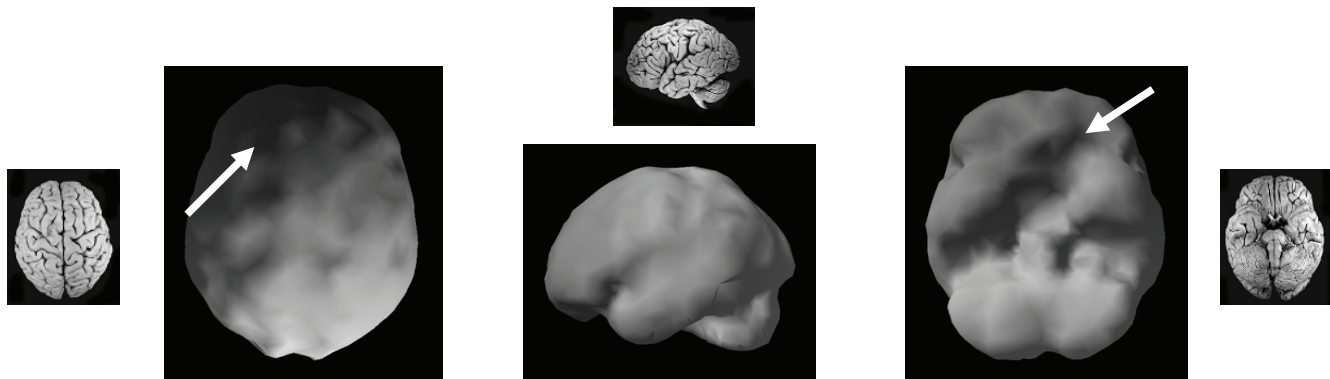


AMEN CLINICS BRAIN SYSTEM HANDOUT

Daniel G. Amen, MD, Amen Clinics, Inc.

The following handout is a compilation of the work done at Amen Clinics. Please use this as a reference to understand the different brain systems as they relate to function, problems, and treatments. We revise this handout as new information is available.

PREFRONTAL CORTEX (PFC)



Top Down Surface View

Left Side Surface View

Underside Surface View

PFC Functions

PFC Dorsal lateral

Attention
Planning
Follow through

PFC Inferior orbital

Impulse control
Inhibition
Judgment
Empathy
Ethics
Morality

Some Conditions Affecting the PFC

ADHD	Depression
Brain Trauma	Dementia
Schizophrenia	Antisocial PD
Conduct disorders	Borderline PD

PFC Problems

Inattention
Lack of forethought
Procrastination

Impulsive
Disinhibited
Poor judgment
Lack of empathy
Lack of ethics

PFC Behavioral Treatments

Coaching/goal setting	Organizational help
Intense aerobic exercise	Relationship counseling
Stimulating activities	Higher protein diet
Neurofeedback	HBOT, rTMS

PFC Supplements

Focus and Energy
Zinc (for hyperactivity)
Attention Support for Kids/Teens
Mood support – SAME (SAME Mood and Movement)
Fish oil – Omega 3 Power

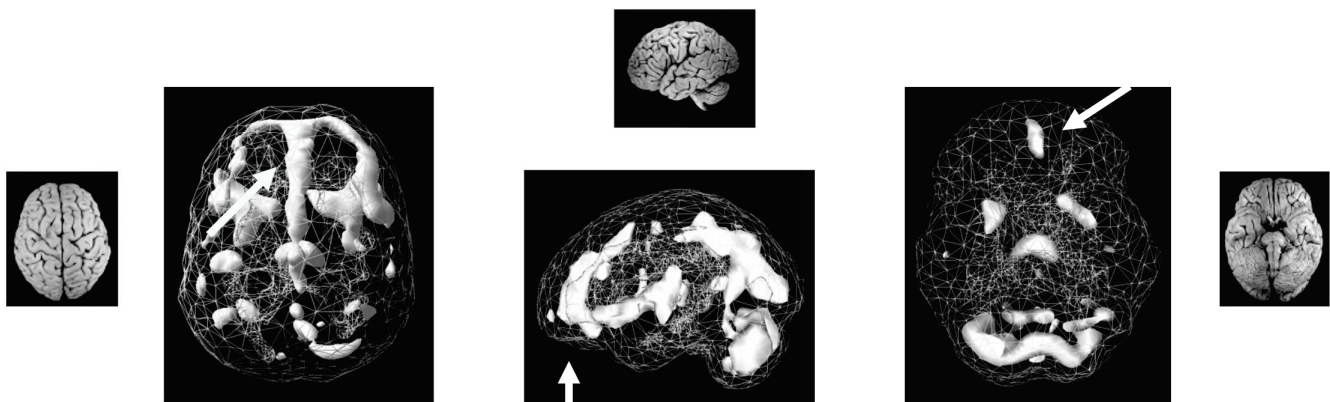
PFC Meds

For ADD – stimulants, such as Adderall or Ritalin, or Strattera
For Depression – Wellbutrin
For Low Energy – Provigil
For Psychosis -- Abilify

Positives w/ low PFC activity: Spontaneous, risk taking, creative, “out of the box,” curious, wide interests.

Decreases in the PFC during concentration is often associated with impulsivity, short attention span, distractibility and difficulties with organization and planning. We have seen a strong correlation between this finding and ADHD and ADD, especially when this occurs during the performance of a concentration task. When decreased activity in the PFC is seen during a resting state, it is often associated with depressive disorders, and may be responsive to antidepressant medication. When it is seen in both the resting and concentration states there may be a combination of depression and ADD or ADHD present. Clinical correlation is always needed. This pattern has also been seen in response to head injuries affecting this part of the brain, and later in life in some dementia processes.

ANTERIOR CINGULATE GYRUS (ACG)



Top Down Surface View

Left Side Surface View

Underside Surface View

ACG Functions

- Brain's gear shifter
- Cognitive flexibility
- Cooperation
- Go from idea to idea
- See options
- Go with the flow
- Error detection

ACG Problems

- Gets stuck, Trouble shifting
- Inflexible, worries
- Holds grudges, oppositional
- Obsesses
- Compulsions
- Argumentative
- Excessive error detection

Area 25 – mood states, activates GI system

Area 24v – emotional attention, communicates with limbic system

Area 24g - (genu) - attention to cold cognition

Area 24d - activated in nearly all cognitive tasks, focus to detail

Area 24d more posterior – error detection

Middle Cingulate – response to pain, also insular cortex

Posterior Cingulate – visual memory, visual attention, response to pain, posterior part has access to hippocampus and memory circuit



Some Conditions Affecting the ACG

OCD	Anxiety disorders
Addictions	PMS
Eating Disorders	Chronic pain
PTSD	Oppositional Defiant

ACG Behavioral Treatments

Distraction, Paradox, Options
Cognitive/behavioral strategies
Intense aerobic exercise
Lower protein/complex carbs diet

ACG Supplements

Worry and Insomnia – Serotonin Mood Support
Mood – Serotonin Mood Support, Happy Saffron
Anxiety – DHA Omega-3s
Fish oil – Omega 3 Power

ACG Meds

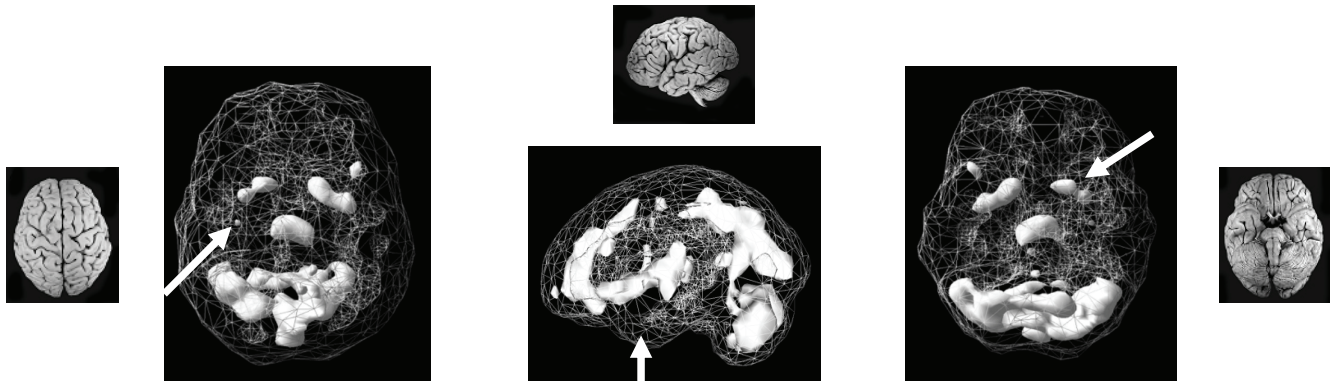
For Worry, Anxiety and Depression – SSRIs, such as Lexapro, Paxil, Zoloft, Celexa, Prozac, and Luvox
Effexor or Cymbalta if also low PFC
A typical antipsychotics in refractory cases

Positives w/ high ACG activity: Persistent, strong-willed, likes routine, consistent.

Increased ACG is often associated with problems shifting attention which may be clinically manifested by cognitive inflexibility, obsessive thoughts, compulsive behaviors, excessive worrying, argumentativeness, oppositional behavior or “getting stuck” on certain thoughts or actions. We have seen a strong association with this finding and obsessive-compulsive disorders, oppositional defiant disorders, eating disorders, addictive disorders, anxiety disorders, Tourette’s syndrome, and chronic pain (especially when combined with increased basal ganglia activity). If clinically indicated, hyperactivity in this part of the brain may be helped by anti-obsessive antidepressants that increase serotonin. Certain forms of behavior modification techniques have also been found to help lessen activity in this part of the brain. When this area is low in activity it is often associated with low motivation and verbal expression. Clinical correlation is always needed.



BASAL GANGLIA SYSTEM (BGS)



Top Down Surface View

Left Side Surface View

Underside Surface View

BG Functions

Caudate

Sense of calm
Sets anxiety level
Conflict avoidance

Putamen

Motor related

Nucleus Accumbens

Mediates pleasure

BG Problems

Tension, nervousness
Anxiety/panic
Predicting the worst

Tremors/tics

Addiction

** ventral striatum has to do with limbic/
emotional/neuroendocrine regulation, while
dorsal caudate is more related to dorsal PFC/
executive and 'cold' cog functions

Some Conditions Affecting the BGS

Anxiety Disorders, Tourette's/tics, OCD, PTSD,
Movement disorders.

BG Behavioral Treatment

Body biofeedback ANT therapy
Hypnosis, meditation Relaxing music
Assertiveness training Limit caffeine/alcohol
EMDR

BG Supplements

Anxiety – GABA Calming, Everyday Stress Relief,
Magnesium Chewables
Fish oil (Omega 3 Power)

BG Meds

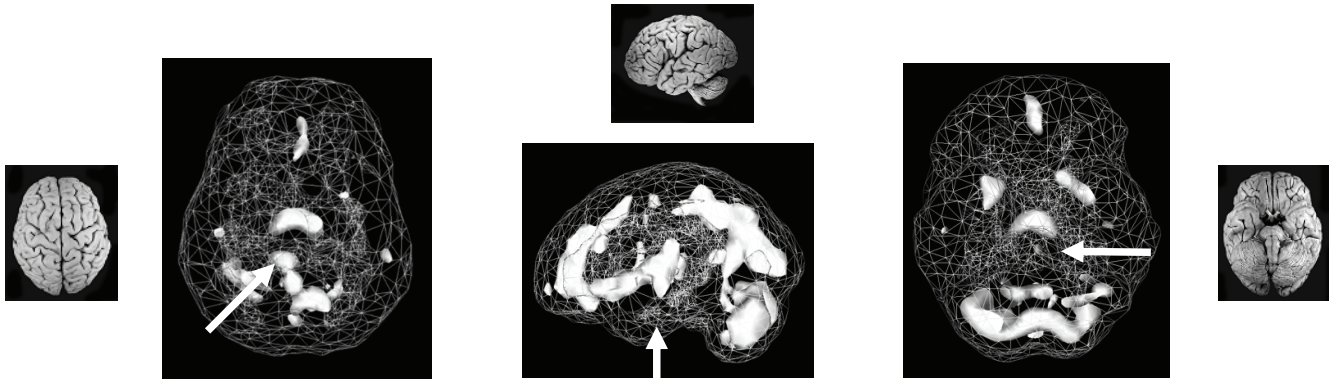
For Anxiety – Buspar, anti-seizure meds, some
blood pressure meds, such as propranolol may
help, benzodiazepines (low dose, short tim

Positives w/ high BG activity: Prepared, cautious, risk-averse, motivated.

Increased basal ganglia activity is often associated with anxiety (left sided problems are often associated with irritability, right sided problems more often associated with inwardly directed anxiety). Often, we have seen increased activity in this part of the brain in our normal population as well. We have seen increased activity associated here with increased motivation. Clinical correlation is needed. We have seen relaxation therapies, such as biofeedback and hypnosis, and cognitive therapies help calm this part of the brain. If clinically indicated, too much activity here may be helped by anti-anxiety medications, such as buspirone. Sometimes, if the finding is focal in nature (more one side than the other), anticonvulsant medications can also be helpful.



DEEP LIMBIC SYSTEM/THALAMUS (DLS)



Top Down Surface View

Left Side Surface View

Underside Surface View

DLS Functions

Mood control
Motivation
Attitude
Appetite/sleep
Bonding
Sense of smell
Libido

DLS Problems

Depression
Poor motivation
Poor attitude
Sleep/appetite issues
Tends to isolate
Negativity, guilt
Hopelessness

DLS Supplements

Mood – Happy Saffron, SAME, DL-phenylalanine, L-tyrosine
Fish oil (Omega 3 Power)
Cyclic Mood Changes – Fish oil, GABA Calming
For Pain - SAME

DLS Meds

For Depression – antidepressants, such as Wellbutrin, Effexor or Cymbalta, SSRIs (if high ACG also present)
Cyclic Mood Changes - anticonvulsants or lithium
For Pain - Cymbalta

Some Conditions Affecting the DLS

Depression
Pain syndromes
Cyclic mood disorders

Behavioral Treatments

Cognitive-behavioral strategies
Biofeedback, increase left prefrontal activity

Intense aerobic exercise, Relationship counseling
Increased protein diet – The Zone

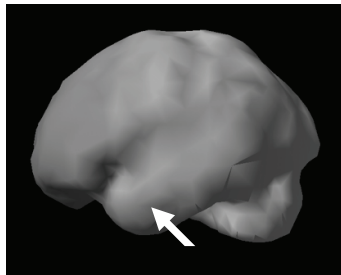
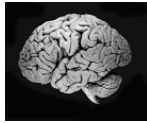
Positives w/ high DLS activity: Sensitive, deeply feeling, empathic.

Increased activity in the DLS can be associated with mood issues. Left-sided problems are often associated with anger and irritability, right sided problems more often associated with inwardly directed sadness. In our experience we have seen diffuse DLS overactivity tends to be more consistent depression and focal increased DLS activity (more on one side than the other) to be associated with cyclic mood disorders. When focal increased uptake is found in conjunction with patchy increased uptake across the cortical surface there is a higher likelihood of a cyclothymic or bipolar disorder. If clinically indicated, diffuse increased DLS uptake is often helped by antidepressant medications. If there is also increased anterior cingulate activity, consider a serotonergic antidepressant. If there is not increased anterior cingulate activity, consider an antidepressant which increases either dopamine (such as buprion) or norepinephrine (such as imipramine or desipramine).

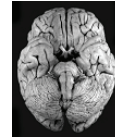
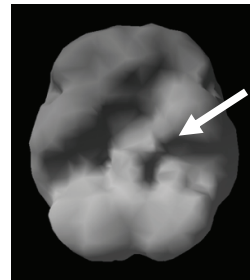
We use anticonvulsants or lithium to help with focal DLS hyperactivity when a cyclic mood clinical pattern is present. We have also seen increased activity in this part of the brain in our normal population. Clinical correlation is needed.



TEMPORAL LOBES (TLS)



Left Side Surface View



Underside Surface View

TL Functions

Amygdala

Emotional valence
Emotional reactions
Mood stability
Temper Control

Hippocampus

Memory
Mood

Lateral

Language
Listening
Reading
Read social cues
Rhythm, music
Spiritual experience
Recognizing face

Inferior

Some Conditions Affecting the TLs

Head injury	Dissociation
Anxiety	Temporal epilepsy
Amnesia	Serious depression

Left side – aggression, dyslexia

Right side – autistic spectrum disorders

TL Problems

Moodiness
Irritability, rage
Anxiety, fears
Dark thoughts

Forgetfulness
Depression

Trouble finding words
Processing problems
Poor reading
Poor social skills
Rhythm problems
Unusual experiences,

Recognize faces

TL Behavioral Treatments

Biofeedback to stabilize TL function
Relationship counseling, anger management
Ketogenic diet
HBOT

TL Supplements

For Mood Stability, Irritability or Anxiety – GABA
Calming, valerian, fish oil (Omega 3 Power)

For Memory – Brain and Memory Power Boost
(gingko and vinpocetine for blood flow, huperzine
A for acetylcholine, phosphatidylserine (PS), NAC,
and alpha lipoic acid)

TL Meds

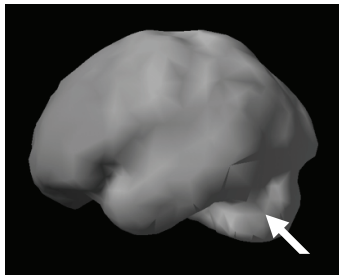
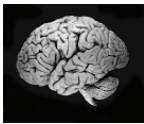
For Mood Stability, Irritability and Anxiety – anti-
seizure medications: Lyrica, Neurontin for anxiety,
irritability, and pain; Lamictal and Depakote for
bipolar symptoms

For Memory - memory enhancing medications for
more serious memory problems, such as
Namenda, Aricept, Exelon or Reminyl

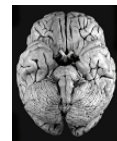
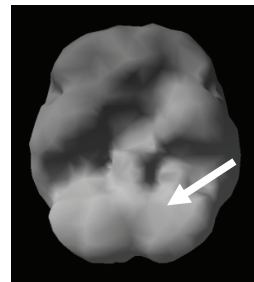


Abnormal TL (either increased or decreased) activity may be associated with mood instability, irritability, memory struggles, abnormal perceptions (auditory or visual illusions, periods of déjà vu), periods of anxiety with little provocation, periods of spaciness or confusion, and unexplained headaches or abdominal pain. Left sided problems are more associated with irritability and dark thoughts, right sided more with anxiety and social struggles. Anticonvulsant medications often help with TL problems. Decreased activity in the posterior aspects of the left temporal lobes, in our experience is often, although not always, associated with language learning problems, especially reading and auditory processing problems. Memory loss is often associated with decreased activity in the medial temporal lobes.

CEREBELLUM (CB)



Left Side Surface View



Underside Surface View

CB Functions

- Motor control
- Posture, gait
- Executive function, connects to PFC
- Speed of cognitive integration (like clock speed of computer)

CB Problems

- Gait/coordination problems
- Slowed thinking
- Slowed speech
- Impulsivity
- Poor conditioned learning

Some Conditions Affecting CB

- Trauma
- Alcohol abuse
- Autism, Asperger's ADHD

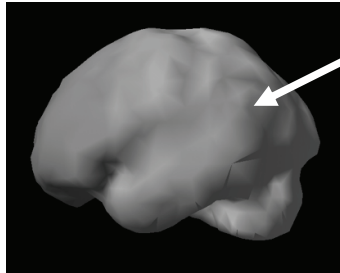
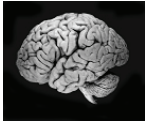
CB Treatments

- Prevention of brain injury
- Stop alcohol use or other toxic exposure
- Occupational Therapy
- Maximize brain nutrition
- Hyperbaric Oxygen Therapy
- Interactive Metronome
- Coordination exercises such as dance or table tennis

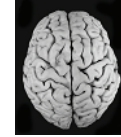
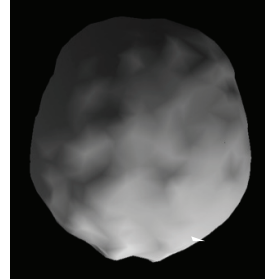
The cerebellum is usually the most active part of the brain and is usually symmetrical in appearance. When it is low in activity it has been associated with ADD, autism, brain trauma, toxic exposure, and judgment or impulsivity issues.



PARIETAL LOBES (PLS)



Left Side Surface View



Top Down Surface View

PL Functions

Direction sense
Create and read maps
Sense of touch
Spatial processing
Sees objects in space
Visual guidance
Distinguish L from R

PL Problems

Gets lost easily
Poor map reading
Oversensitive
Poor spatial processing
Poor tracking
Poor visual guidance
RL Confusion

Some Conditions Affecting PLs

Trauma
Toxic exposure
Infection
Anoxia
Substance abuse
Alzheimer's Disease

R - Personal ownership

Unilateral neglect
Construction apraxia
Denial
Admitting a problem

L - Spatial cognition

Calculation, writing, reading

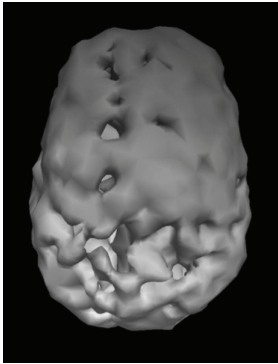
PL Treatments

Prevention of brain injury/toxic exposure
Occupational Therapy
Sensory Integration Therapy
Maximize brain nutrition
Hyperbaric Oxygen Therapy.

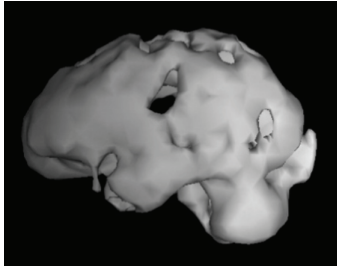
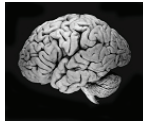
Increased activity in the PLs often indicates hypersensitivity to noise, touch, and taste. The parietal lobes have also been implicated in attentional issues and distractibility (too much stimulation comes in). In addition, when there is both sided parietal lobe and frontal lobe activity it is often associated with a pattern we call the ring of fire. Decreased activity in the PLs may be associated with trauma, toxicity, or memory loss.



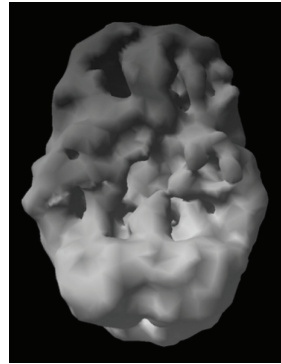
TOXICITY/SCALLOPING



Top Down Surface View



Left Side Surface View



Underside Surface View

Toxicity/Scalloping

On scans toxicity shows up as scalloping, bumpy or irregular appearance

Toxicity/Scalloping Causes

Drug or alcohol abuse/exposure
Environmental toxic exposure (paint fumes, solvents, metals, pesticides, pollution, mold, etc.)
Oxygen deprivation
Brain infections
Cancer chemotherapy
Anesthesia/surgery
Metabolic issues (thyroid, liver, kidney)

Toxicity/Scalloping Symptoms (depends on system affected)

Cognitive problems (attention and memory)
Fatigue
Irritability
Prefrontal, temporal, and/or parietal lobe symptoms

Toxicity/Scalloping Treatments

Eliminate offending agent(s)

Maximize brain nutrition

Hyperbaric Oxygen Therapy

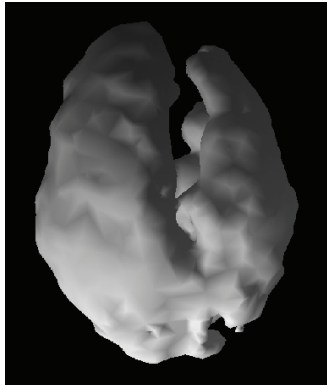
Brain healthy strategies to consider:

- Both physical & mental exercise
- Avoid behaviors risky for brain injury
- Omega-3 fatty acids
- Alpha lipoic Acid, 100-300mg 2XD
- Multiple vitamin
- Vitamin E 100 IUs 2XD and Vitamin C 1,000mg 2XD as antioxidants
- Brain and Memory Power Boost 3 2XD
- Coenzyme Q10 (CoQ10) help with energy/memory, especially if Parkinson's disease is present or in family. 100 – 400 mg/day

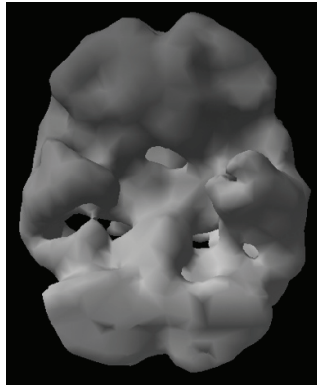
Toxicity or scalloping is often seen on scans and may be due to a number of causes, such as substance abuse, environmental toxins, oxygen deprivation, infections, etc. Scans cannot date the time of exposure but say if there is increased likelihood that they occurred. When toxicity is present it is critical to eliminate the offending agent and work to regain the best brain health possible.



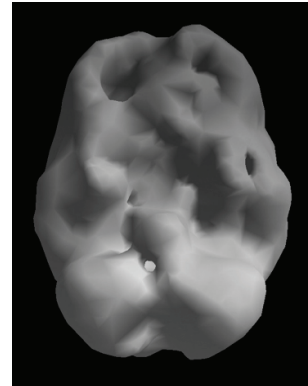
PHYSICAL BRAIN TRAUMA PATTERNS



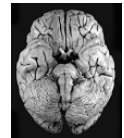
Top Down Surface View



Left Side Surface View



Underside Surface View



Physical Brain Trauma Patterns

Brain trauma can show in many different ways on scans. Typically, there is:

- Focal areas of decreased activity in the prefrontal cortex, temporal lobes, parietal lobes, occipital lobes
- Decreased prefrontal pole
- Decreased anterior temporal poles
- Decreased temporal lobes
- Focal areas of increased activity
- Off center anterior cingulate activity

Trauma Causes

Blunt force

Whiplash injuries

Acceleration/deceleration injuries

Falls, sports, motor vehicle accidents

**loss of consciousness may not be present

Trauma Symptoms (depends on system affected)

Cognitive problems (attention and memory)

Fatigue

Irritability

Prefrontal, temporal, parietal lobe symptoms

Physical Brain Trauma Treatments

Eliminate risk for future injuries

Maximize brain nutrition

Hyperbaric Oxygen Therapy

Neurofeedback over damaged area

Brain healthy strategies to consider:

- Both physical & mental exercise
- Avoid behaviors risky for brain injury
- Omega-3 fatty acids
- Brain and Memory Power Boost 3 2XD
- Multiple vitamin
- Coenzyme Q10 (CoQ10) help with energy/ memory, especially if Parkinson's disease is present or in family. 100 – 400 mg/day

Physical brain trauma is more common than people realize. We often see damage on scans of what most people would consider minor brain trauma. Scans cannot date the time of the trauma but say if there is increased likelihood that they occurred. When trauma is present it is critical to eliminate future risk and work to regain the best brain health possible.