FRONTAL LOBE PREFRONTAL, DORSOLATERAL, AND ORBITOFRONTAL (Areas 9, 10, 11, 12)

LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity leads to impaired executive function (decision making and planning), lack of motivation, depression, and inability to control impulses or desires. Ablation leads to dramatic personality changes. Trouble sustaining attention in routine situations. Inability to give close attention to detail or avoid mistakes. Lack of clear goals or forward thinking. Difficulty expressing feelings. Difficulty following through or finishing things.

Epileptiform activity leads to partial seizures and alterations of personality, emotion, and behavior often accompanied by tonic motor components (25% of complex partial seizures originate in the frontal lobe and 75% originate in the temporal lobe)

BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Difficulty with restraint and controlling impulses or desires
- Emotional instability (lability)
- Difficulty planning and organizing
- Difficulty making decisions
- Lack of motivation, enthusiasm, interest and drive (apathetic)
- Difficulty getting a sound or melody out of your thoughts (Perseveration)
- Constantly repeat events or thoughts with difficulty letting go
- Difficulty initiating and finishing tasks
- Episodes of depression
- Mental fatigue
- Decrease in attention span
- Difficulty staying focused and concentrating for extended periods of time
- Difficulty with creativity, imagination, and intuition
- Difficulty in appreciating art and music
- Difficulty with analytical thought
- Difficulty with math, number skills and time consciousness
- Difficulty taking ideas, actions, and words and putting them in a linear sequence

EXAMINATION FINDINGS

- Abnormal mental status exam (appearance, attitude, behavior, mood and affect, speech, thought process, thought content, perceptions, cognition, insight, and judgement)
- Logic and abstraction testing
- Auditory Go-No-Go
- Manual Alternating sequence tasking
- History findings of attention, focus, improper social behavior, poor planning, impaired strategy, depression, personality changes, abulia, perseveration

APPLICATIONS

- Activation of other frontal regions such as frontal eye fields, motor regions as indicated by the exam. (Saccades)
- Activation of presynaptic projections to the frontal cortex with contralateral cerebellum activity, visual therapy, or auditory therapy
- Dietary, nutritional, and lifestyle factors to address underlying neurochemical imbalances.
- Mindfulness
- Yoga
- Meditation
- Working memory tasks are those that require the goal-oriented active monitoring or manipulation of information or behaviors in the face of interfering processes and distractions.
- Supplementary eye filed: Predictive saccades, Memory guided saccades
- DLPF: Prioritization and motivation and organization techniques.
- Go No Go inhibitory techniques for orbitofrontal. Impulse control.
- Frontal eye fields: Saccadic hypometria, loss of parietal lobe smooth pursuit, Issues with following saccades in a predictable fashion, loss of anticipation saccades, loss of smooth pursuits and OKN towards the lesions.
- Supplementary and premotor areas: Mirror action and visualization of movement and primary cerebellar input

**FRONTAL LOBE PRECENTRAL AND SUPPLEMENTARY MOTOR AREAS** (Areas 4 and 6)

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**

Loss of activity in area 4 leads to Upper Motor Neuron (UMN) pattern of spastic paralysis (contraction of limb with weakness) and hyperreflexia on the opposite side of the body in association with the homuncular region of the precentral cortex.

Epileptiform activity in area 4 activity in area induces spastic contraction or myoclonic jerks on the opposite side of the body in association with the homuncular region of the precentral gyrus.

Loss of activity in Area 6 leads to pattern of movement including contralateral abduction of the arm at the shoulder and flexion of the arm at the elbow with tonic rotation of the head, eyes, and trunk towards the opposite side. Additionally there are bilateral movements in the lower extremities.

**EXAMINATION FINDINGS**

- Weakness with injury to the premotor cortex and no weakness with injury to the supplementary motor cortex only dyspraxia
- Gait apraxia with injury to supplemental motor area
- Spastic on increased tone with pyramidal posturing with injury to precentral region
- Spastic posture and increase muscle tone during passive stretch or clasp knife resistance during passive stretch
- Positive Babinski
- Clonus with stretch reflex
- Hyperreflexia with deep tendon reflexes
- Motor apraxia (finger-to-thumb, foot tapping, finger-to-nose)
- Presentation of primitive reflexes such as frontal release signs (palmar grasp, palmomental reflex, rooting reflex, sucking reflex, snout reflex, glabellar reflex)

**APPLICATIONS**

- Coordinated motor activities
- Activation of other frontal regions such as frontal eye fields, motor regions as indicated by the exam.
- Activation of presynaptic projections to the frontal cortex with contralateral cerebellum activity
- Lateral cerebellar activation
- Memory guided saccades
- Memory of sequential saccades
- Reversing saccades from an established pattern

**BRAIN REGION LOCALIZATION**

- Initiating movements with your arm or leg has become more difficult
- Feeling of arm or leg heaviness, especially when tired
- Increased muscle tightness in your arm or leg
- Reduced muscle endurance in your arm or leg
- Noticeable difference in your muscle function or strength from one side to the other
- Noticeable difference in your muscle tightness from one side to the other
FRONTAL LOBE BROCA’S MOTOR SPEECH (Areas 44, 45)

LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity leads to nonfluent aphasia. Struggling to produce words despite knowing the words needed to communicate. Forces individuals to speak with short sentences. Ablation leads to mutism (inability to speak). Writing words is intact with Area 44 and 45 lesions.

Epileptiform activity leads to arrest of speech and occasionally simple vocalization occurs.

BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Difficulty producing words verbally, especially when fatigued
- Find the actual act of speaking difficult at times
- Notice word pronunciation and speaking fluency change at times

EXAMINATION FINDINGS

- Non-fluent speech

APPLICATIONS

- Speech therapy
- Vocalization with handedness.

  Left brain: Vocalization with small picture ideas on for left brain.

  Right brain: Vocalization with big picture ideas for the right brain.

Loss of activity leads to nonfluent aphasia. Struggling to produce words despite knowing the words needed to communicate. Forces individuals to speak with short sentences. Ablation leads to mutism (inability to speak). Writing words is intact with Area 44 and 45 lesions.

Epileptiform activity leads to arrest of speech and occasionally simple vocalization occurs.
LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity leads to loss of discriminative sensory modalities involving stereognosis, position sense, graphesthesia, and tactile localization.

Epileptiform activity leads to episodes of localized tingling paresthesias. Epileptiform activity typically spreads to primary motor cortex and leads to accompanying focal motor seizures both associated with the homuncular topography.

BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Difficulty in perception of position of limbs
- Difficulty with spatial awareness when moving, laying back in a chair, or leaning against a wall
- Frequently bumping body or limbs into the wall or objects accidentally
- Reoccurring injury in the same body part or side of the body
- Hyposensitivities to touch or pain perception

EXAMINATION FINDINGS

- Somatosensory perception
  (pin prick, temperature, vibration sense, joint position, two-point discrimination)
- Graphesthesia
- Stereognosis
- Tactile extinction

APPLICATIONS

- Cognitive visualization of body regions
- Somatosensory stimulation
  (TENS unit, cooling gel, vibrating stimulus)
- Adjustments
- Fascial release
- Joint mobilization
- Graphesthesia
- Stereognosis
- Superimposition of similar letters: d/p/6/9
LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity in the dominant hemisphere (97% left side) leads to defects in reading, writing, calculations, right/left confusion. A variety of fluent aphasia occurs related to difficulty in interpretation of speech and language.

Loss of activity on the non-dominant (right) hemisphere leads to difficulty

Epileptiform activity leads to arrest of speech.

BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Right/left confusion
- Difficulty with math calculations
- Difficulty finding words
- Difficulty with writing
- Difficulty recognizing symbols or shapes
- Difficulty with simple drawings
- Difficulty interpreting maps

EXAMINATION FINDINGS

Test for Gertsman Syndrome counting backwards (dyscalculia), writing (dysgraphia), finger distinction (finger agnosia), and left-right discrimination when evaluating the dominant hemisphere (97% left).

Identifying faces of celebrities or shapes upside down.

APPLICATIONS

- Math tasks, left-right discrimination tasks, writing tasks for the dominant hemisphere (97% left)
- Tangram, jigsaw puzzles and frames for the non-dominant hemisphere (right)
Loss of activity and epileptiform activity

Unilateral loss of activity leads to inability to localize sound or distinguish sound clearly with background noise. Bilateral lesion (rare) leads to cortical deafness.

Epileptiform activity leads to tinnitus and/or auditory hallucinations (voices speaking to them).

Brain region localization form symptoms

- Reduced function in overall hearing
- Difficulty interpreting speech with background or scatter noise
- Difficulty comprehending language without perfect pronunciation
- Need to look at someone’s mouth when they are speaking to understand what they are saying
- Difficulty in localizing sound
- Dislike of left predictable rhythmic, repeated tempo and beat music
- Dislike of non-predictable rhythmic with multiple instruments
- Noticeable ear preference when using your phone

Examination findings

- General hearing (rubbing fingers together)
- Weber test
- Rinee test
- Receptive language evaluations

Applications

- Hearing aid for minor and cochlear implant for severe sensorineural loss
- Bone conduction implant for conductive hearing loss
- Predictable rhythmic, repeated tempo music for the left auditory cortex with focused hearing for each beat for functional impairment
- Non-predictable rhythmic with multiple instruments with focused hearing for tempo fluctuation for the right auditory cortex for functional impairment
- Memory exercises coupled with declarative memory (Facts and events)
- Reading and then comprehension of what is read.
- Auditory visualization of a described event
- Interpretation of complex comments and phrase meaning.
TEMPORAL LOBE AUDITORY ASSOCIATION CORTEX (Area 22)

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**

Unilateral loss of activity leads to fluent aphasia or deficit in comprehension of speech.

Epileptiform activity leads to tinnitus and/or auditory hallucinations (voices speaking to them). A common area for complex partial seizures (75%) that starts with sound hallucinations and spreads to other areas of the brain leading to impairment of awareness, amnesia, automatisms (unconscious stereotyped patterns of movement), olfactory hallucinations and potentially feeling of fear.

**BRAIN REGION LOCALIZATION FORM SYMPTOMS**

- **L**: Difficulty comprehending meaning of spoken words
- **R**: Tend toward monotone speech without fluctuations or emotions

**EXAMINATION FINDINGS**

- Fluent aphasia for left auditory association cortex
- Dysprosody of speech for the right auditory association cortex

**APPLICATIONS**

- Predictable rhythmic, repeated tempo music for the left auditory cortex with focused hearing for each beat
- Non-predictable rhythmic with multiple instruments for the right auditory cortex with focused hearing for tempo fluctuation

Unilateral loss of activity leads to fluent aphasia or deficit in comprehension of speech.

Epileptiform activity leads to tinnitus and/or auditory hallucinations (voices speaking to them). A common area for complex partial seizures (75%) that starts with sound hallucinations and spreads to other areas of the brain leading to impairment of awareness, amnesia, automatisms (unconscious stereotyped patterns of movement), olfactory hallucinations and potentially feeling of fear.
**MEDIAL TEMPORAL LOBE HIPPOCAMPUS**

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**

Loss of activity leads to impaired declarative memory, impaired spatial memory and navigation, loss of visual memory and altered cortisol circadian rhythms. Bilateral injury leads to amnesia.

Epileptiform activity leads to episodes of déjà vu.

**BRAIN REGION LOCALIZATION FORM SYMPTOMS**

- Memory less efficient
- Memory loss that impacts daily activities
- Confusion about dates, the passage of time, or place
- Difficulty remembering events
- Misplacement of things and difficulty retracing steps
- Difficulty with memory of locations (addresses)
- Difficulty with visual memory
- Always forgetting where you put items such as keys, wallet, phone, etc.
- Difficulty remembering faces
- Difficulty remembering names with faces
- Difficulty with remembering words
- Difficulty remembering numbers
- Difficulty remembering to stay or be on time (reduced left)

**EXAMINATION FINDINGS**

- Evaluate their recall in medical history
- Memory Recall (3 items after 3-5 minutes)
- Evaluate their recall in medical history
- Mini Mental Status Exam (MMSE)
- Self-Administered Gerocognitive Exam (SAGE)
- Clock Drawing Test
- Mini-Cog Test
- Cortisol Salivary Profile for circadian rhythm

**APPLICATIONS**

- Lumosity and memory Apps
- Memorize phone numbers
- Think of 5 words that start and end with the same letter as another word
- Repeat a map in your head of a location you visited

Loss of activity leads to impaired declarative memory, impaired spatial memory and navigation, loss of visual memory and altered cortisol circadian rhythms. Bilateral injury leads to amnesia.

Epileptiform activity leads to episodes of déjà vu.
## OCCIPITAL LOBE (Area 17, 18, 19)

### LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity may lead to difficulty in discriminating color. Ablation may lead to homonymous visual deficits such as homonymous hemianopsia or quadrantanopsia. Ablation can also lead to defects in visual fixation.

Visual hallucinations such as flashing lights, stars, jagged lines that are correlated with the contralateral visual field or at times to the contralateral eye. Epileptiform activity in area 17 can produce deviation of the eyes to the contralateral visual field.

### BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Difficulty in discriminating similar shades of color
- Dullness of colors in visual field
- Difficulty coordinating visual inputs and hand movements, resulting in an inability to efficiently reach out for objects
- Floater or halos in visual field

### EXAMINATION FINDINGS

- Confrontation testing
- Visual Field Mapping
- Amsler Grid

### APPLICATIONS

- Visual Illusion games
- Identification of image shape and color will be occipital – temporal. Looking at depth is more occipital.

Loss of activity may lead to difficulty in discriminating color. Ablation may lead to homonymous hemianopsia or quadrantanopsia. Ablation can also lead to defects in visual fixation.

Visual hallucinations such as flashing lights, stars, jagged lines that are correlated with the contralateral visual field or at times to the contralateral eye. Epileptiform activity in area 17 can produce deviation of the eyes to the contralateral visual field.
**CEREBELLUM – SPINOCEREBELLUM**

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**

Loss of activity leads to poor trunk stability, poor balance.

Epileptiform activity leads to vertigo, instability and post-synaptic projections induce dysautonomia such as increased heart rate, orthostatic hypotension, nausea, etc.

**BRAIN REGION LOCALIZATION FORM SYMPTOMS**

- Difficulty with balance, or balance that is worse on one side
- A need to hold the handrail or watch each step carefully when going down stairs
- Feeling unsteady and prone to falling in the dark
- Proness to sway to one side when walking or standing

**EXAMINATION FINDINGS**

- Wide stance gait, ataxia, and instability with ambulation.
- Positive Romberg’s test

**APPLICATIONS**

- Postural balance exercises (bosu ball, rocker board, etc.)
- Core-stability exercises (planking, yoga, etc.)

Loss of activity leads to poor trunk stability, poor balance.

Epileptiform activity leads to vertigo, instability and post-synaptic projections induce dysautonomia such as increased heart rate, orthostatic hypotension, nausea, etc.
**CEREBELLUM – CEREBROCEREBELLUM**

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**

Loss of activity leads to termination and kinetic tremors, clumsiness, limb hypotonia, and impaired motor coordination.

Epileptiform activity leads to vertigo, instability and post-synaptic projections induce dysautonomia such as increased heart rate, orthostatic hypotension, nausea, etc.

**BRAIN REGION LOCALIZATION FORM SYMPTOMS**

- Recent clumsiness in hands
- Recent clumsiness in feet or frequent tripping
- A slight hand shake when reaching for something at the end of movement

**EXAMINATION FINDINGS**

- Intention or Kinetic tremor
- Termination tremor with end-stage targeting (finger-to-nose)
- Dysmetric (hypometric and hypermetric) targeting (finger-to-nose or heel)
- Dysdiadochokinesia with rapid alternation movements
- Ataxic dysarthria

**APPLICATIONS**

- Coordinated motor activities specific to limb and side of involvement
- Proximal for interpose region
- Spinal for midline cerebellar
- Hand specific for dentate

Loss of activity leads to termination and kinetic tremors, clumsiness, limb hypotonia, and impaired motor coordination.

Epileptiform activity leads to vertigo, instability and post-synaptic projections induce dysautonomia such as increased heart rate, orthostatic hypotension, nausea, etc.
LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity leads to dizziness, disorientation, poor spinal stability (vestibulospinal tract). Post-synaptic projections from impaired Pukinje inhibition lead to nausea, anxiety, tinnitus, and dysautonomia.

Epileptiform activity leads to vertigo, instability and post-synaptic projections induce dysautonomia such as increased heart rate, orthostatic hypotension, nausea, etc.

BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Episodes of dizziness or disorientation
- Back muscles that tire quickly when standing or walking
- Chronic neck or back muscle tightness
- Nausea, car sickness, or sea sickness
- Feeling of disorientation or shifting of the environment
- Crowded places cause anxiety

EXAMINATION FINDINGS

- Wide stance gait, ataxia, and instability with ambulation.
- Positive Romberg's test
- Nystagmus with pure vertical, horizontal, or torsional patterns
- Strabismus and diplopia
- Nystagmus after headshaking test
- Optokinetic activity leads to decay in movement and can induce vertigo or autonomic symptoms
- Impaired and/or hyperactive vestibular-ocular-reflexes (VOR)
- Impaired VOR-cancelation test
- Impaired smooth pursuits
- Hypometric and hypermetric saccades
- Overshooting with head thrust test
- Findings of dysautonomia during exam including, abnormal heart rate variability

APPLICATIONS

- Gaze stability exercises
- Visual pursuits and targeted saccades specific to examination findings
- Rotational exercises specific for the side of the vestibular canals
- Repetitive head positioning movements specific to each vestibular canal
- Swaying back and forth exercises specific for otolith stimulation
- Optokinetic stimulations specific to the vestibular system
BASAL GANGLIA DIRECT PATHWAY

**LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY**
Loss of activity leads to muscle stiffness and slowness of movements

**BRAIN REGION LOCALIZATION FORM SYMPTOMS**
- Slowness in movements
- Stiffness in muscles (not joints) that goes away during movement
- Cramping of hands when writing
- A stooped posture when walking
- Voice has become softer
- Facial expression changed leading people to frequently ask if you are upset or angry

**EXAMINATION FINDINGS**
- Mask face, reduced blinking, hypophonia, aprosody of speech, resting pill rolling tremor striatal postural deformities, camptocormia, drooling due to reduced swallowing, and slowness of thinking with initial survey
- Gait analysis demonstrates lack of arm swing, shuffling, slowness, freezing of gait, festination, hesitancy initiating first step, limitations in turning, and postural instability.
- Glabellar tap test demonstrating inability to attenuate blinking response after 3 taps
- Pull test – cannot stabilize after 3 steps
- Micrographia and/or tremor with handwriting
- Loss of smell
- Impaired bowel sound motility (constipation)
- Lead-pipe or cogwheel rigidity with passive stretch of the limbs
- Hypokinetic (bradykinesia) and decrementing movements of limbs with repeated motor tasks (finger-to-thumb, supination/pronation, foot tapping).

**APPLICATIONS**
- Dietary, nutritional and lifestyle strategies to reduce protein aggregations.
- Brain rehabilitation strategies focused on frontal cortex activation to the striatum and or cerebellum activation of the ventral ascending dopaminergic system
- Non-linear movements. Alternating activity movements that are repetitive. Visualization and motor and limbic activation while moving.
### BASAL GANGLIA INDIRECT PATHWAY

#### LOSS OF ACTIVITY AND EPILEPTIFORM ACTIVITY

Loss of activity leads to hyperkinetic movement disorders, inability to suppress thoughts and emotions, vocal and/or motor ticks due to extreme urges.

#### BRAIN REGION LOCALIZATION FORM SYMPTOMS

- Uncontrollable muscle movements
- Intense need to clear your throat regularly or contract a group of muscles
- Obsessive compulsive tendencies
- Constant nervousness and restless mind

#### EXAMINATION FINDINGS

- Hyperkinetic moment disorder such as dystonia, hemiballism, chorea, athetosis, restless leg, stereotypy, vocal/motor tick
- Cognitive disorders such as obsessive-compulsive disorder

#### APPLICATIONS

- Application vary on the underlying mechanisms which include genetic counselling for autosomal dominant mutation (Huntington’s), vascular physiology nutritional and lifestyle modification for lacunar strokes, hepatic biotransformation and chemical tolerance, and antioxidant strategies for toxic insults, dietary and lifestyle management for autoimmune mechanisms, antibiotic and viral treatments for infections etiologies.
- Brain rehabilitation strategies focused on frontal cortex activation to the striatum and or cerebellum activation of the ventral ascending dopaminergic system.
- Go – No activation. Focus on the no or inhibition. May be multimodal.
- Linear and sustained movements.