

AgrAbility Webinar

Brain Injury and Cognitive and Behavioral Consequences

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Lance E. Trexler, PhD, FACRM
Rehabilitation Hospital of Indiana
Indiana University School of Medicine

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Basic Webinar Instructions

- Audio available through computer or phone.
- Check sound via Communicate menu at top.
- Closed captions: use arrow to expand or contact the Media Viewer window. May need to log in.
- Expand/contract any of the windows in the right-hand column with the arrows. May need to do this to see video of presenter.
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Basic Webinar Instructions

- **Questions and comments**
- Click Chat icon at top right of screen (it should turn blue). Enter message in box, choose who to send it to, and click send. You may enter questions about the presentation at any time. Please don't use Q & A option.)
- In addition, during the Q & A period, if you have a web microphone, click the "Raise Hand" icon to indicate that you have a question. We will enable your microphone or phone connection.

Basic Webinar Instructions

- 4 quick survey questions + opportunity to share comments
- Session recorded and archived with PowerPoint files at www.agrability.org/Online-Training/archived
- Problems: use chat window or email agrability@agrability.org



- **AgrAbility:** USDA–sponsored program that assists farmers, ranchers, and other agricultural workers with disabilities.
 - Partners land grant universities with disability services organizations. Currently 20 state projects
 - National AgrAbility Project: Led by Purdue’s Breaking New Ground Resource Center.
 - Partners include:
 - Goodwill of the Finger Lakes
 - The Arthritis Foundation, Heartland Region
 - University of Illinois at Urbana–Champaign
 - Colorado State University
 - More information available at www.agrability.org

Lance E. Trexler, PhD., FACRM

Dr. Trexler is the Executive Director, Departments of Rehabilitation Neuropsychology and Resource Facilitation, Rehabilitation Hospital of Indiana, Adjunct Clinical Assistant Professor of Physical Medicine and Rehabilitation, Indiana University School of Medicine, Adjunct Assistant Professor of Speech and Hearing Sciences at Indiana University, and Adjunct Assistant Professor of Psychological Sciences at Purdue University. The American Congress of Rehabilitation Medicine (ACRM) awarded Dr. Trexler the Lifetime Achievement Award in 2011, was named a Fellow of the American Congress of Rehabilitation Medicine in 2013, and the Distinguished Member Award in 2015.

Dr. Trexler has published over 35 book chapters and peer-reviewed articles and has given over 120 peer-reviewed and invited presentations at professional conferences throughout the North American and Europe. Dr. Trexler is the Managing Editor of the Cognitive Rehabilitation Manual: Translating Evidence-Based Recommendations into Practice published by ACRM in 2012.

Overview

- Neuropathology of TBI
- Severity of TBI
- Course of Recovery from TBI
- Cognitive and Behavioral Consequences of TBI

The Biological Basis of Our Consciousness, Our Identity, and Adaptability



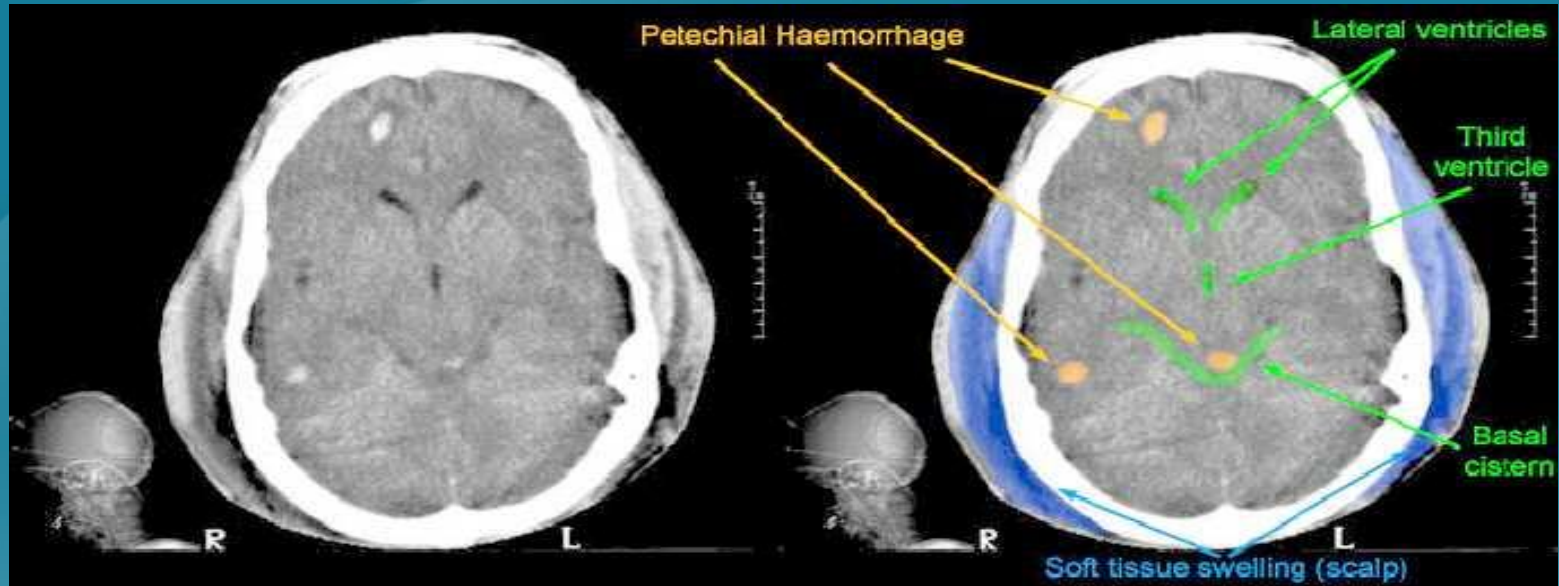
Men ought to know that from nothing else but the brain come joys, delights, laughter and sports, and sorrows, grief's, despondency, and lamentations. And by this, in a special manner, we acquire wisdom and knowledge, and see and hear and know what are foul and what are fair, what are bad and what are good, what are sweet and what are unsavory... And by the same organ we become mad and delirious, and fears and terrors assail us...All these things we endure from the brain when it is not healthy...In these ways I am of the opinion that the brain exercises the greatest power in man.

-Hippocrates, *On the Sacred Disease* (Fourth century B.C.)

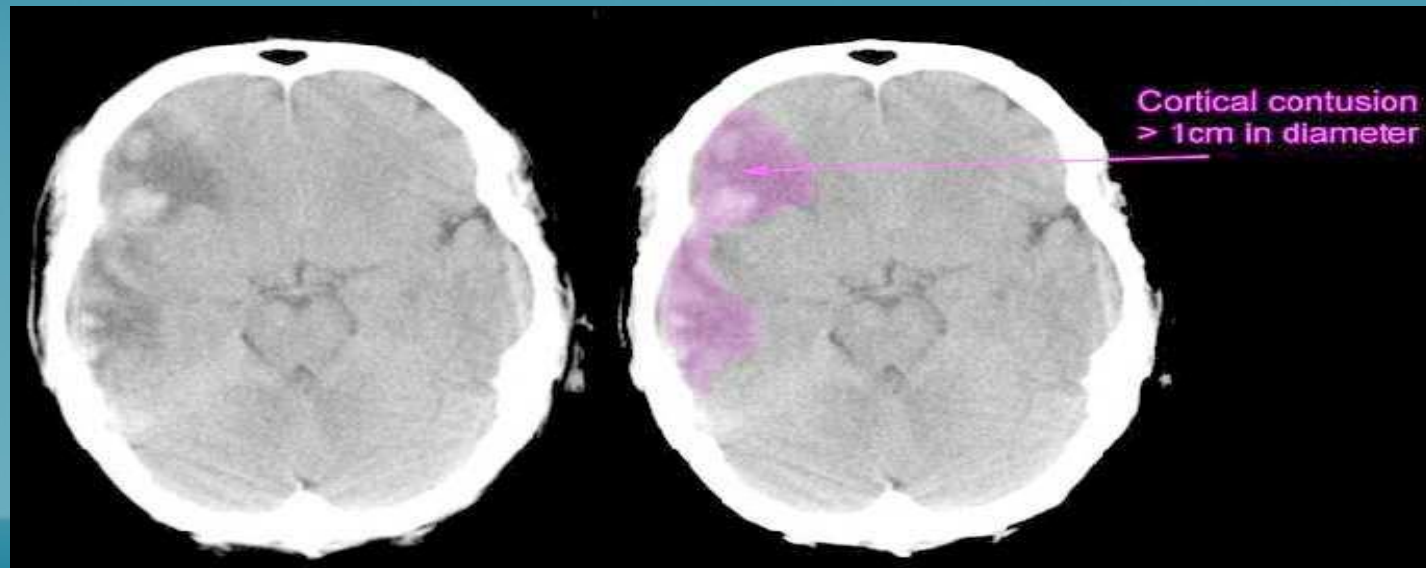
TBI Neuropathology

- Closed Head Injury– Skull Intact vs Open Head Injury- opening in Skull
- Diffuse Axonal Injury: Twisting & Tearing of Brain Tissue
- Bruising & Contusions
- Hematomas & Hemorrhages

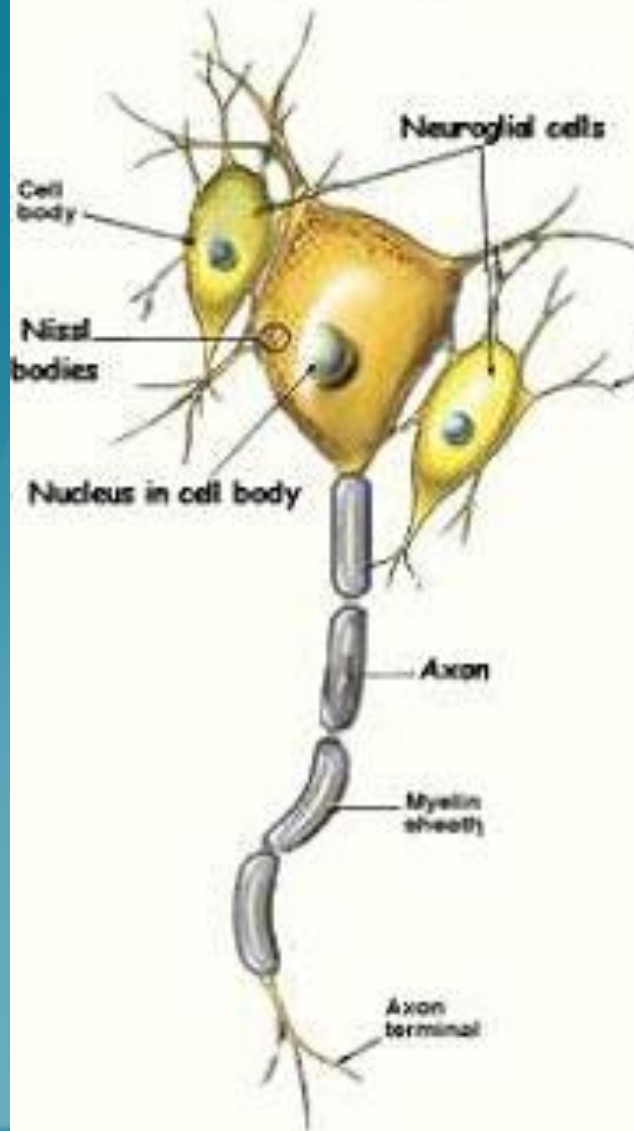
Diffuse Axonal Injury



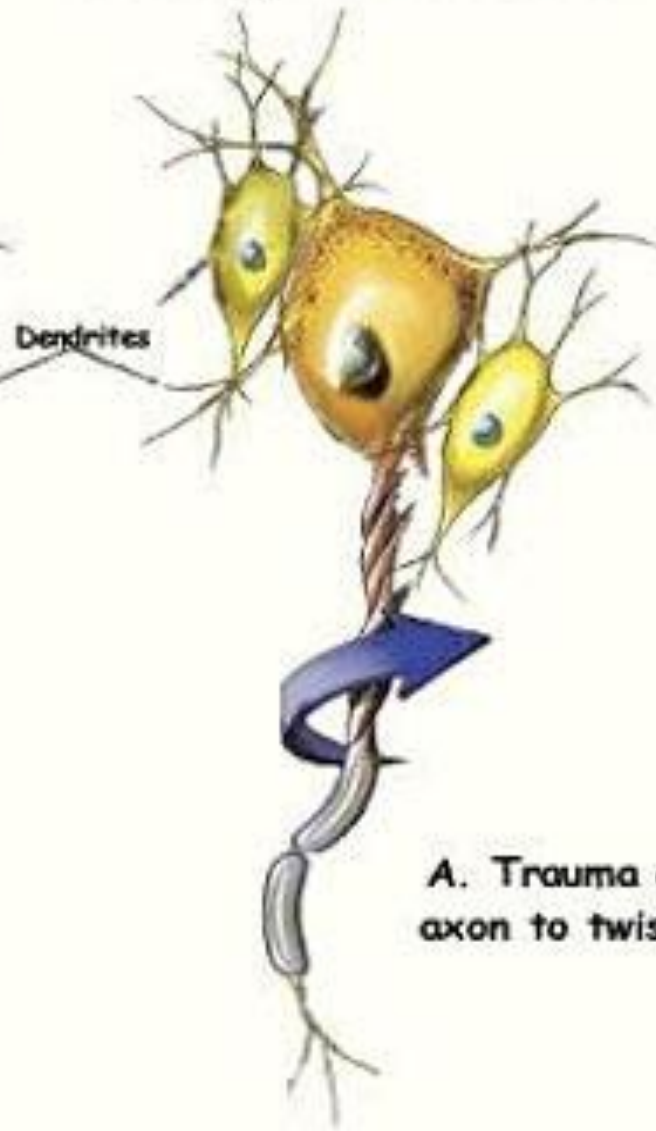
Cerebral Contusion



Normal Axon



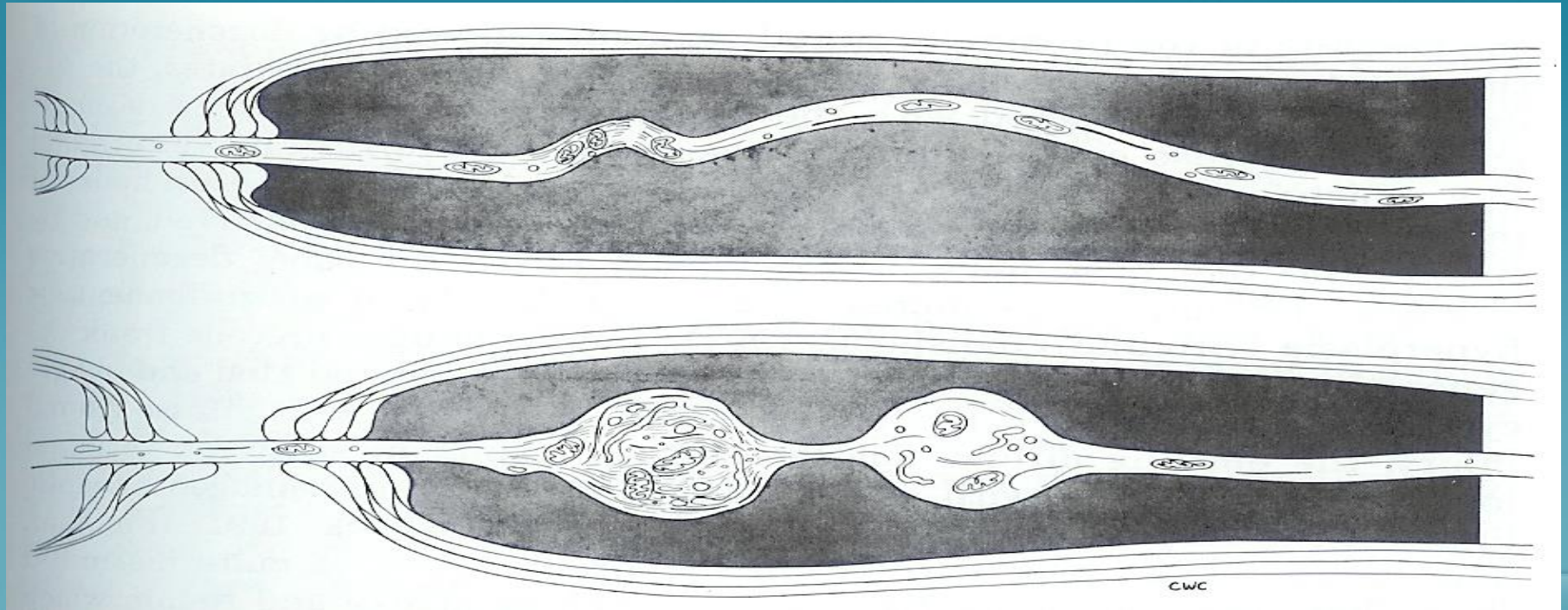
Shearing of the Axon



Post-trauma Condition



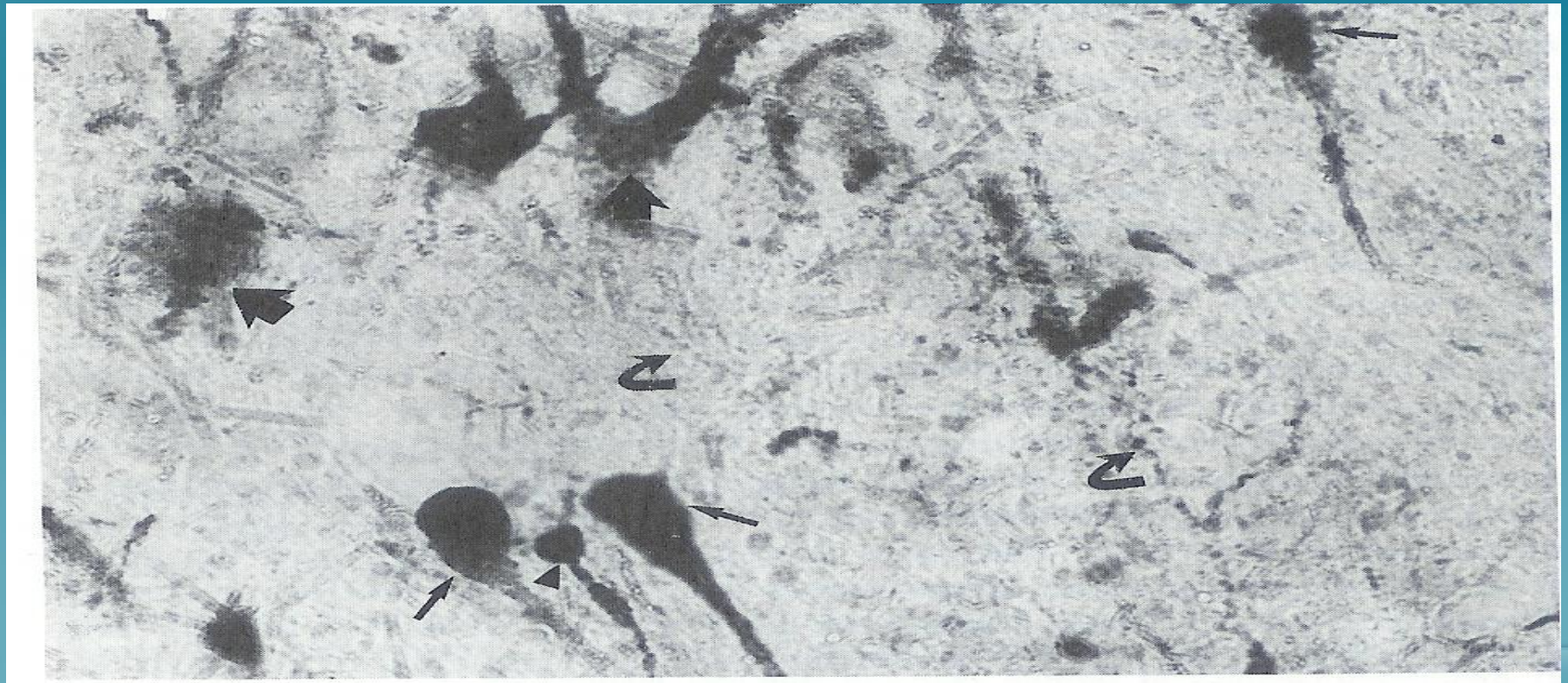
Axonal Changes following TBI: Stretching, Swelling & Lobulation



Axonal Changes following TBI: Retraction Ball & Associated Reactive Swelling



Micrograph of Axonal Damage: Retraction Balls (arrows) & intact Neurons (curved arrows)

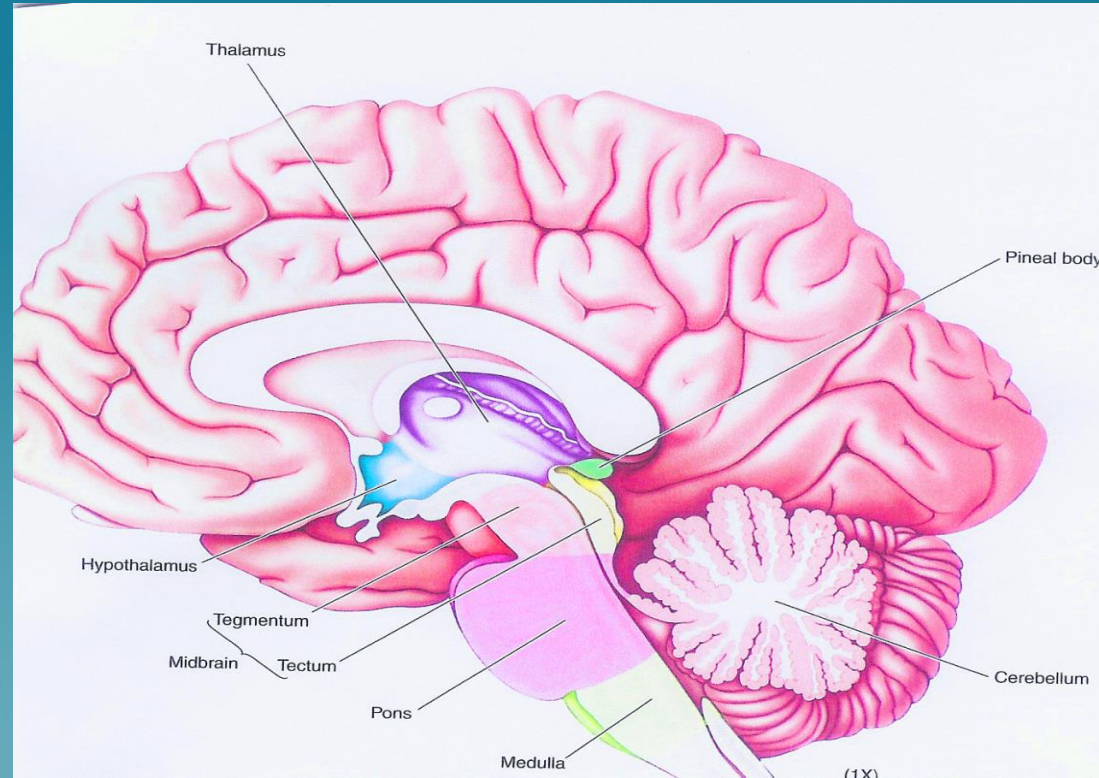


Time Course

- Changes in axonal structure evolve over 12-24 hour period in cat
- Wallerian Degeneration evolves over 2-60 days
- Regenerative activity occurs over weeks to months

Diffuse Axonal Injury

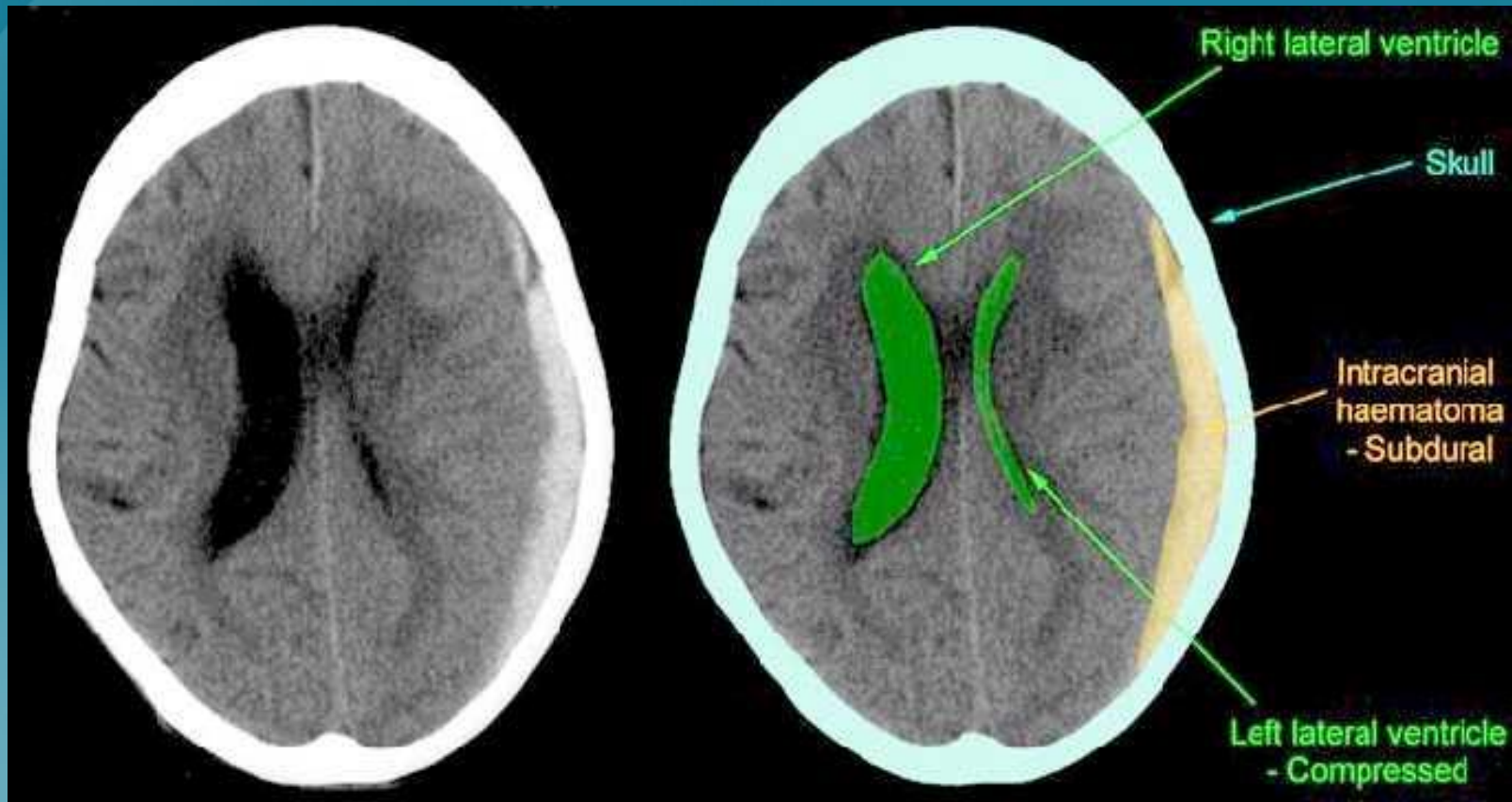
- Upper brainstem 95%
- Corpus callosum 92%
- Choroid plexus of third ventricle 90%
- Hippocampus 88%
- Periventricular (3rd ventricle) 83%
- Cingulate gyrus 61%
- Thalamus 56%



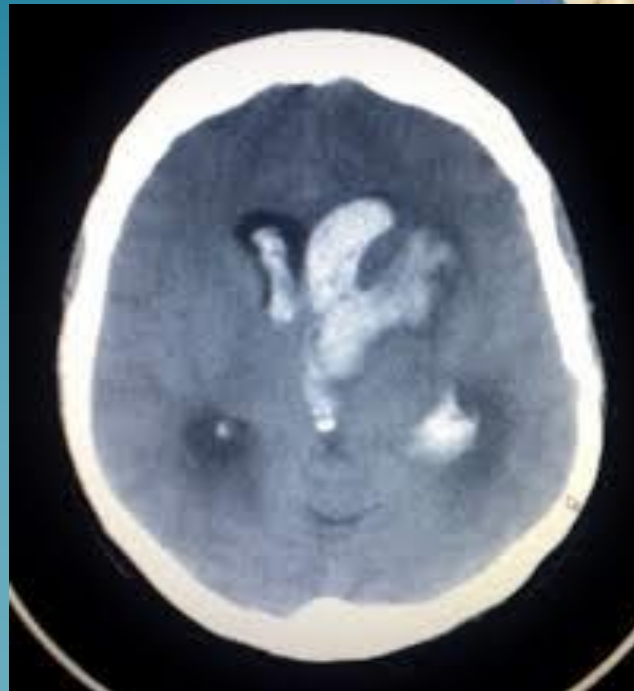
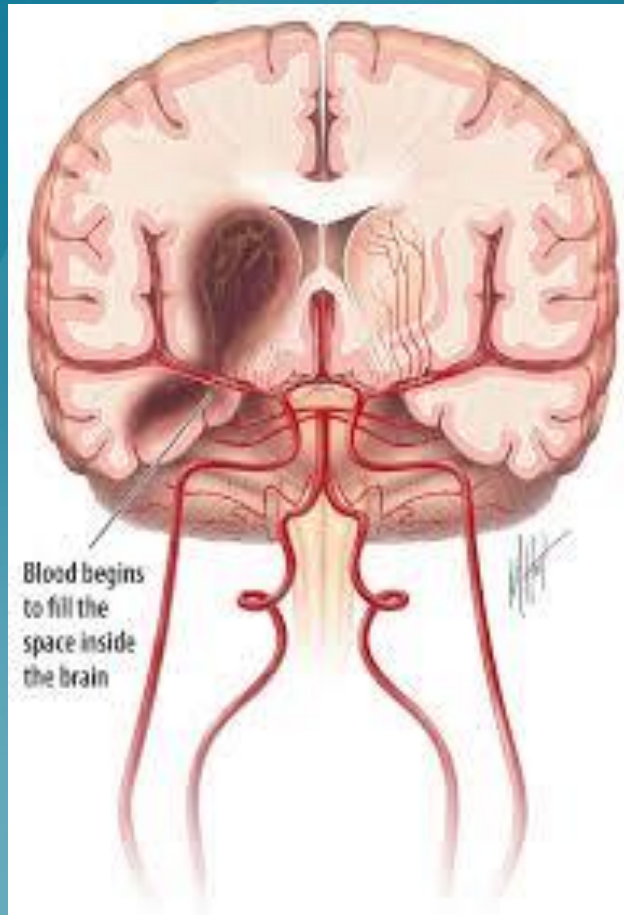
Subdural Hematoma

- Collection of Blood on the Brain's Surface
- Acute SDH- Bleeding Fills Rapidly
- Chronic SDH- Slow leaking
- Can Lead to Increased Intracranial Pressure
- To relieve Pressure
 1. Burr Holes- allows drainage
 2. Craniotomy

Subdural Hematoma



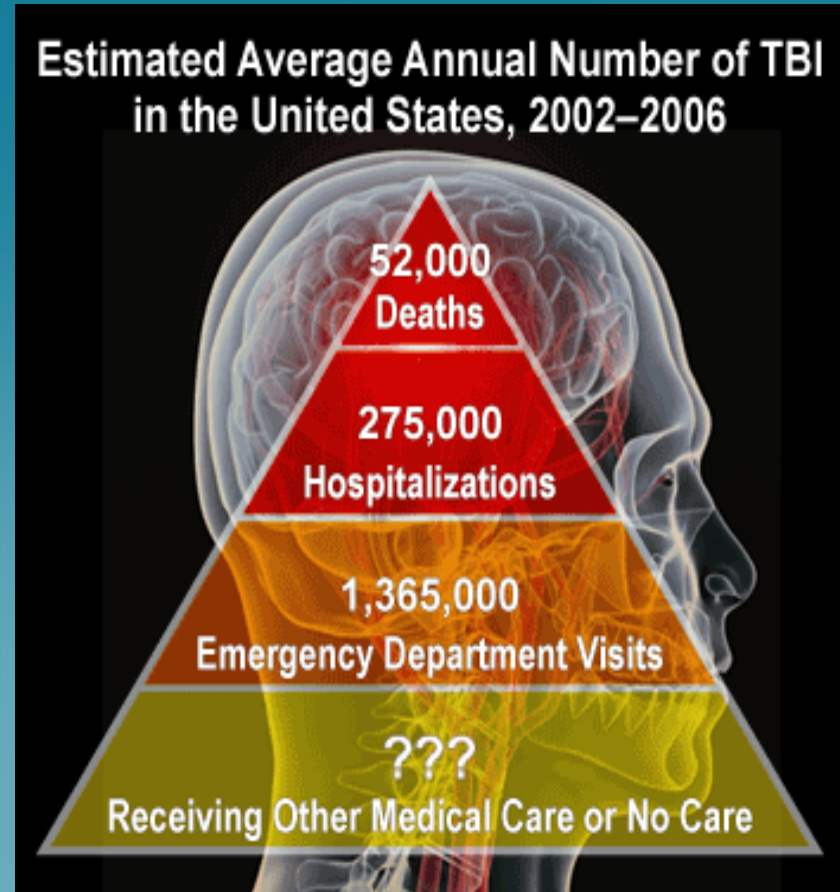
Intracerebral Hemorrhage



Incidence

www.cdc.gov/Features/dsTBI_BrainInjury/

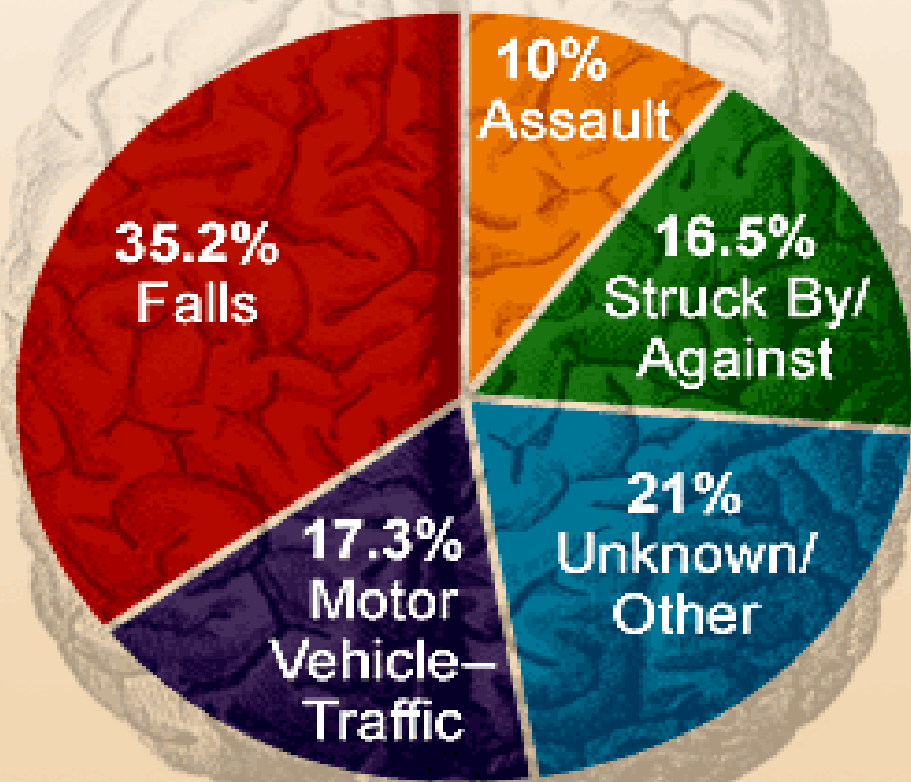
- 1.4 million TBI each year in USA
 - 4,000/day
 - 3/minute



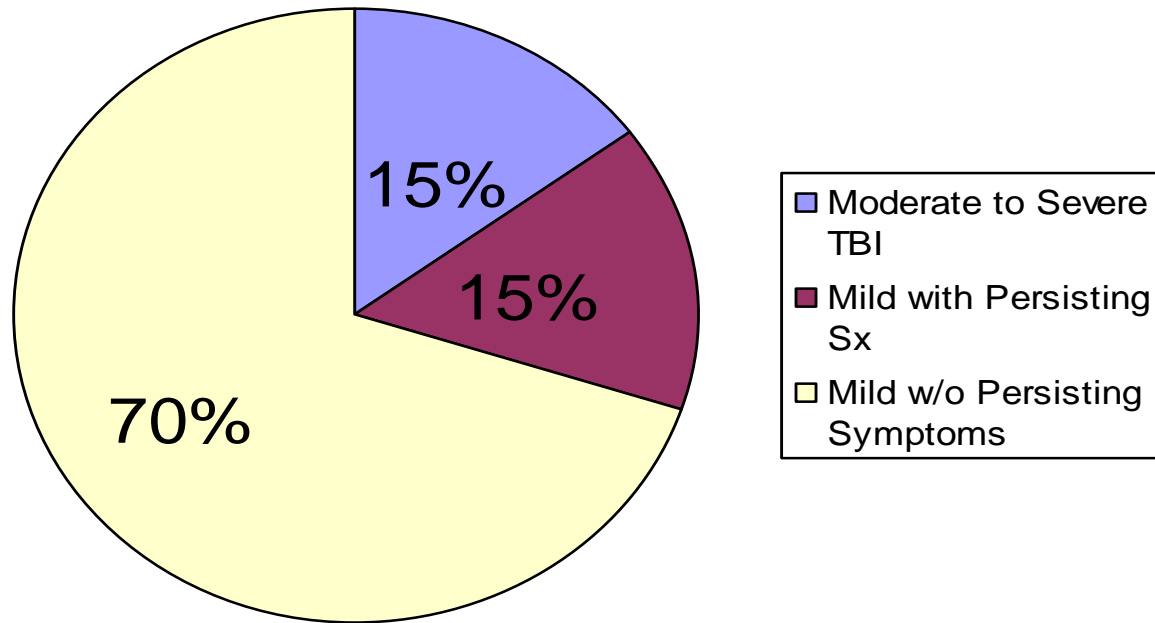
Cause of TBI

http://www.cdc.gov/Features/dsTBI_BrainInjury/

Estimated Average Percentage of Annual TBI by External Cause in the United States, 2002–2006



TBI Incidence by Severity



10,000 TBI in Indiana each year = 1,500 MTBI
with Persisting Symptoms

Severity of TBI

Acute vs. Post-Acute

Classification of Severity in TBI

	MILD	MODERATE	SEVERE
Loss of Consciousness	< 20 minutes	20 minutes to 36 hours	> 36 hours
Post-Traumatic Confusion	< 24 hours	1- 7 days	> 7 days
Glasgow Coma Scale	13-15	9-12	8-3



Concussion/mTBI Grading

- Three levels adopted by the American Academy of Neurology:
 - Level I: No LOC, No PTA, but period of disorientation & confusion (delirium) (mild concussion)
 - Level II: No LOC, presence of PTA (moderate concussion)
 - Level III: LOC (severe concussion)

Kelly, Nichols, Filley, et al (1991) JAMA

Diagnostic Criteria for MTBI by the American Congress of Rehabilitation Medicine

R.M. Ruff et al. (2009). Archives of Clinical Neuropsychology, 24: 3-10

A traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

- Any loss of consciousness
- Any loss of memory before or after injury
- Any alteration of mental state
- Focal neurological deficit that may or may not be transient
- Severity of Injury does not exceed the following:
 - LOC \leq 30 minutes
 - After 30 minutes, an initial GCS score of 13-15
 - PTA \leq 24 hours

Severity of TBI: Post-Acute

- More related to residual brain impairments and abilities
 - Neuropsychological examination
 - Medical condition (i.e., seizures, physical or sensory impairments)
- Level of Disability
 - Psychosocial adjustment
 - independence in the home and community
 - Vocational and recreational functioning

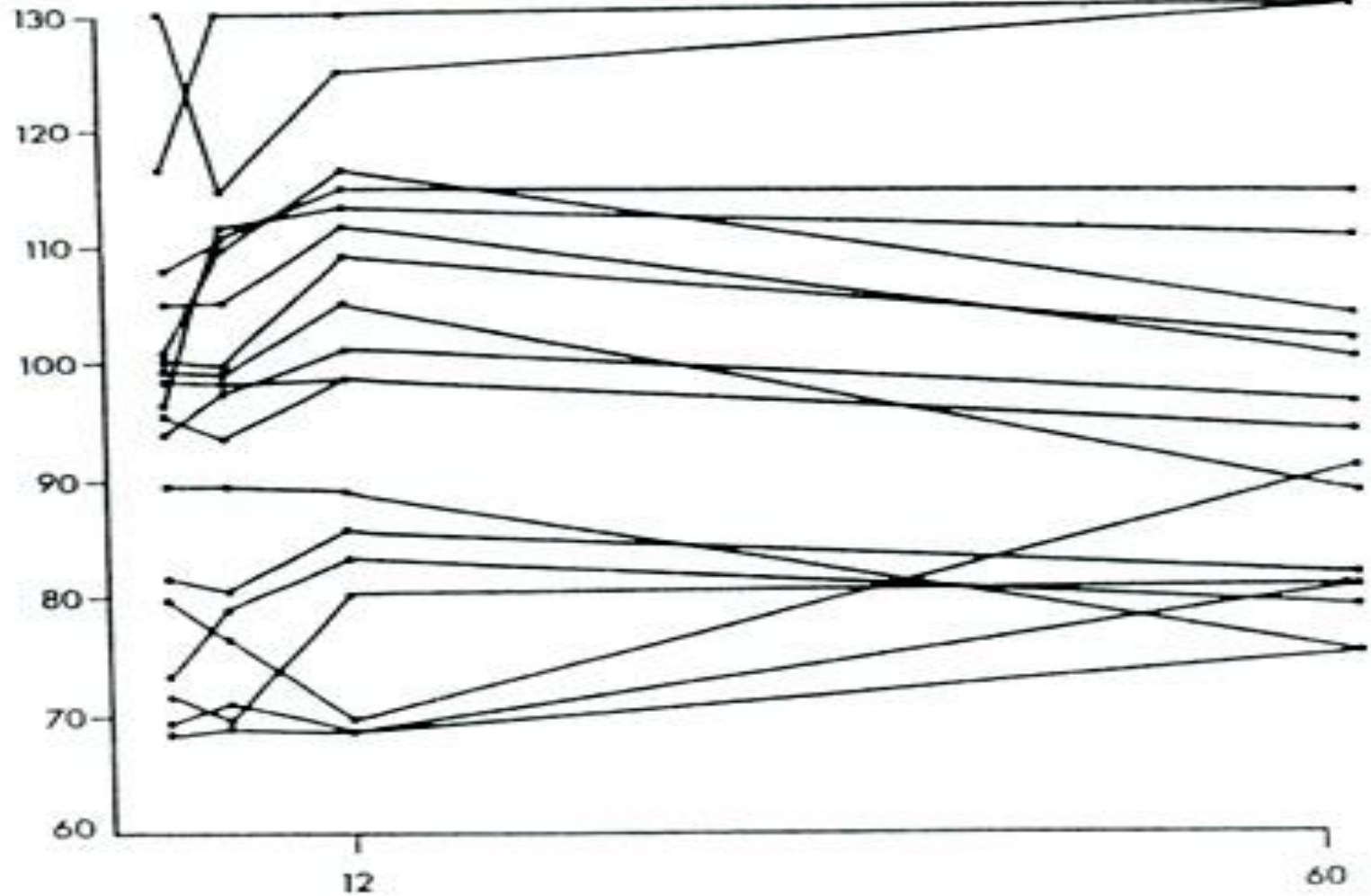
Course of “Recovery” following TBI

Myths About Recovery



Acute Severity \neq Post-Acute Severity

P.M. IQ SCORES



Determinants of “Recovery”

- Medical
 - medications, seizure disorder, endocrine disorder, hydrocephalus
- Psychosocial
 - Co-morbidities including mood disorders, adjustment disorders, substance abuse
 - Emotional and Family support
- Environmental
 - Rehabilitation (short and long-term)
 - Participation (social, vocational, recreational)

Effects of TBI on Attention, Memory, and Executive Functions and Vocational Implications

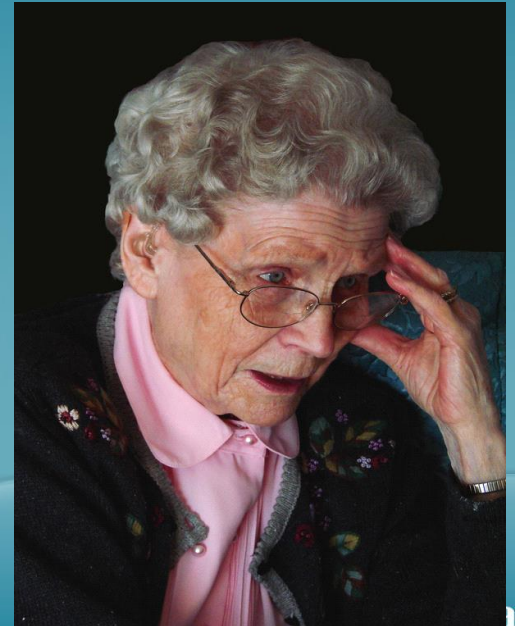
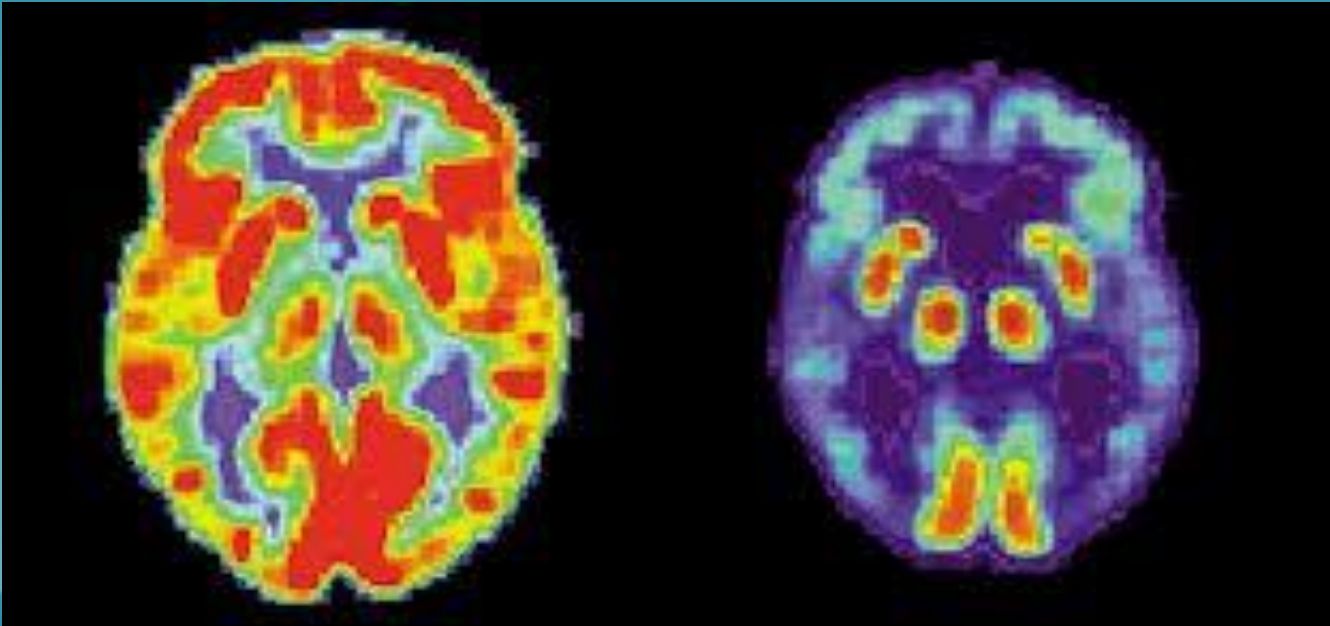
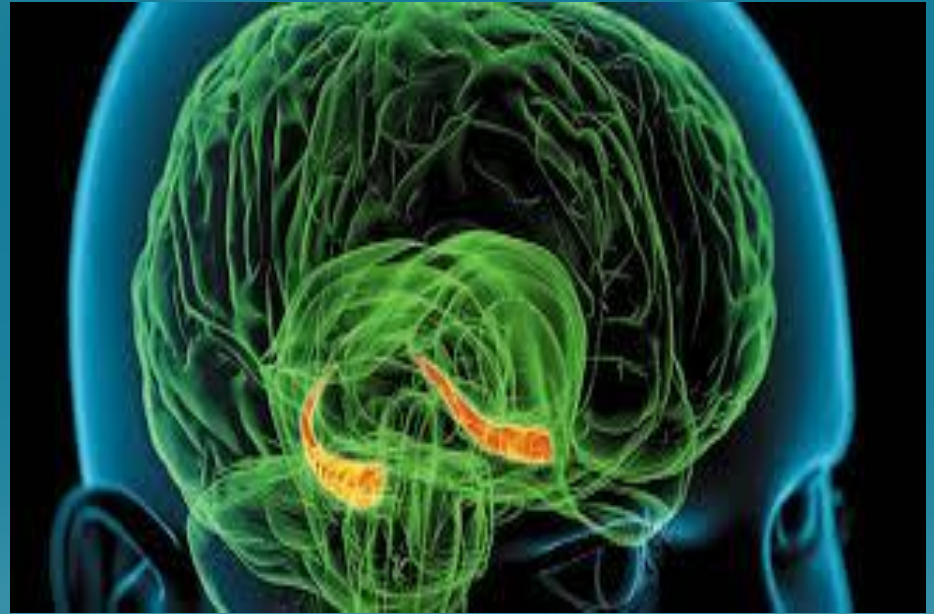
Overview of Major TBI Consequences

TBI Consequence		Functional Impact on Behavior
Attention deficit	→	Difficulty focusing on or responding to required tasks or directions
Memory deficit	→	Difficulty understanding or remembering rules or directions
Irritability or Anger	→	Conflict with co-workers and family
Uninhibited or Impulsive Behavior	→	Poor Inhibition of emotions or desires (e.g., theft or drug use, rage)
Executive Function deficit	→	Difficulty organizing behavior to execute stated intentions or goals (e.g., don't actually do what they wanted or said they would do)

Disorders of Attention

Type	Functions	Impairments	Impact on Work	Possible Treatments
Arousal & Alertness	Wakefulness	Cognitive fatigue	<ul style="list-style-type: none"> • Can't maintain activity, • Poor consistency, • Distractibility, • Gets off track especially in sequence of or multiple tasks • Slow to learn new tasks • Withdrawal from activity 	<ul style="list-style-type: none"> • Medications • fatigue management • Distraction-free environment, • to do lists, • reminder alarms, • Breaks, • one task at a time • Keep a list of tasks, • prioritize
Focused Attention	focus on one stimulus and inhibition of another	internal and external distractibility		
Sustained Attention	capacity to maintain attention over a period of time or vigilance	Loss of sustained performance or persistence		
Divided Attention	'multi-tasking' or responding to more than one stimulus at a time	Irritability, loss of strategy to perform tasks, confusion		

Memory



Types of Memory

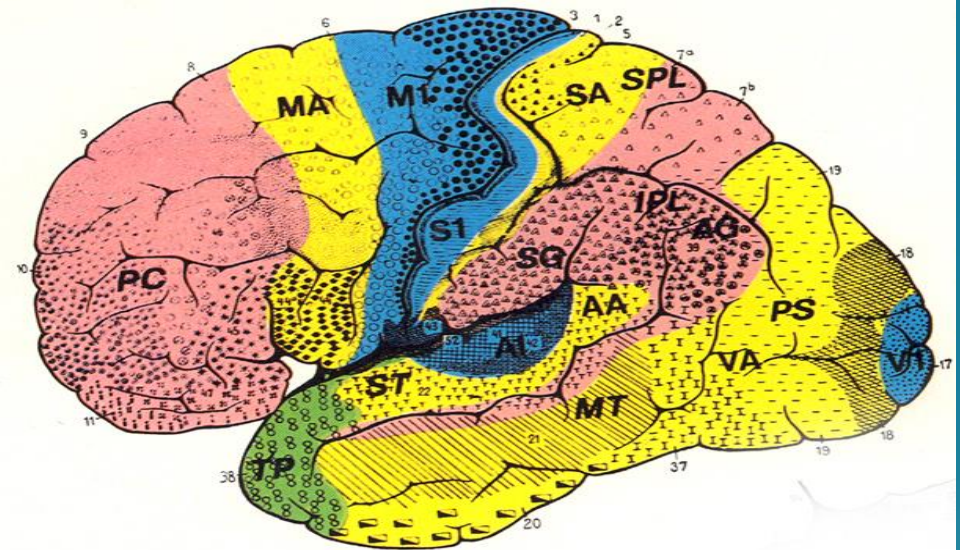
- Declarative: memory for “conscious” facts & experiences
 - Semantic: memory for factual information
 - **Episodic**: memory for events in your life
- Procedural: memory about how to do things
- **Working memory**: short-term storage and management of information
- **Prospective**: remembering according to intent or plan

Disorders of Memory

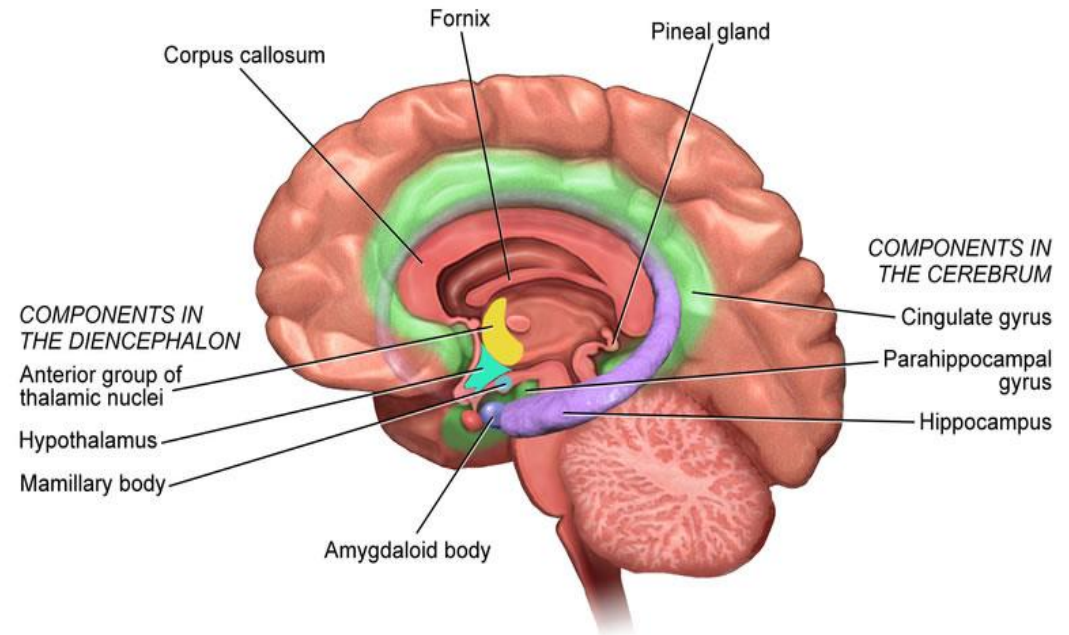
Type	Functions	Impairments	Impact on Work	Possible Treatments
Working Memory	What is “on-line” at the moment	Loosing track of ongoing focus or activity	<ul style="list-style-type: none"> • Forgetting what work activity is to be or priority • Forgetting how to perform a task that was previously learned (post-injury) • Forgetting to perform work activity in the future 	<ul style="list-style-type: none"> • Small pieces of data • Management of distractions • Repetition with consistent rehearsal strategies • Memory notebooks • Task guidance systems (written, digital)
Episodic Memory	Memory for events	Forgetting what one has experiences or learned		
Prospective Memory	Remembering to remember	Forgetting what is intended or planned		

Executive Functions and Frontal Lobes

- Frontal Lobes:
 - Integrate sensory input from the External Milieu with
 - Information from the Internal Milieu (affective & motivational state, & memory)
 - According to Goals and Intent to promote adaptation

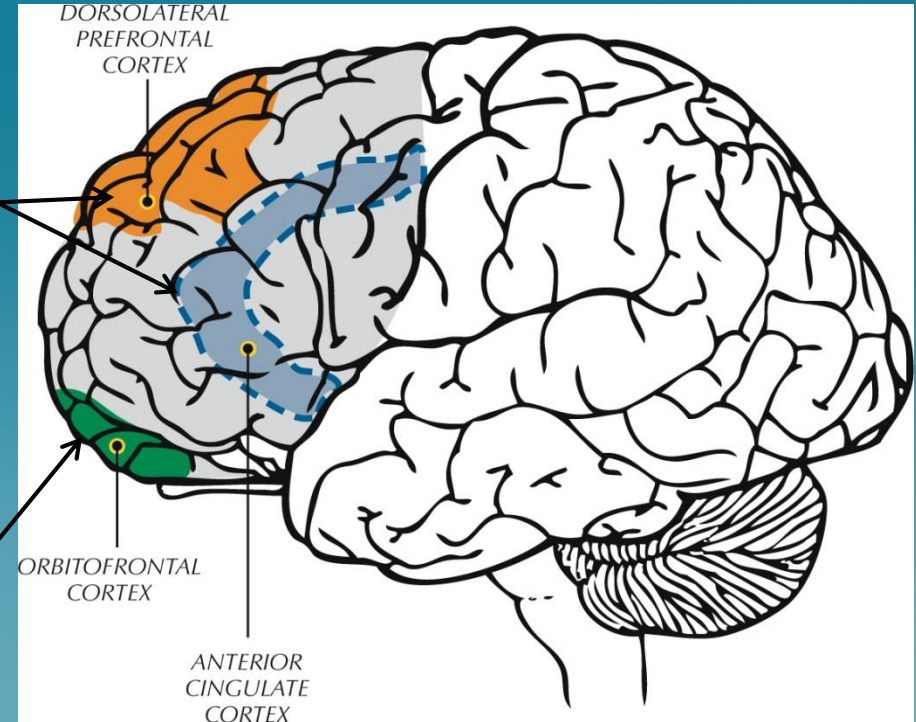


The Limbic System



Executive Functions

- Intention & initiation
- Organization-planning, strategy selection, sequencing, execution, self-monitoring, modification of strategy
- Regulation of affect and drive



Frontal Lobe Anatomy and Executive Functions

	Functions	Impairments	Impact on Work
Dorsolateral Convexity	Initiation, organizing, planning, strategy selection, self-monitoring, and strategy modification	Difficulty developing goals and executing goals, impaired sequencing and problem-solving (cannot find a strategy to solve the problem), poor awareness, results \neq intention	Difficulty generating or staying consistent with vocational goals, not following through with stated goals, poor awareness of errors on the job, can't adjust to change in how to perform tasks, slow to learn new steps or procedures, frustration and disappointment with the discrepancy between goal (performance on the job) and actual performance, difficulties learning from mistakes on the job
Orbitofrontal Cortex	Regulation of mood and behavior according to socially appropriate standards or environmental context	Impulsivity, disinhibition, motor and verbal hyperactivity, indifferent attitude, jocular, irritability and inability to stay with a strategy to solve a problem (inconsistent in behavior and problem-solving)	Distractible on the job (intrusive thoughts of feelings and external distractions), impulsive actions or statements to co-workers, veers off task, inconsistent performance on the same task, appears indifferent to job errors or constructive feedback, makes inappropriate jokes, appears to over-react emotionally

Vocational Strategies in Impairments of Executive Functions

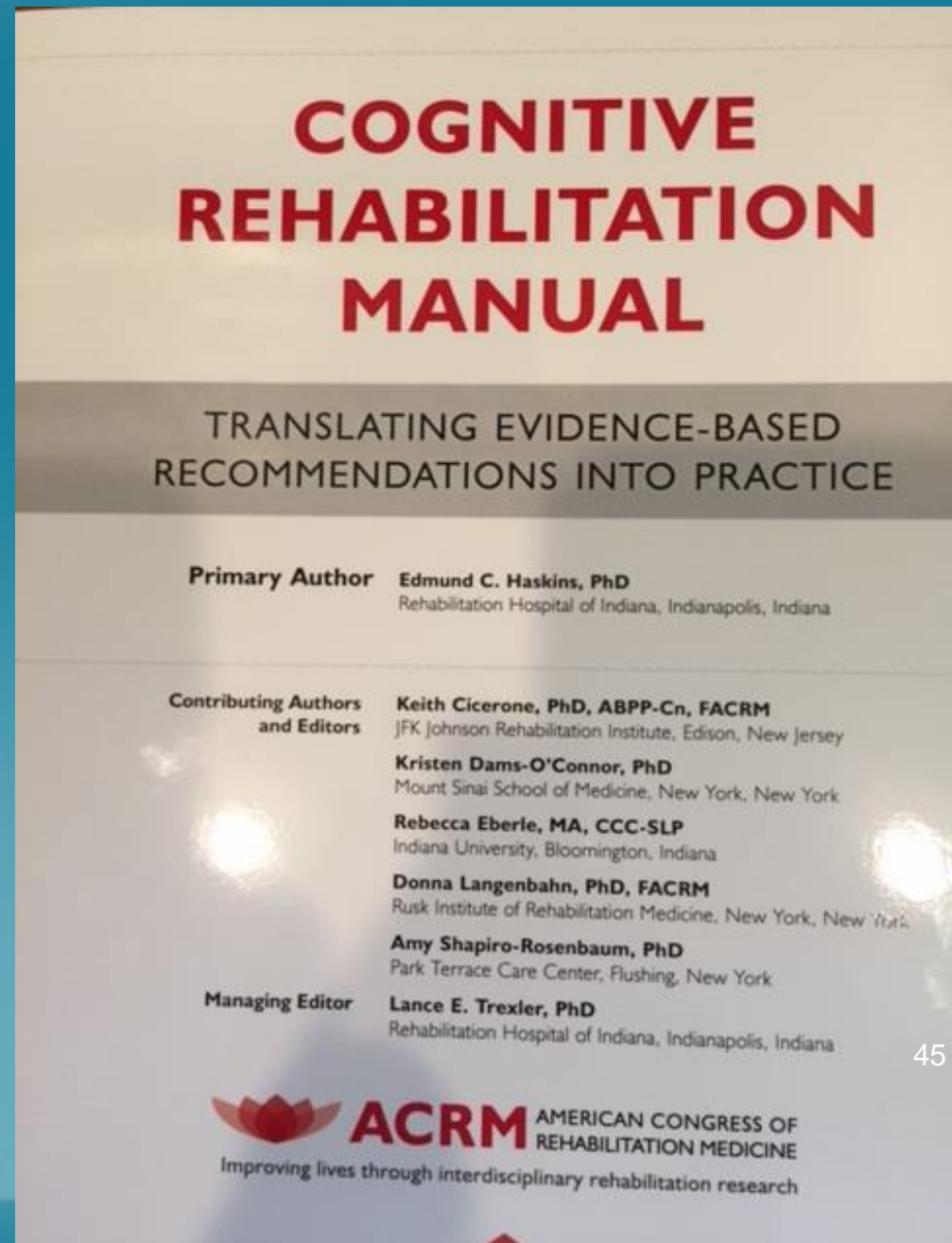
- Intention & initiation
- External cueing strategies, to do lists, break into steps
- Organization-planning, strategy selection, sequencing, execution, self-monitoring, modification of strategy
- Structure, consistency, prepare for change, consistent feedback, checklists for task completion, task guidance systems

Vocational Strategies in Impairments of Executive Functions

- Regulation of affect and drive
- “Stop and think” strategies, anticipate with external cues and strategies, breaks to decrease fatigue and irritability associated with being overwhelmed

American Congress of Rehabilitation Medicine

- Evidence-based cognitive rehabilitation
- Manual for therapists
- Two-day workshops
- <http://www.acrm.org/publications/cognitive-rehab-manual/>



Brain Injury Takes an Integrated Village

- Physical Medicine and Rehabilitation
- Neuropsychology
- Rehabilitation Therapists
- Employment Specialists
- Vocational Rehabilitation Counselors
- Others



Thank you!
Questions and Answers

lance.trexler@rhin.com