal Capsule



Montages

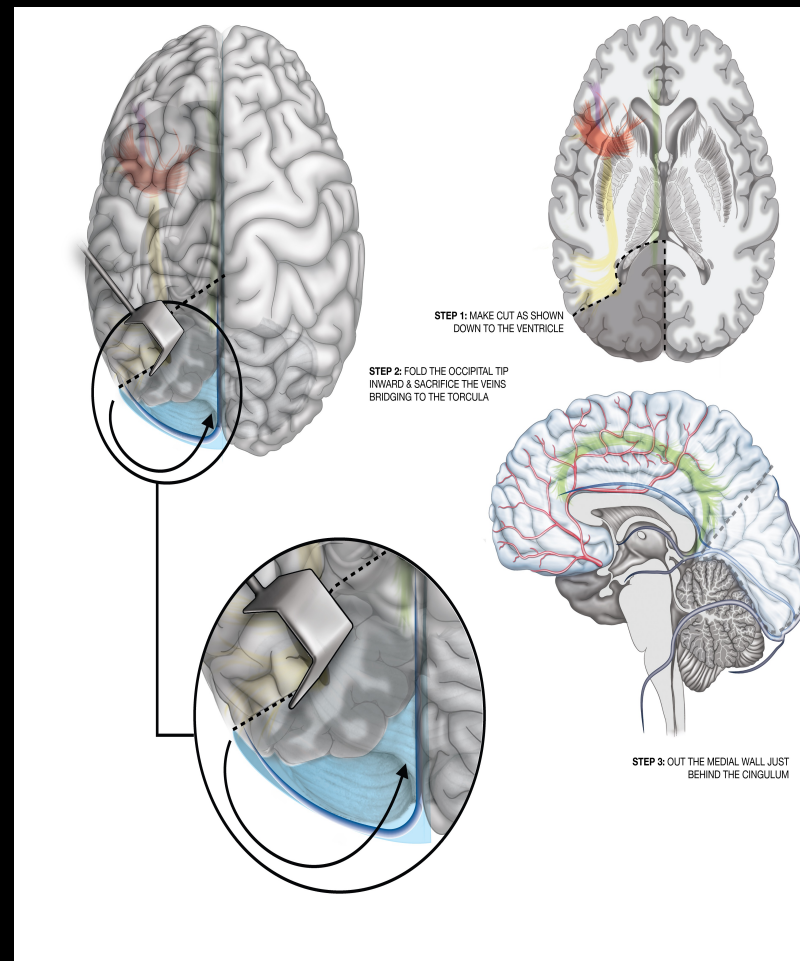
Lateral Parietal

IFOF, SLF, Motor

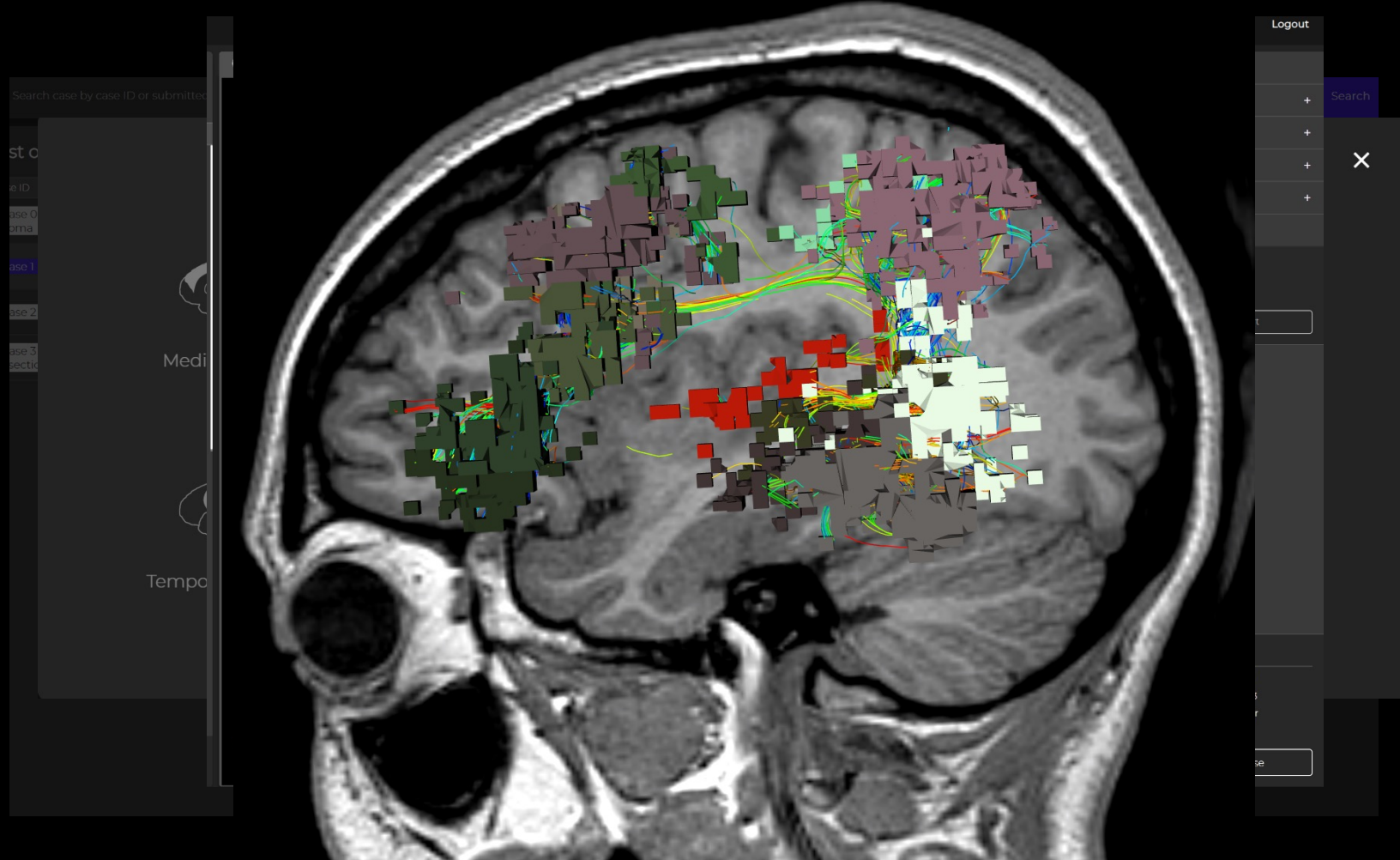


Occipital

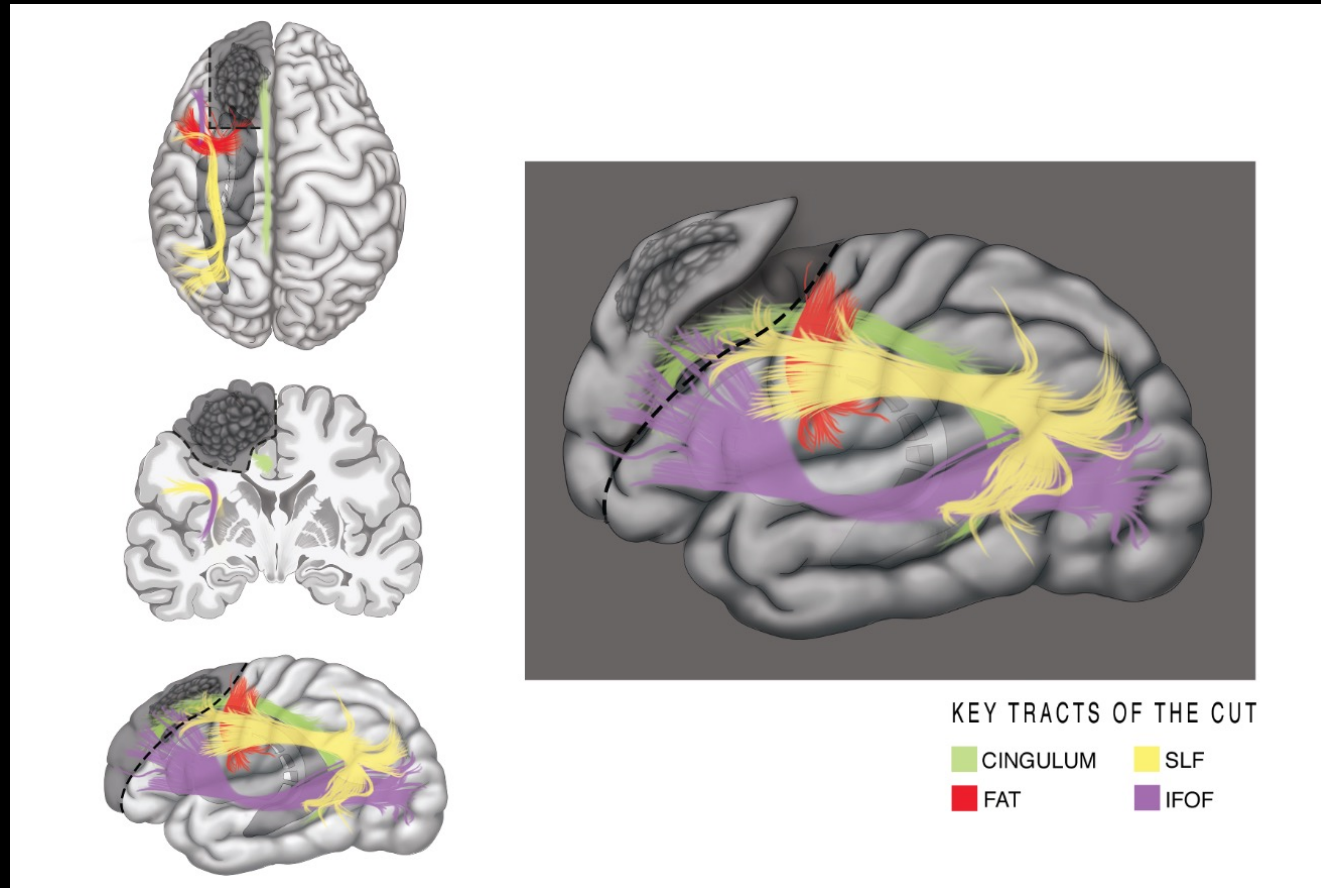
SLF/Arcuate



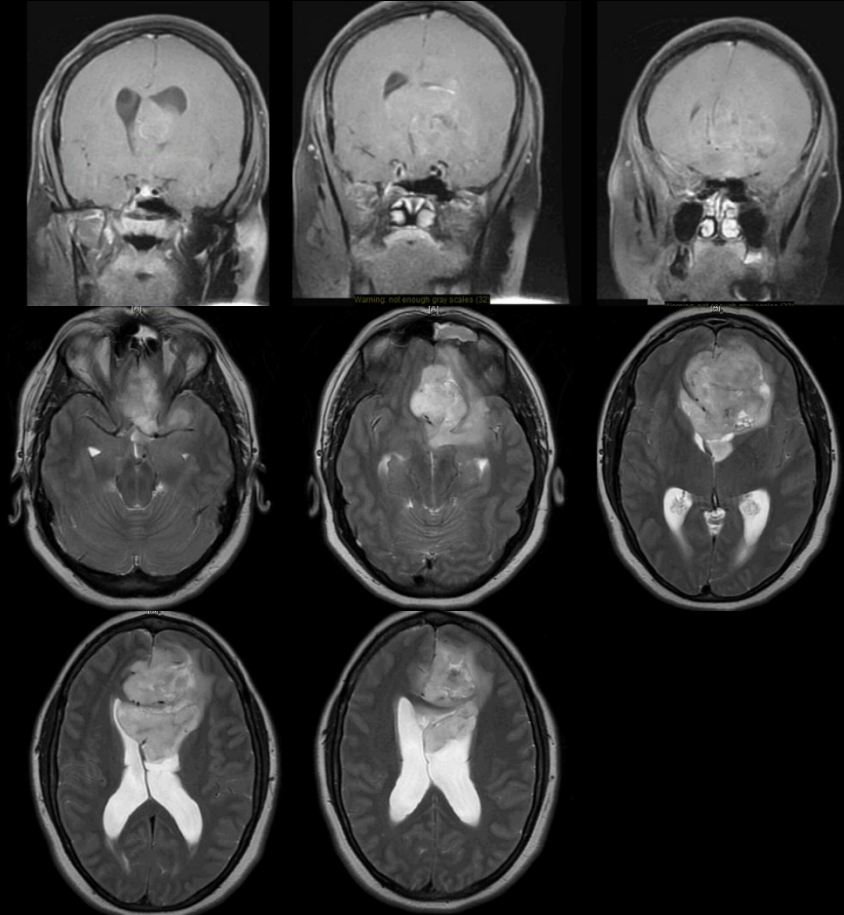
Quick planning



Medial frontal disconnection

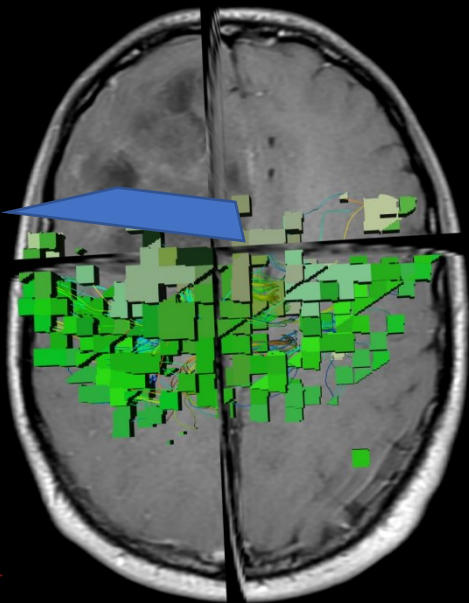
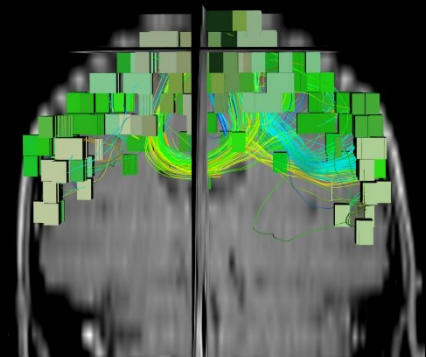


Medial frontal

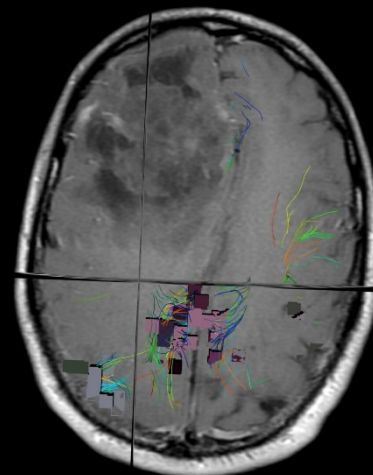
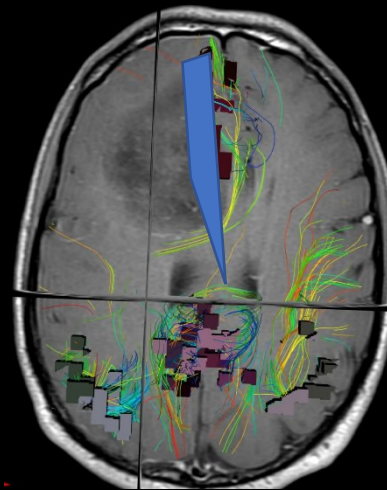


Medial frontal cut

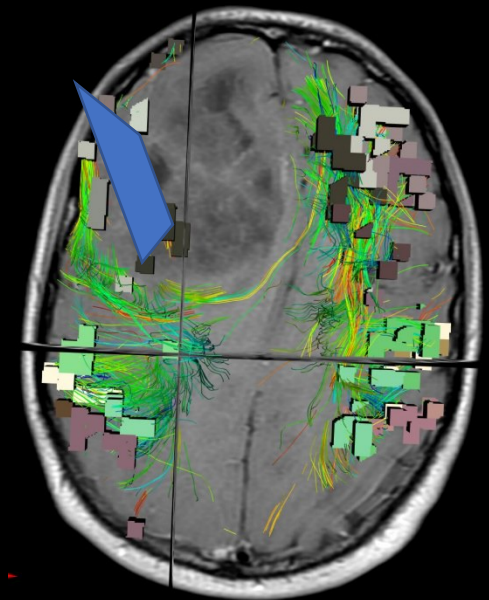
Sensorimotor



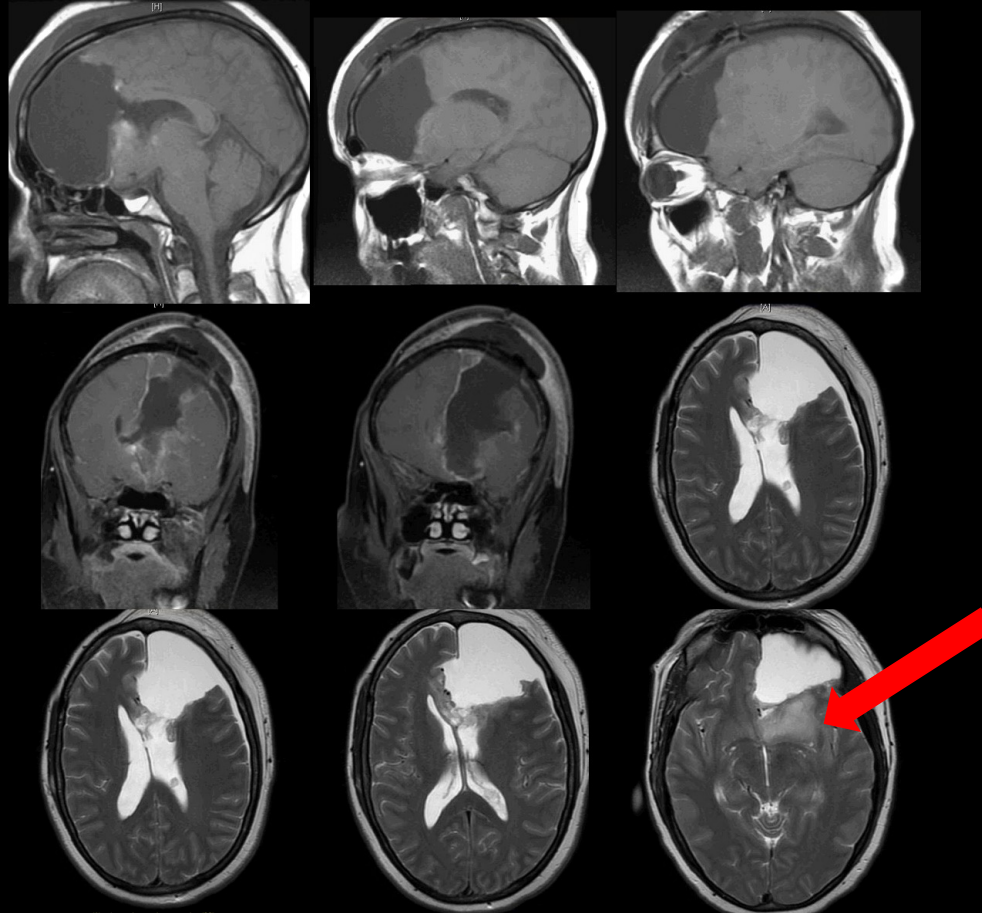
DMN



CEN



Post

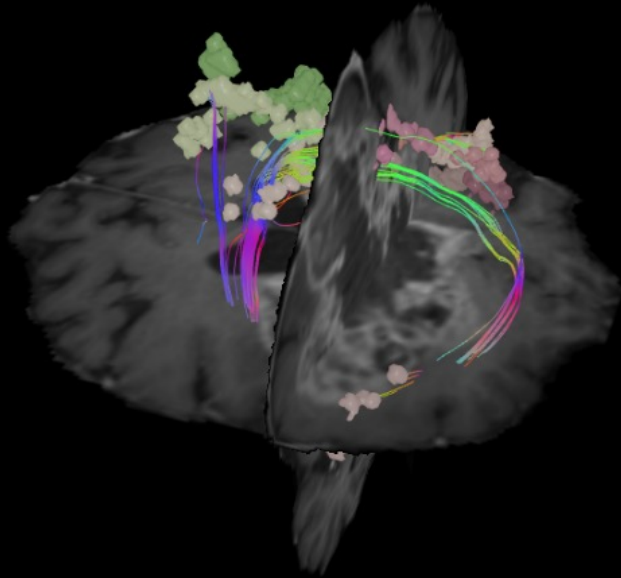


Not all or none

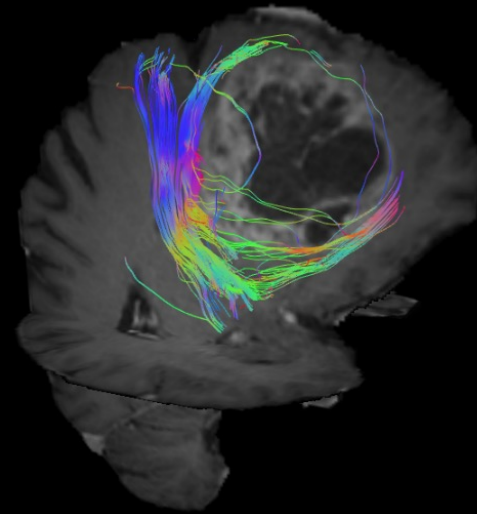
- A disconnection is a concept
- You don't need to make the full cut

You cant always save the network

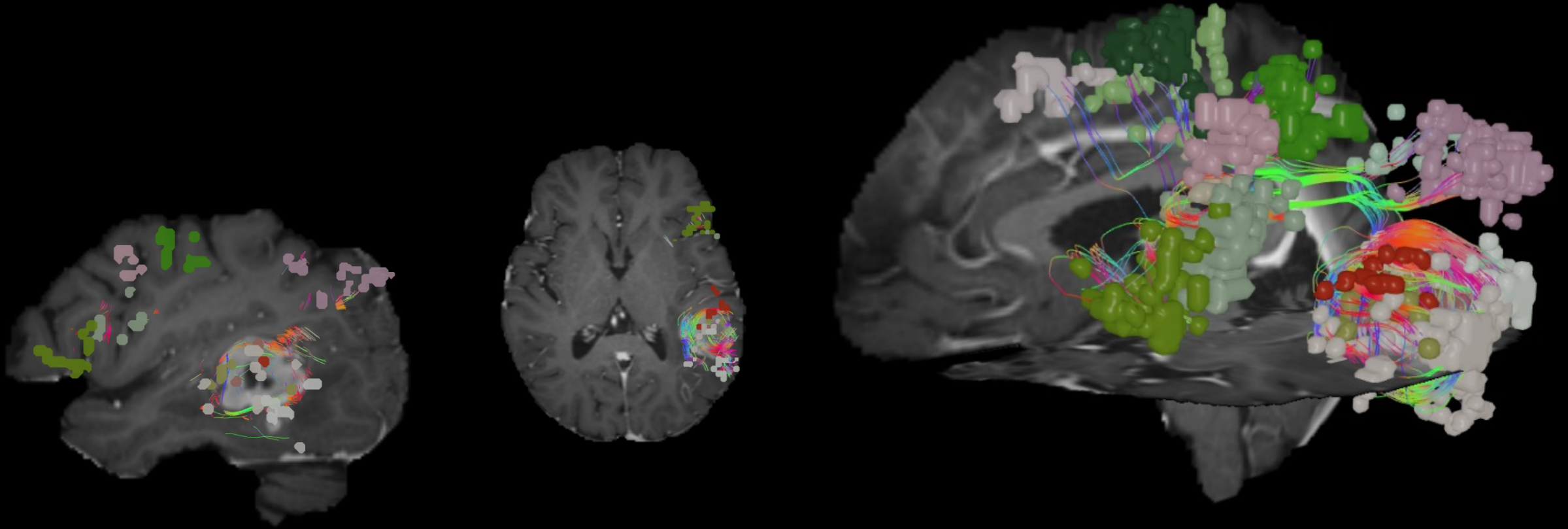
Saliency



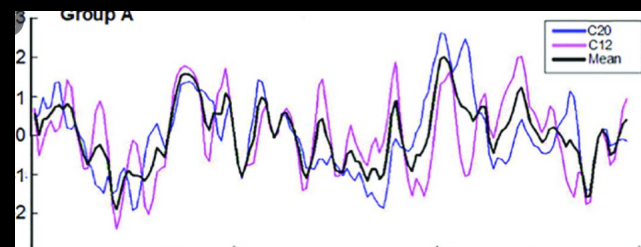
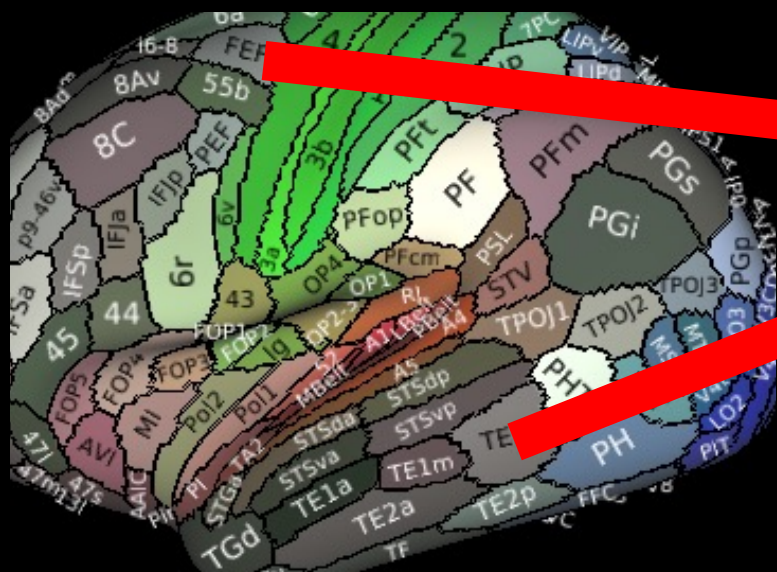
FAT



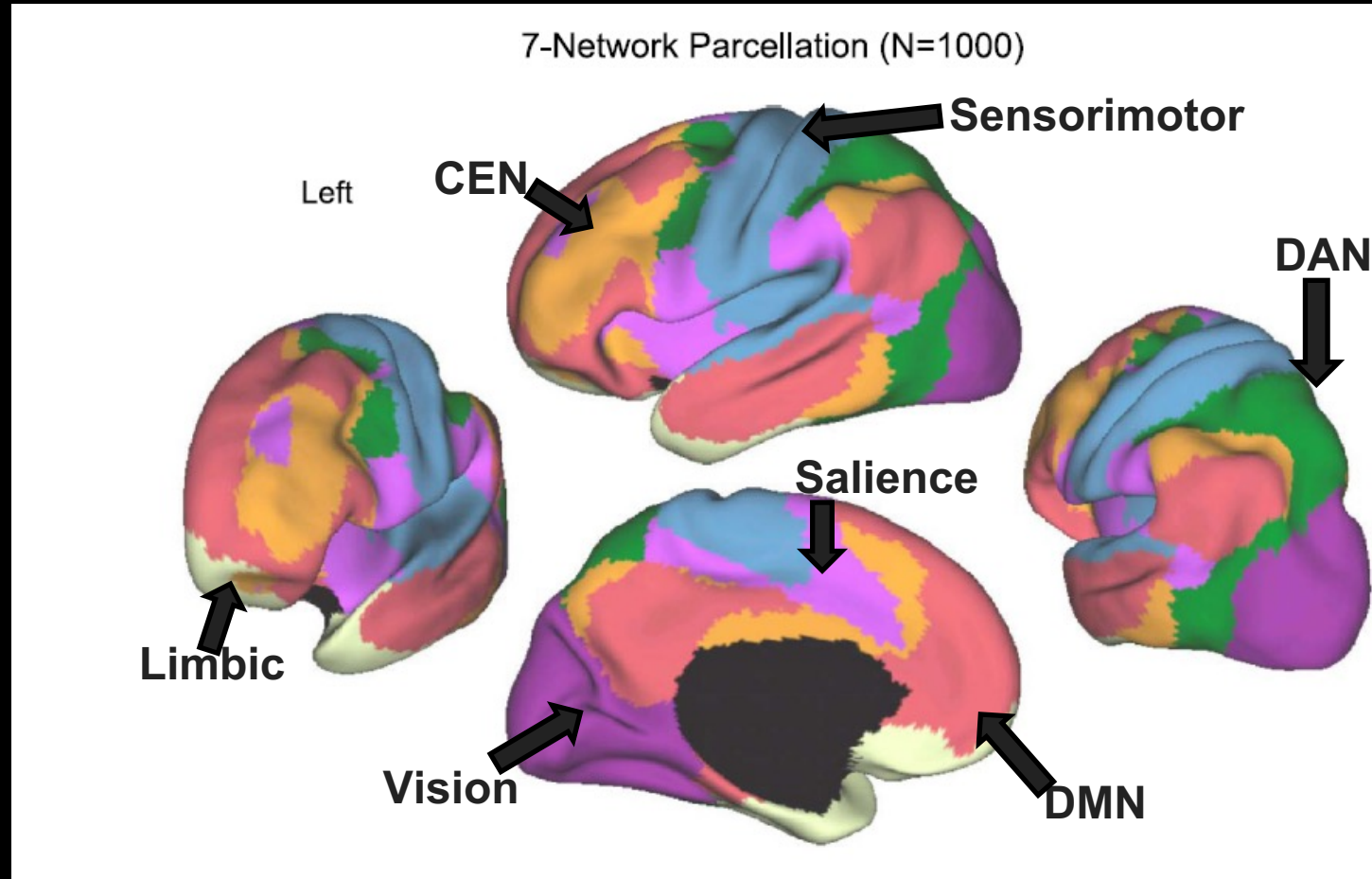
Surrounded on all sides

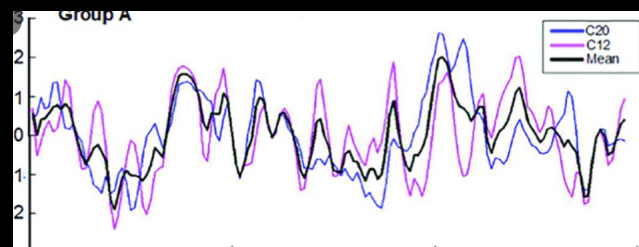
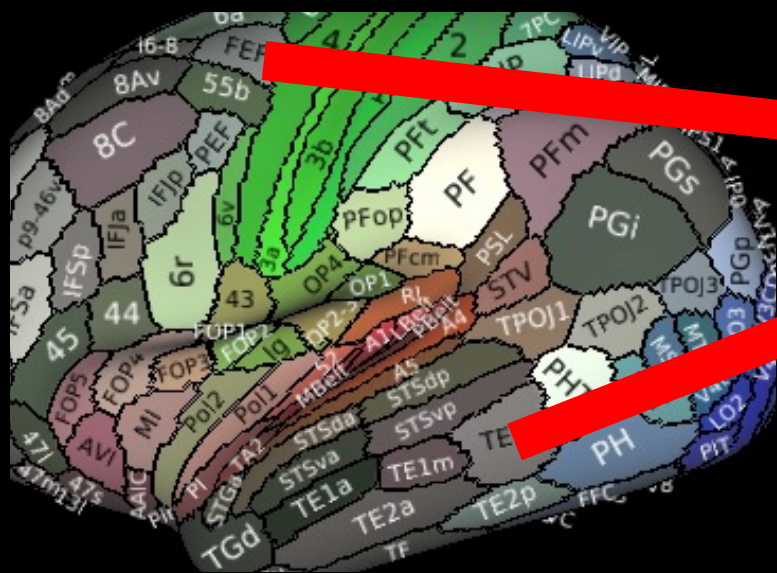


The Main Networks

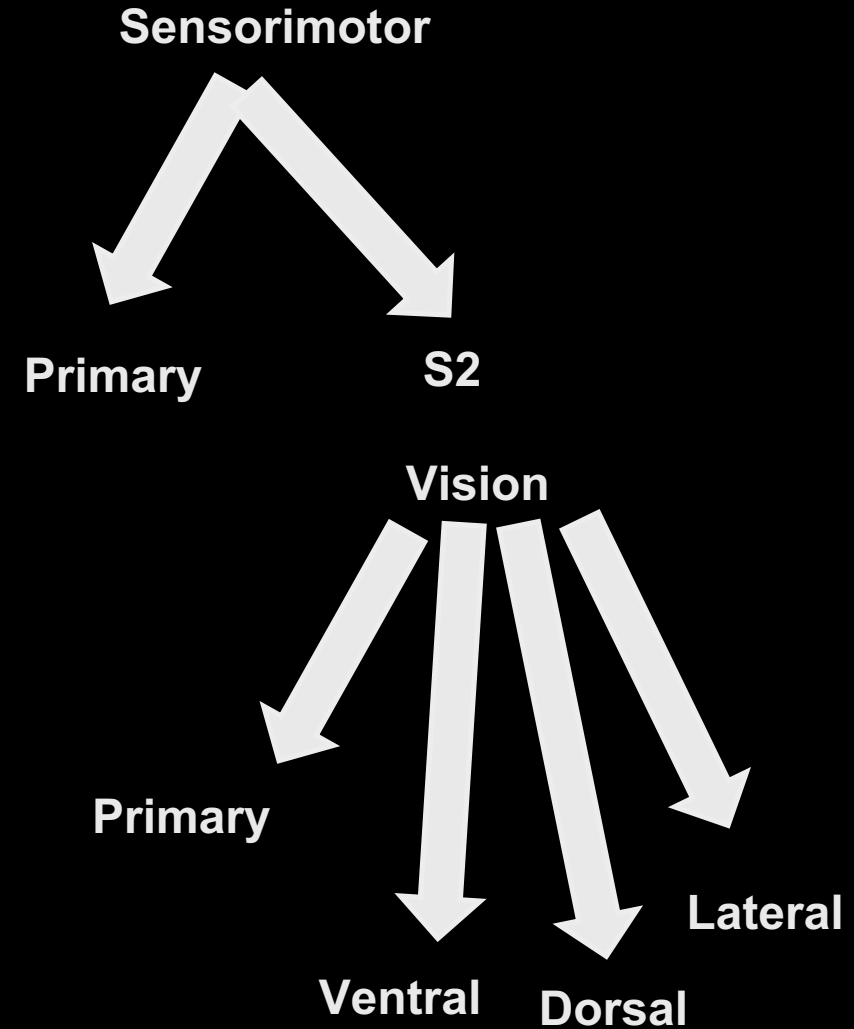
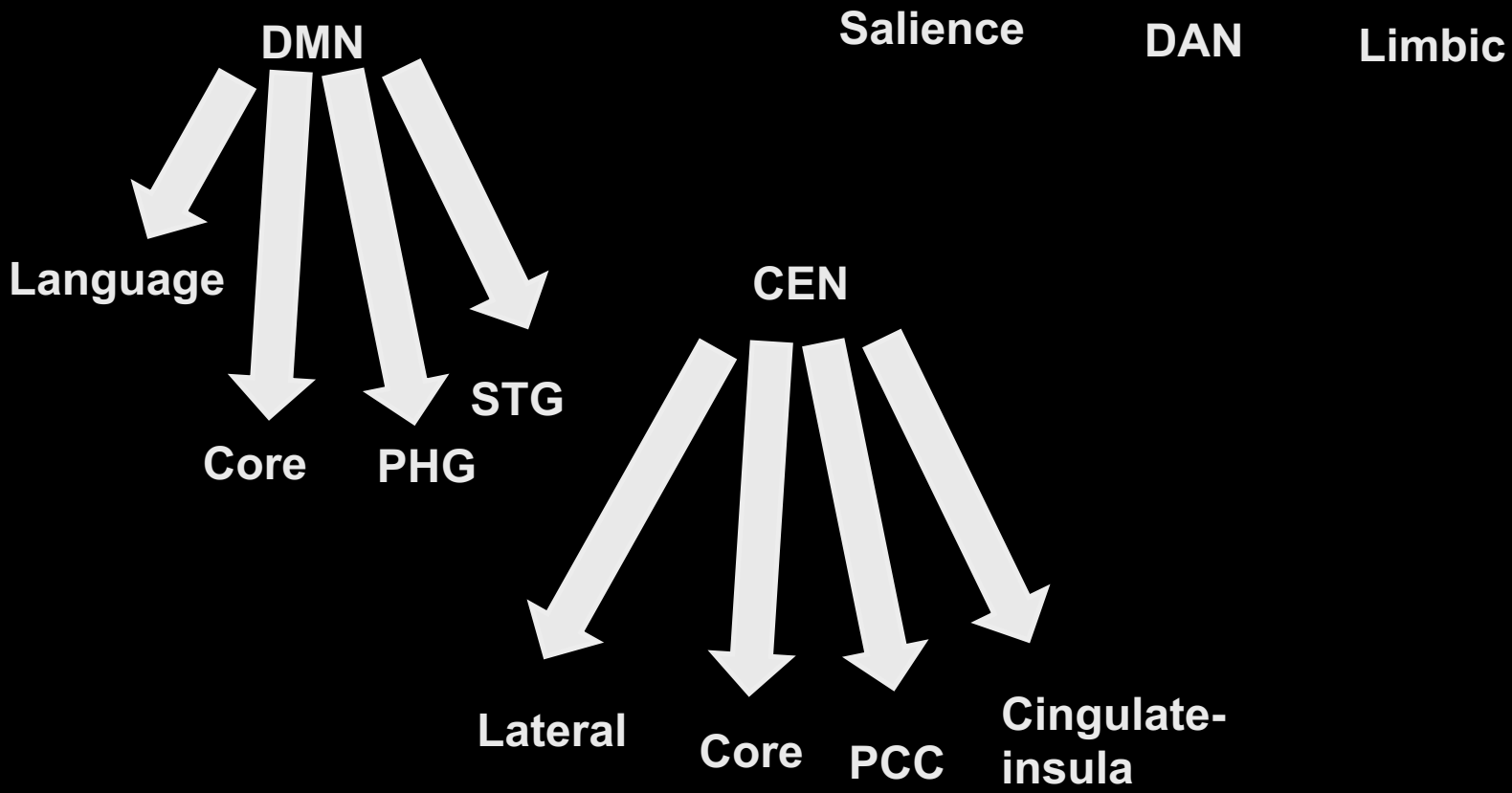


7 Main network



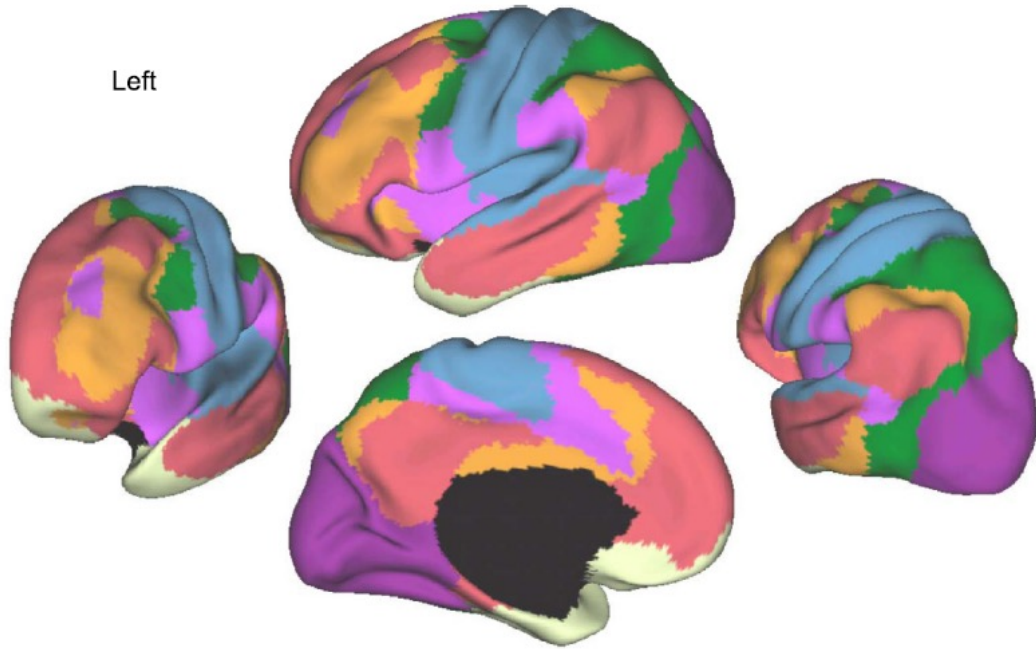


Network Can be divided



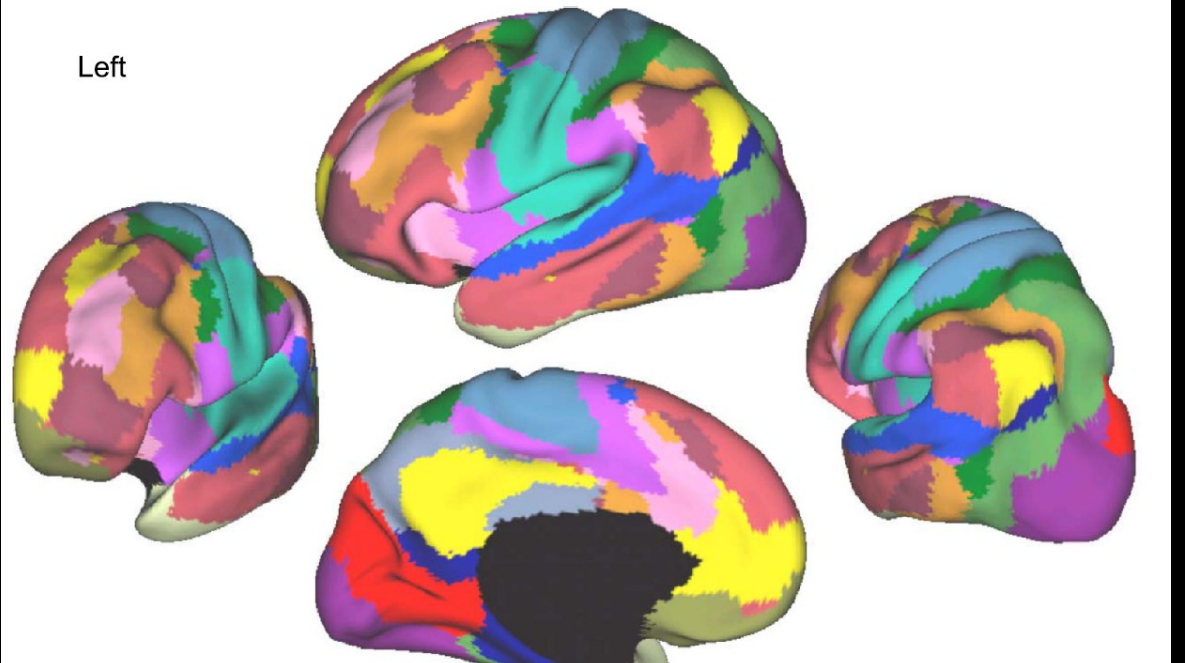
7 network

Left



17 network

Left

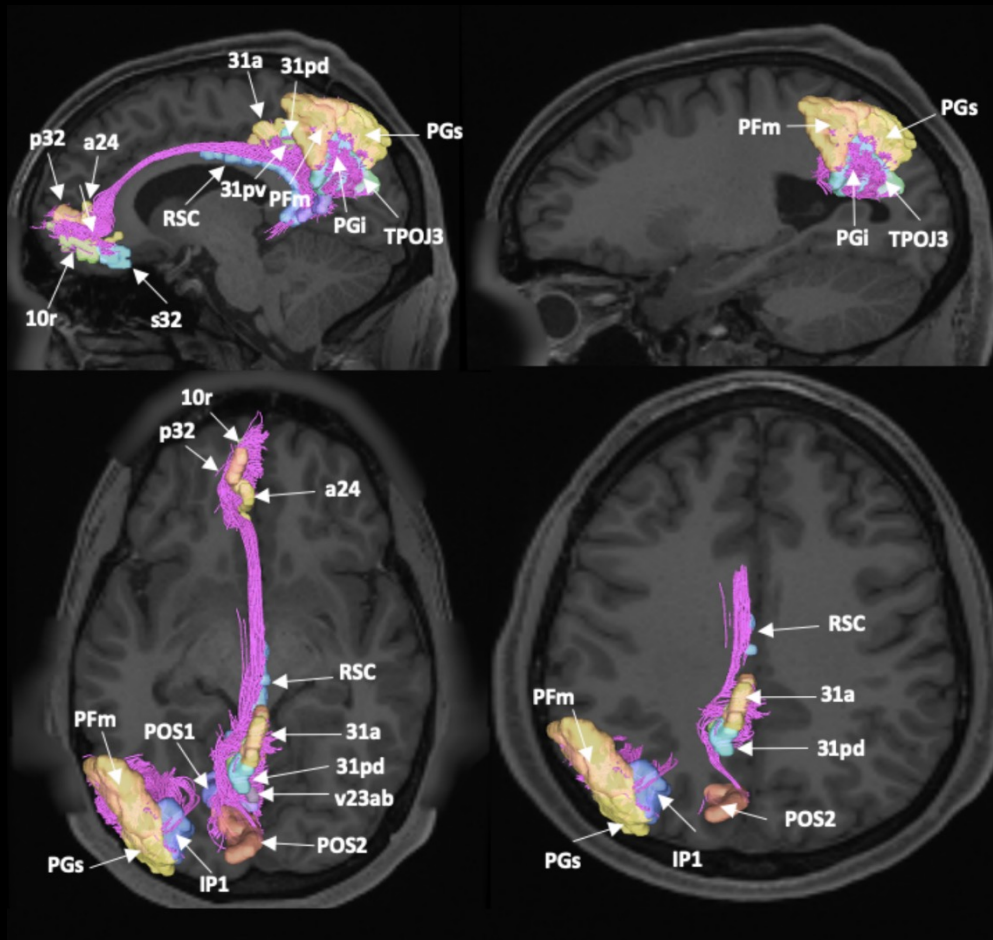


Mixed networks

- Multiple demand
- Ventral attention network (right only)

Making network decisions

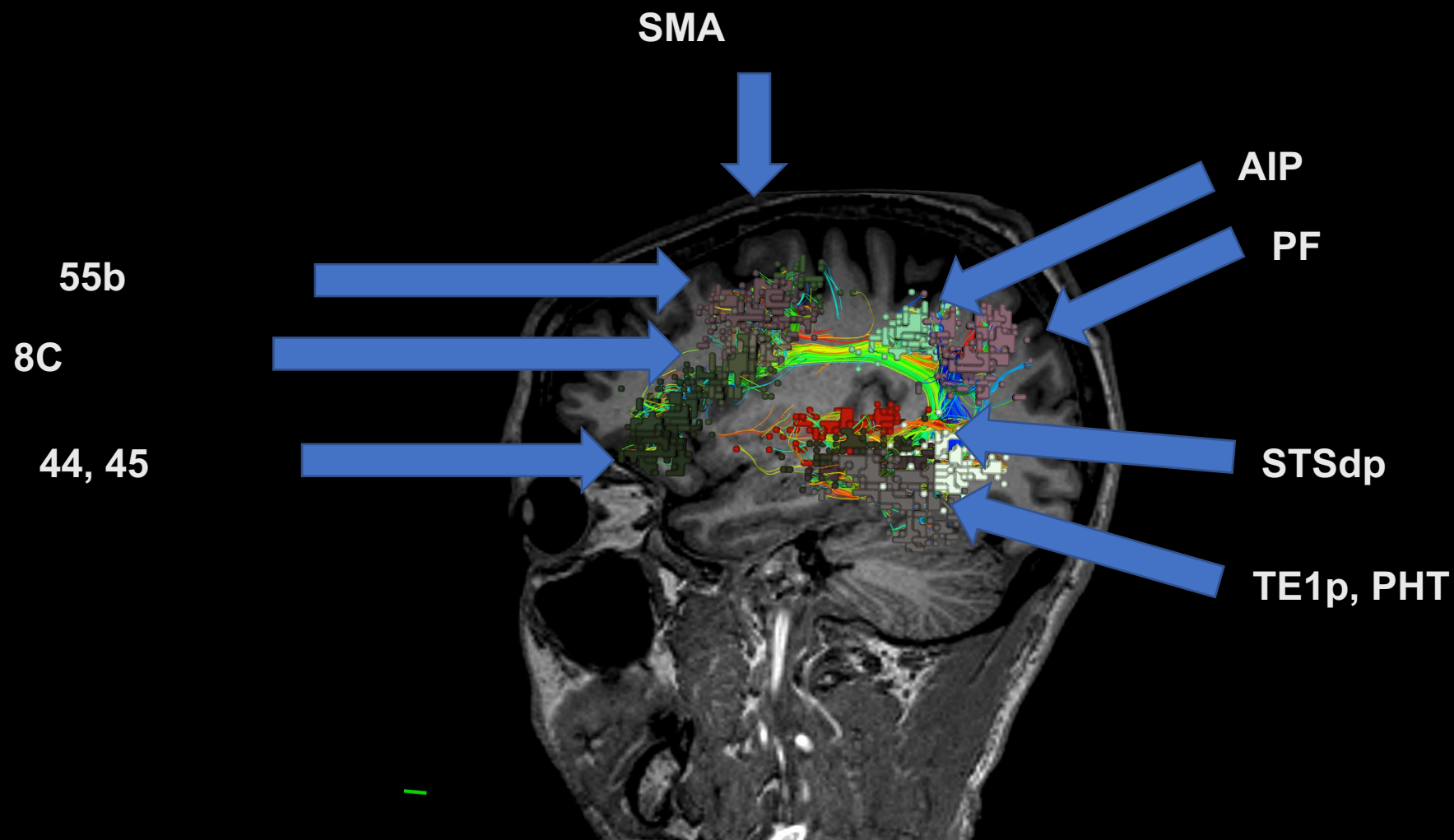
- Focus on the core
- Is it a good trade?
- Is it salvageable?



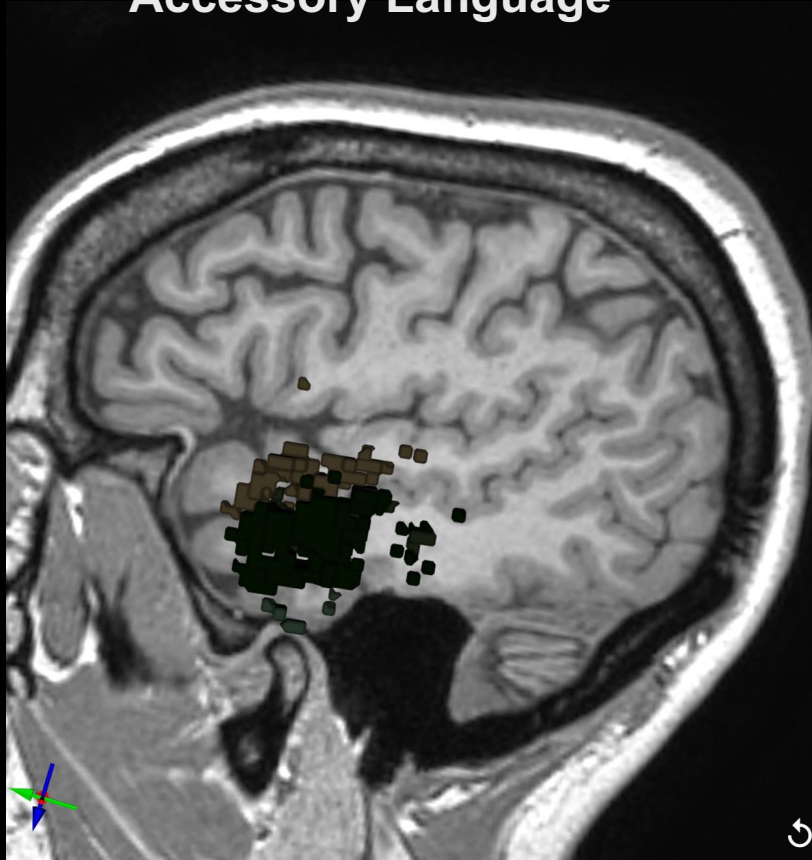
DMN

- Theory of Mind
- Internal thought
- Imagination
- Most mental illnesses
- Much, much more

Language System- Speech

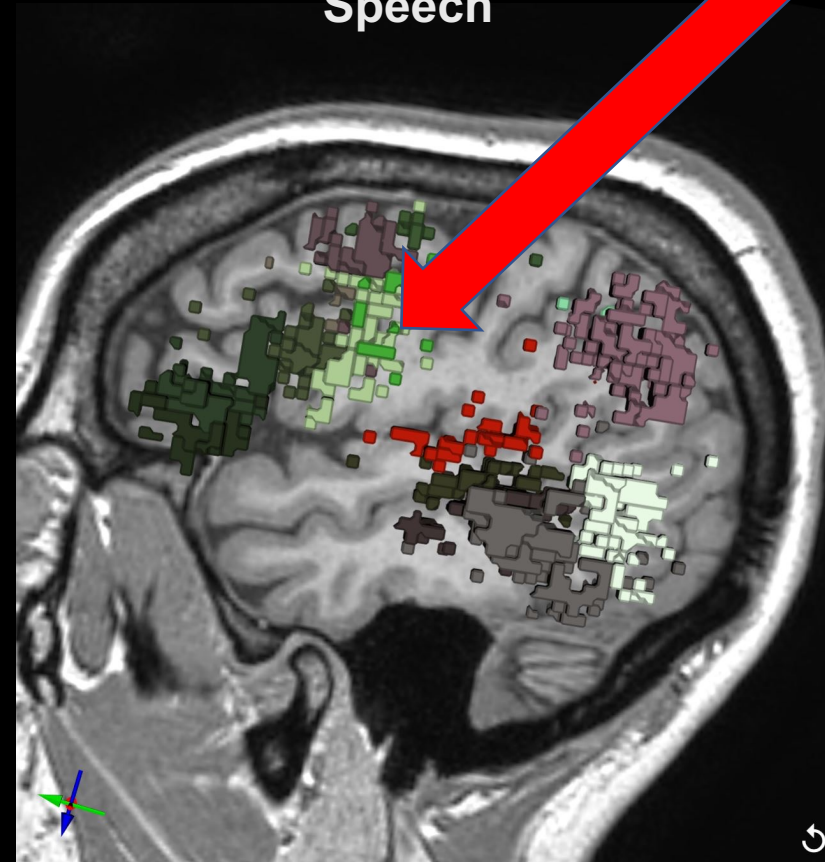


Accessory Language



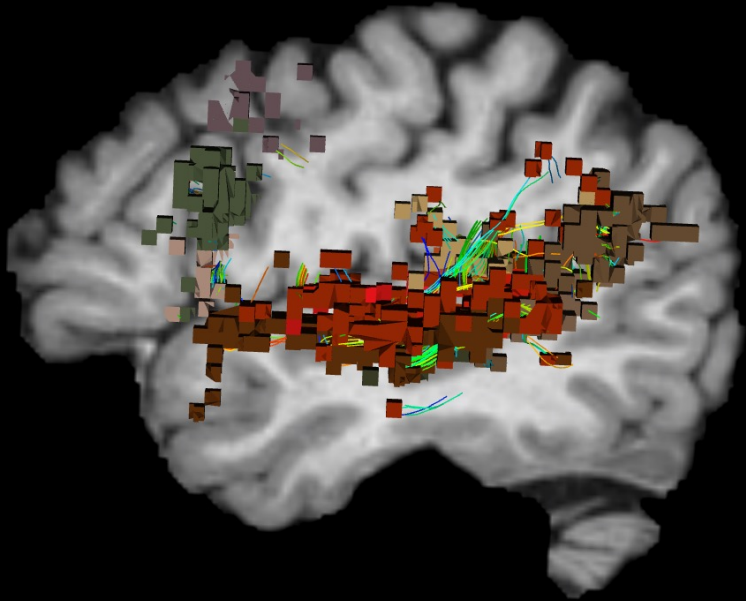
Verbal memory

Speech



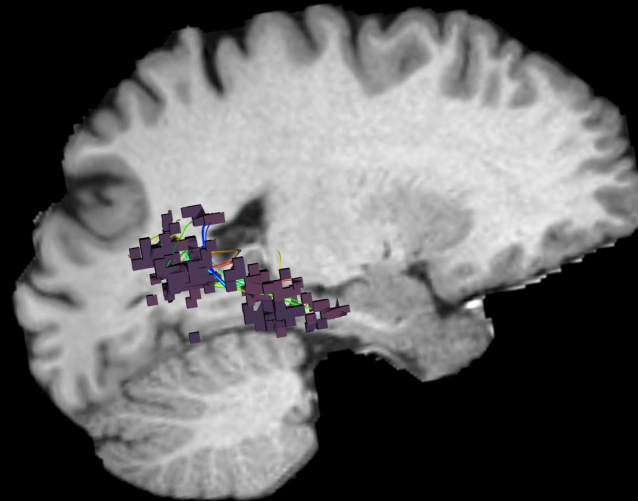
Speech Arrest

Auditory



Auditory Processing

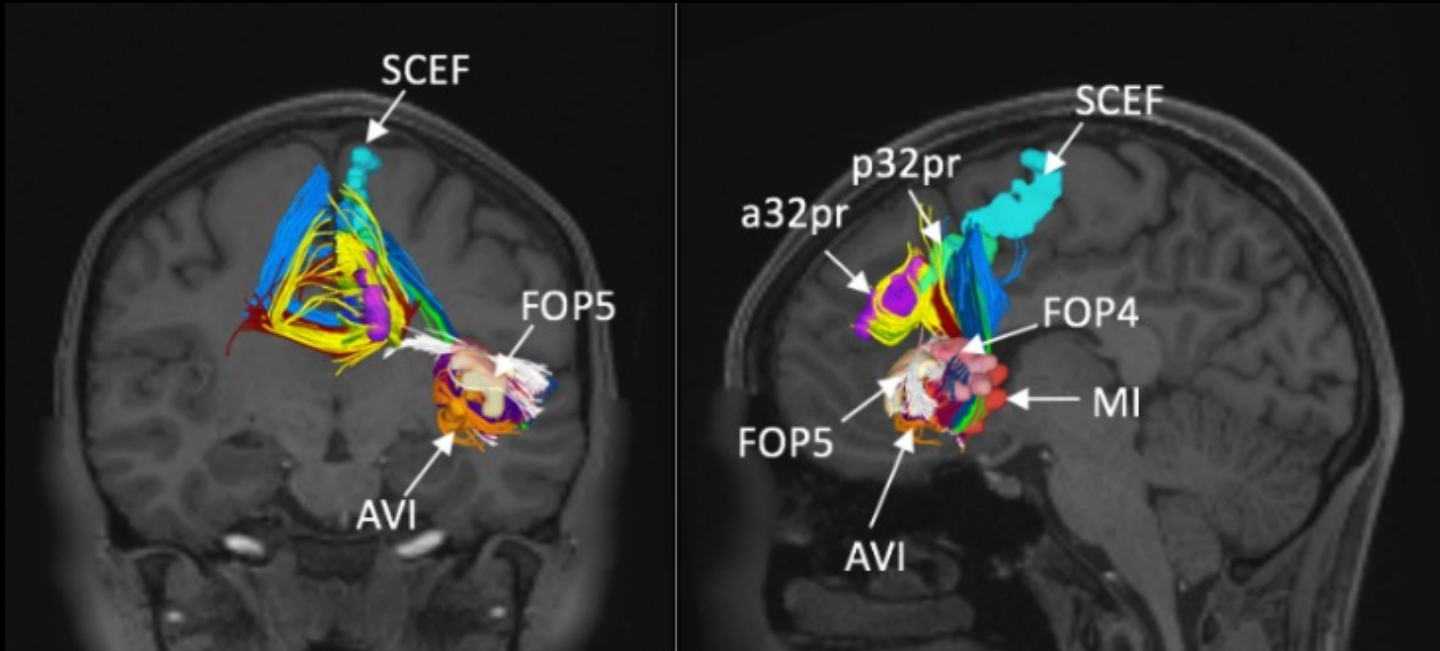
PHG

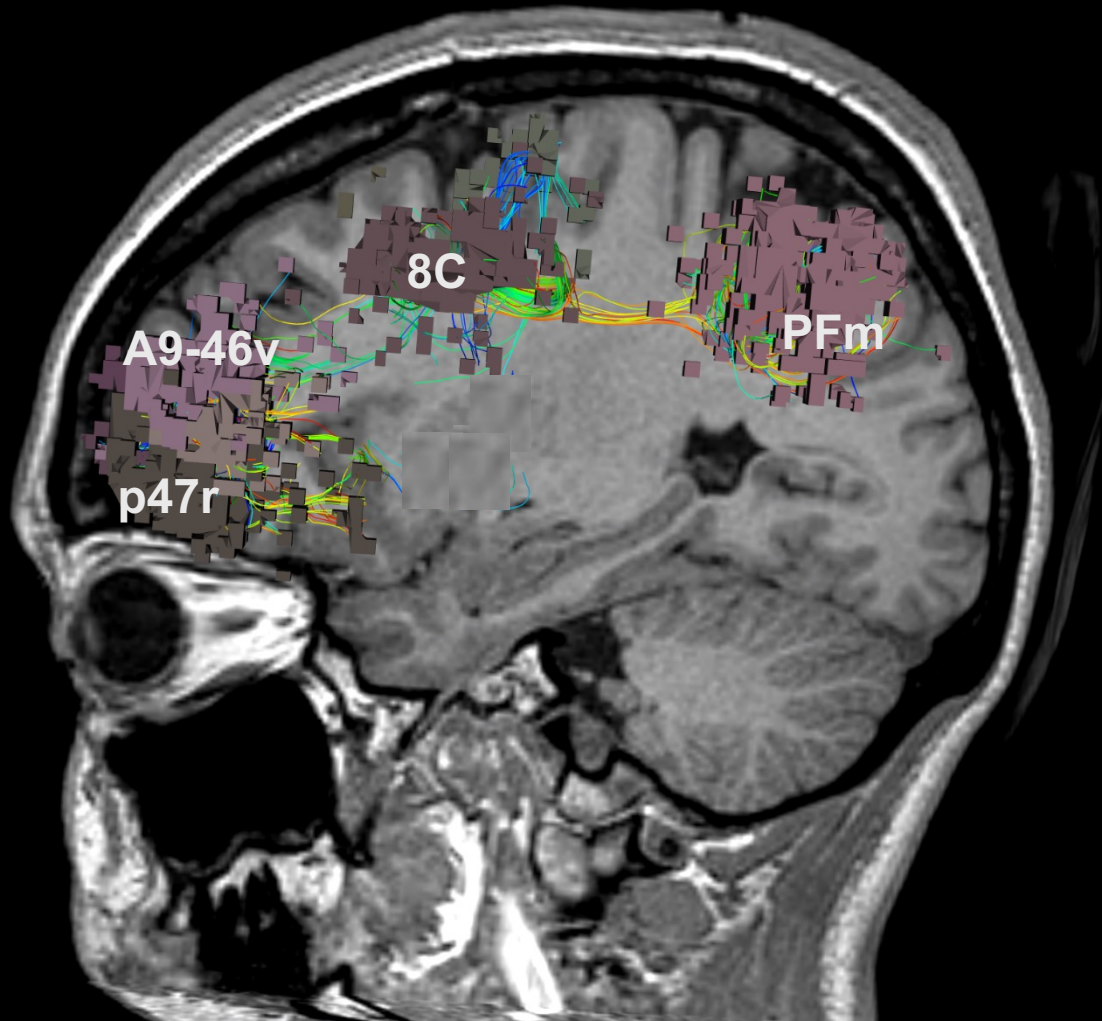


Episodic Memory

Salience

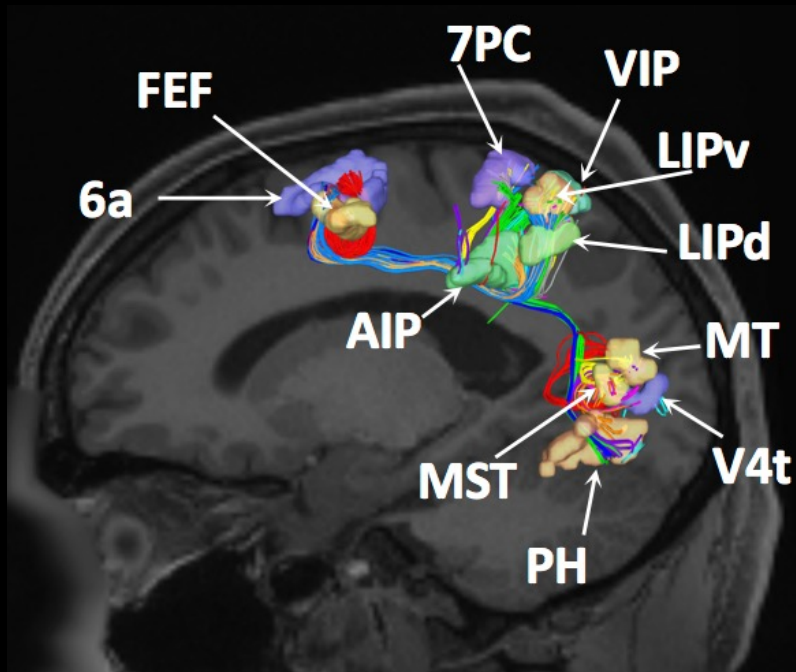
- Coordinating Response to Stimuli
- Pain
- Emotional regulation





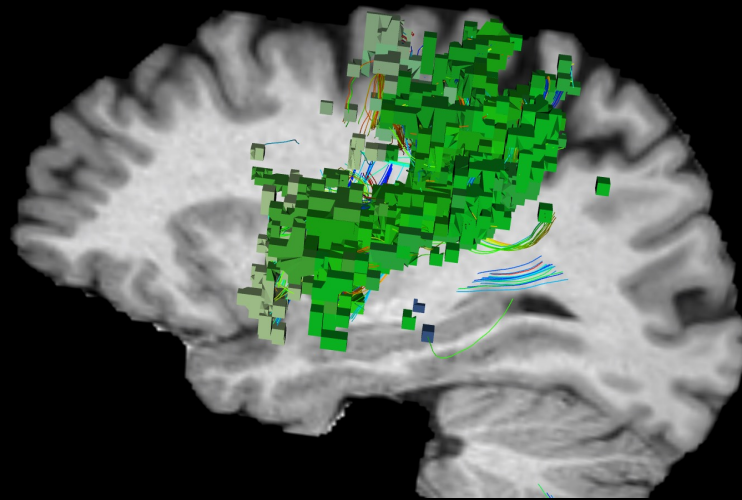
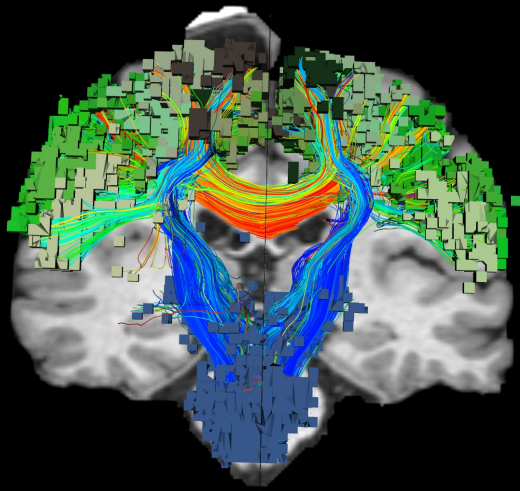
CEN

- Working memory
- Executive function



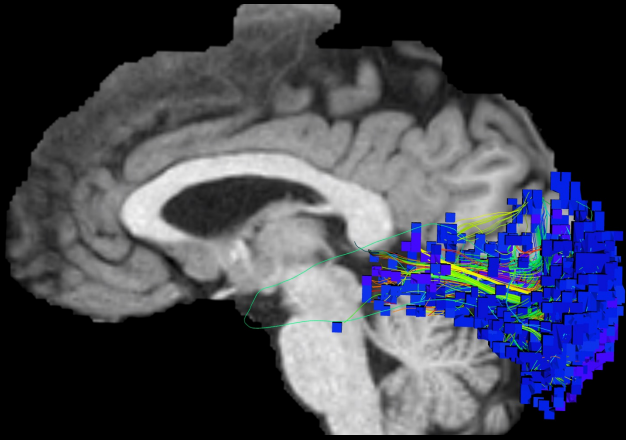
DAN

- Sustained Directed attention
- VAN=Change in attention due to sensory input

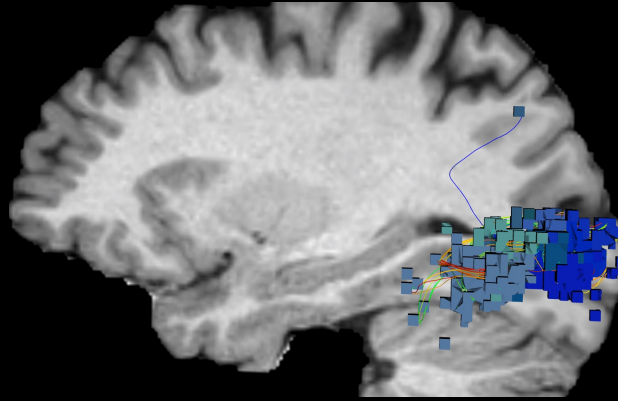


Sensorimotor

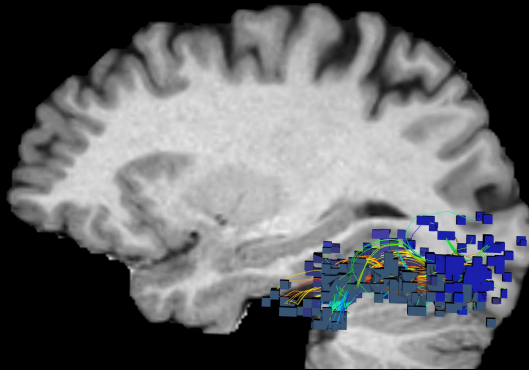
- Primary Motor
- Primary Sensory
- SMA
- Ventral Premotor
- Dorsal Premotor
- Cingulate Motor



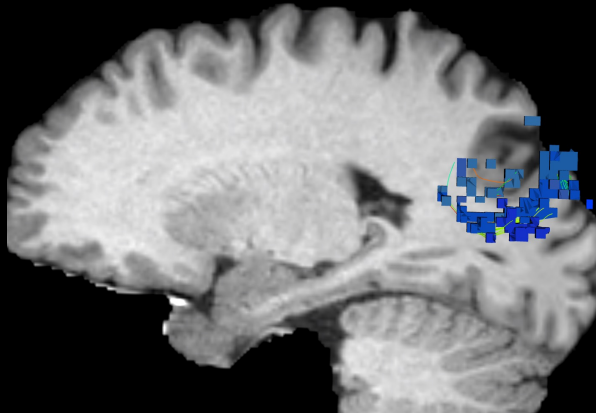
Primary



Lateral



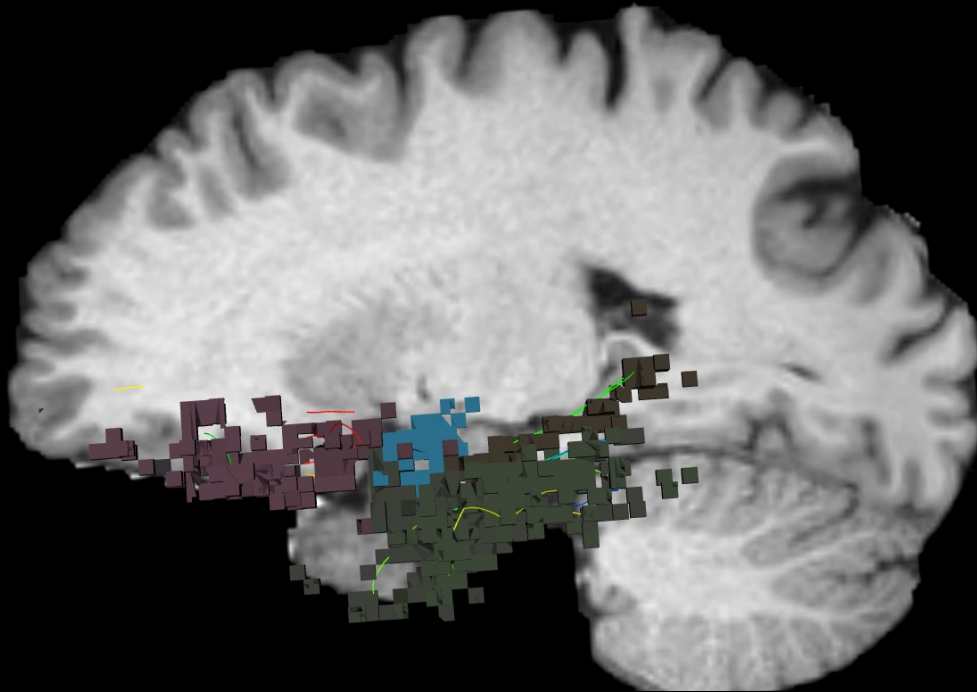
Ventral



Dorsal

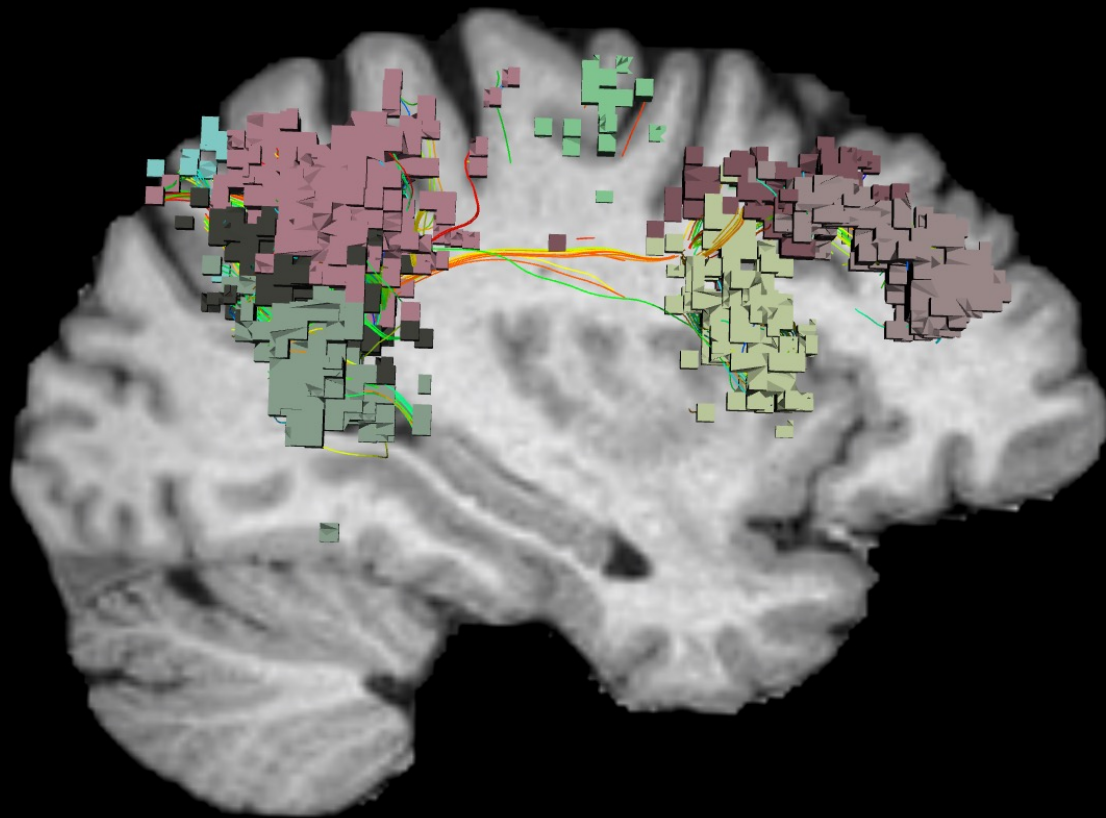
Vision

- **Primary Motor**
- **Lateral (higher order)**
- **Ventral (“what”)**
- **Dorsal (“where”)**



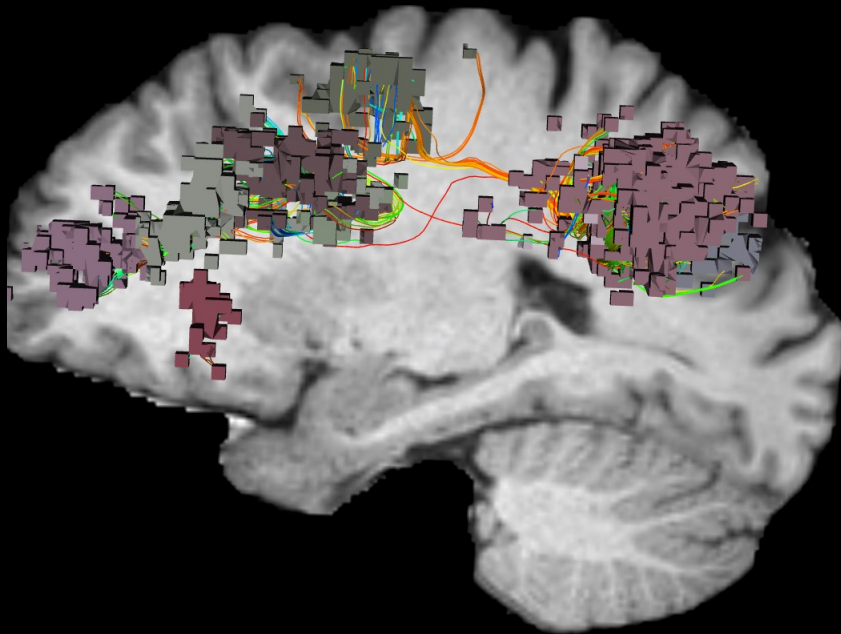
Limbic

- Medial Temporal
- Orbitofrontal
- Subcallosal Cingulate



VAN

- Right Sided Only
- Likely Neglect network



Multiple Demand

- **Mixed Network**
- **Injury Drops IQ**