

Ring My Bell! Concussion Physiology and Care

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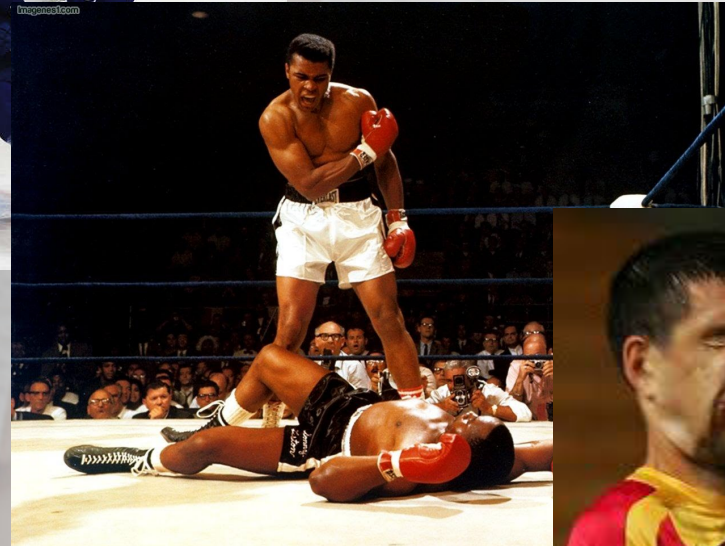


How Important of a Problem are
Concussions?

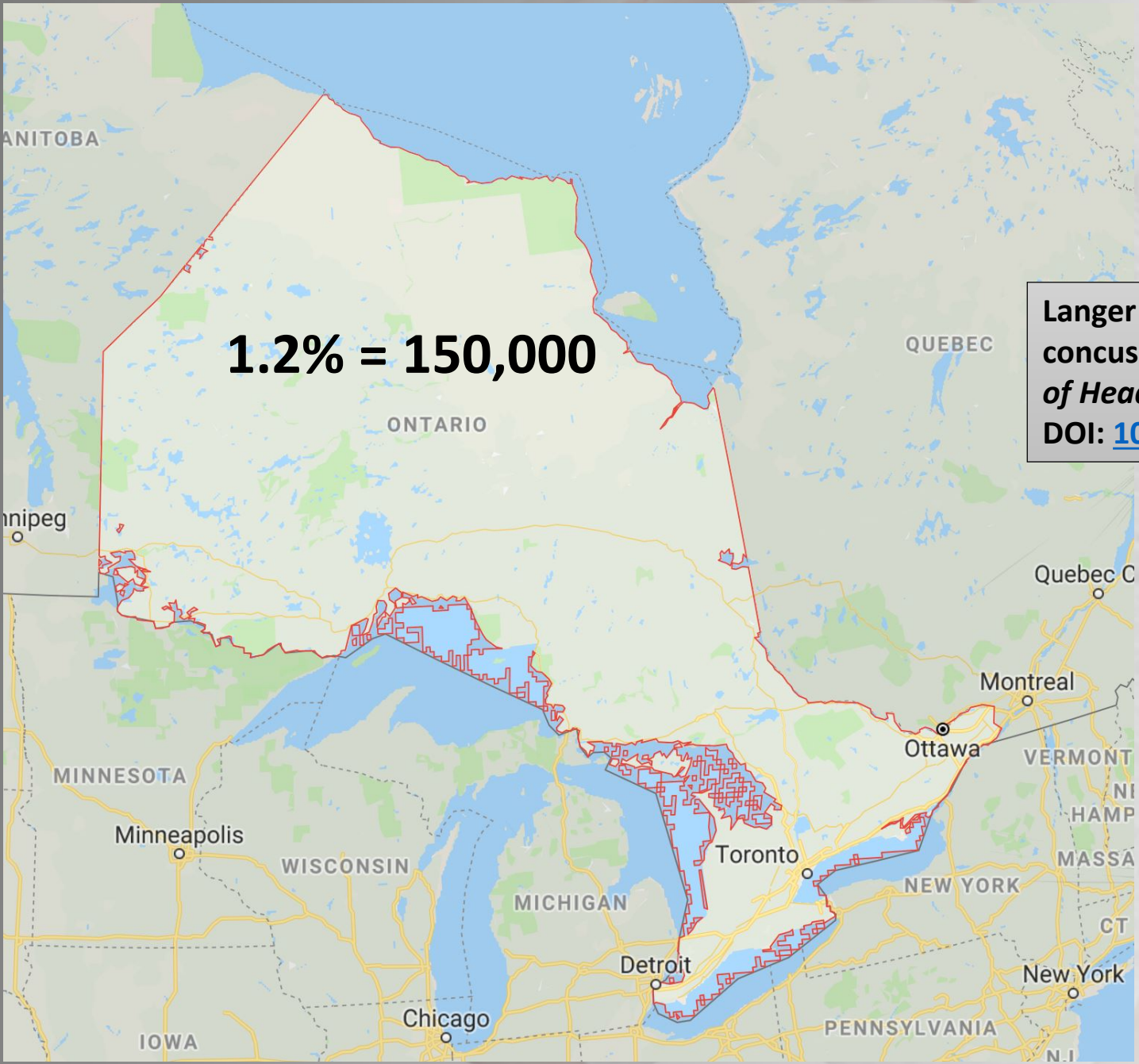
1.6-3.8 M Concussions Annually in US



300,000



Estimated 50% not reported



1.2% = 150,000

Langer L, Levy C, Bayley M. Increasing incidence of concussion: true epidemic or better recognition? *Journal of Head Trauma Rehabilitation*, 2019
DOI: [10.1097/HTR.0000000000000503](https://doi.org/10.1097/HTR.0000000000000503)

Self Reported Recovery...

40 % still had neuropsych deficits!

Concussion Long Term Effects

Mood disorders

Learning disabilities

Attention disorders

Migraines

Memory deficits

Depression / suicide

Definition



American Medical Society for Sports Medicine Definition

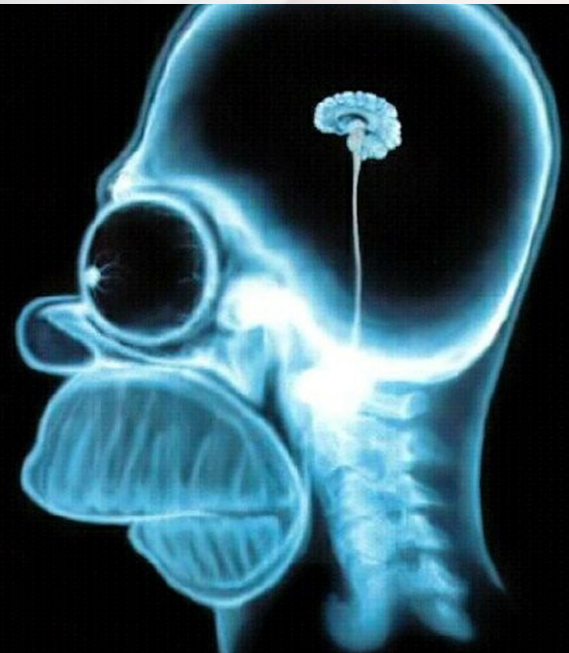
Traumatically induced transient disturbance of brain function that ... is a subset of mild traumatic brain injury which is classified based on acute injury characteristics at the less severe end of the brain injury spectrum.

World Health Organization Definition

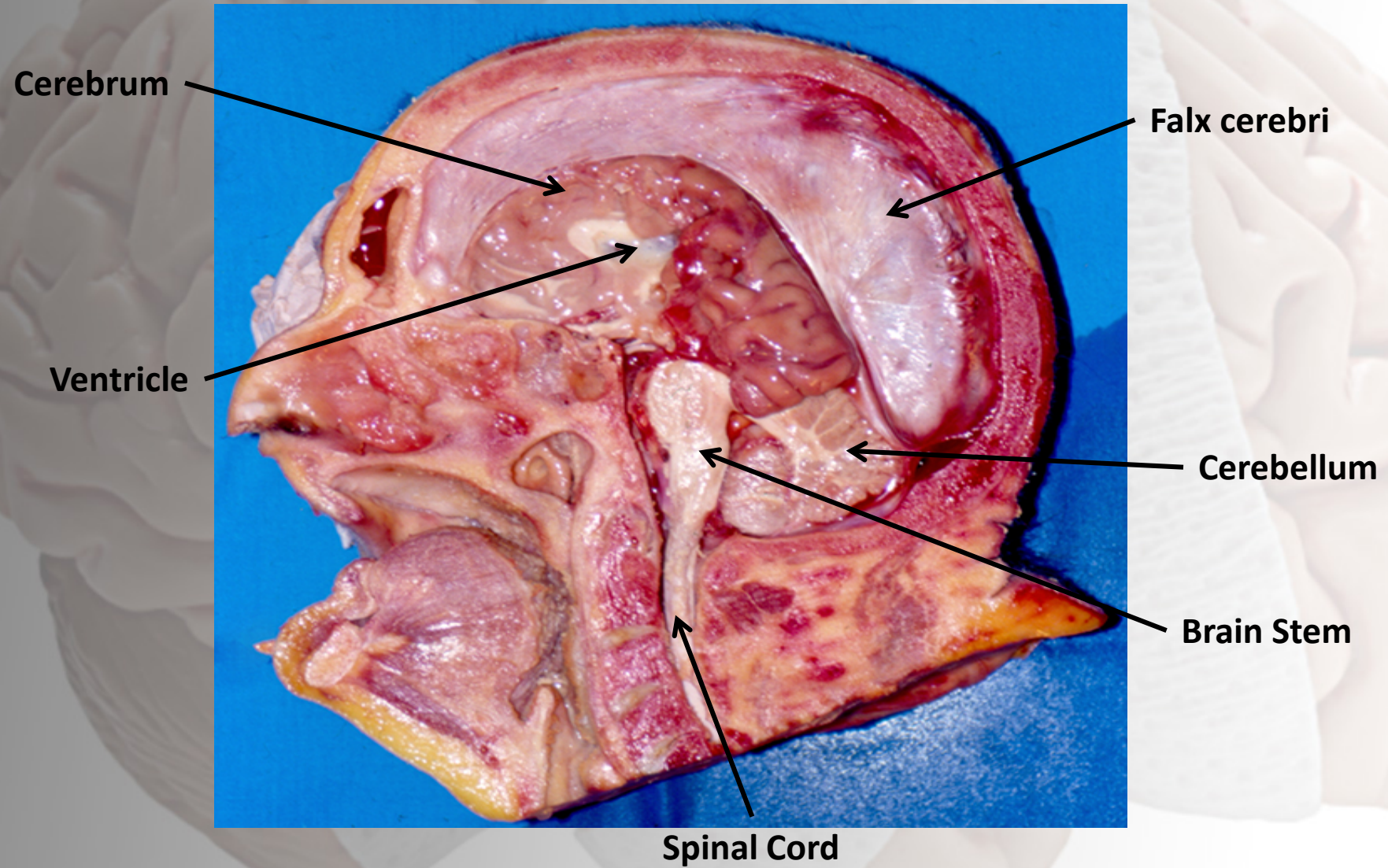
- **Confusion / disorientation**
- **LOC < 30 min**
- **Post-trauma amnesia < 24 hrs**
- **Transient neuro abnormalities**

GCS 13-15 @ 30 minutes or at ER

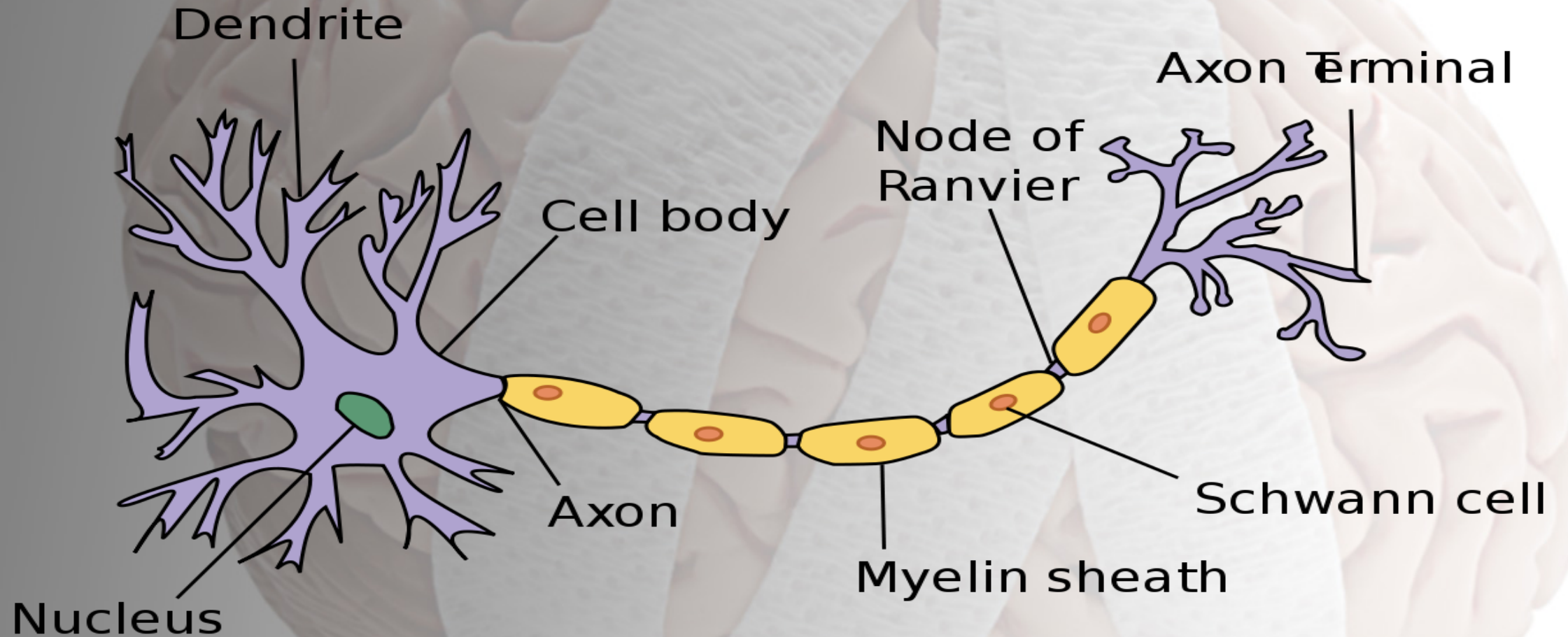
Concussion Anatomy & Pathophysiology



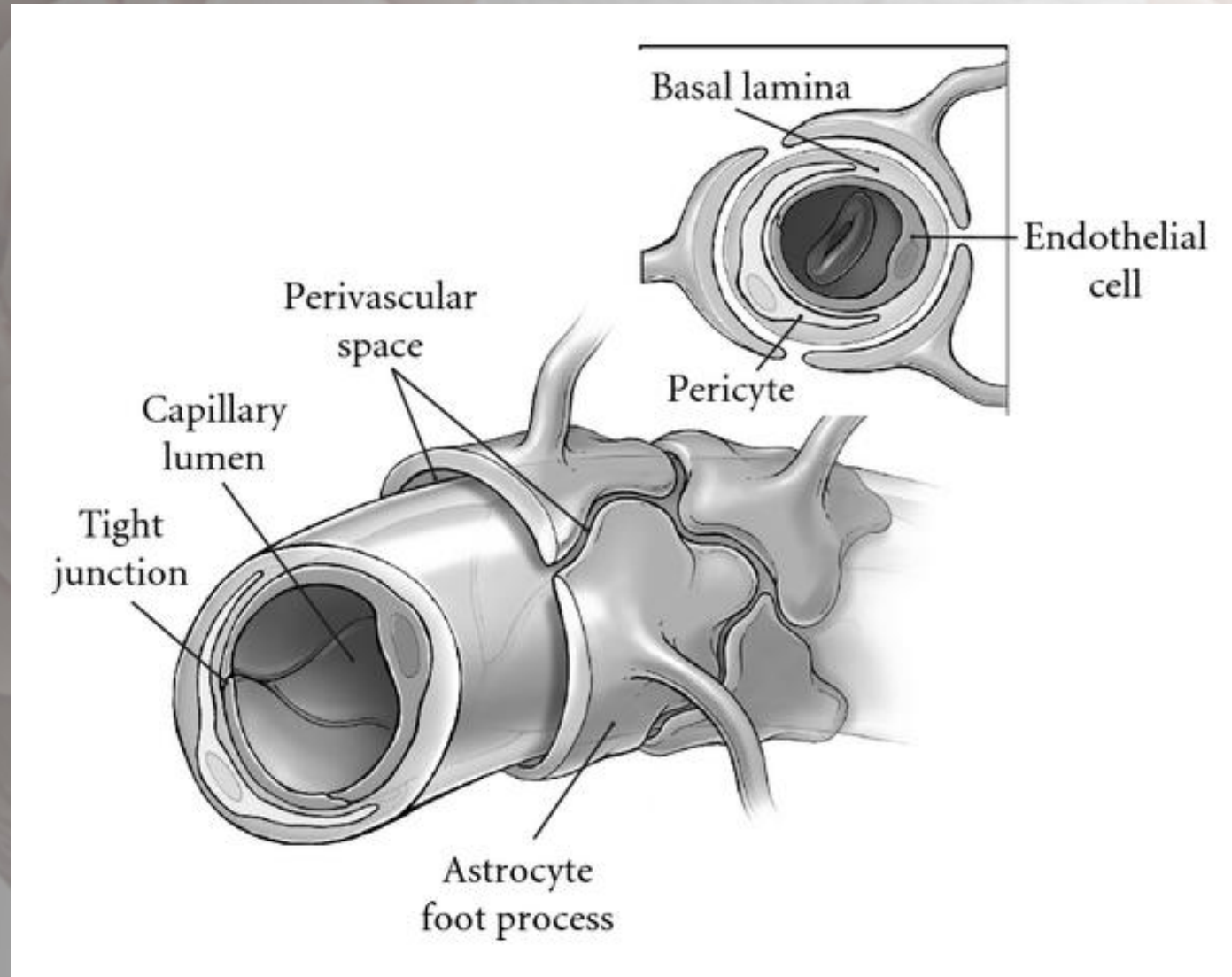
Brain Anatomy



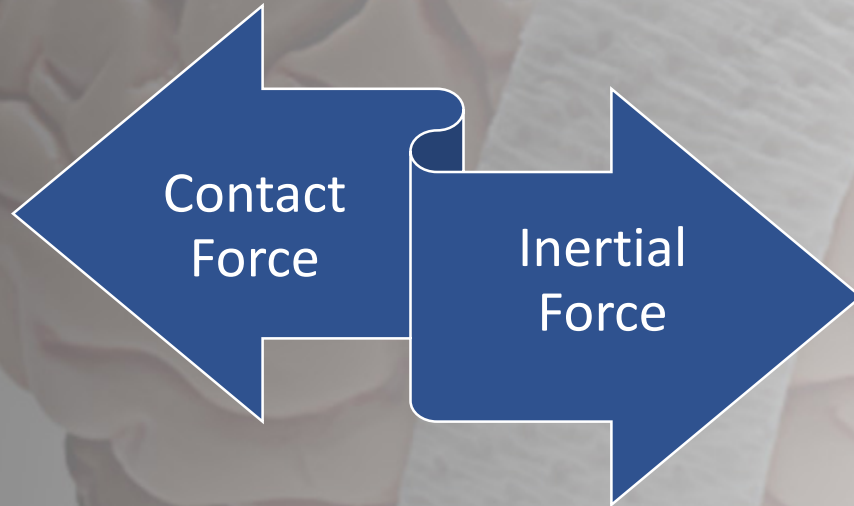
Neuron Anatomy



Blood Brain Barrier



Forces



Contact Force

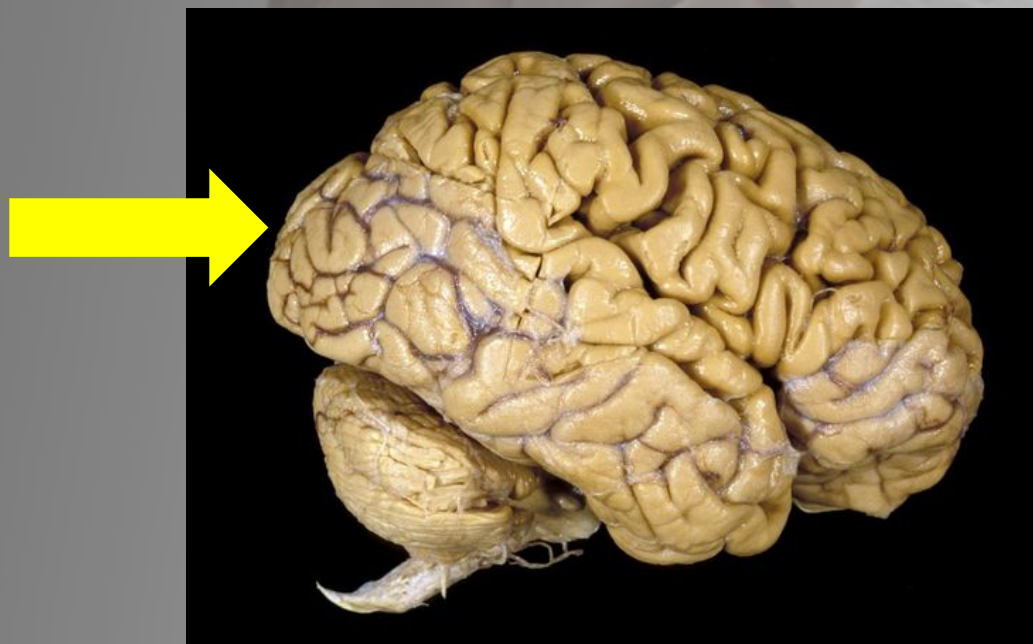


Inertial Force: Acceleration – Deceleration

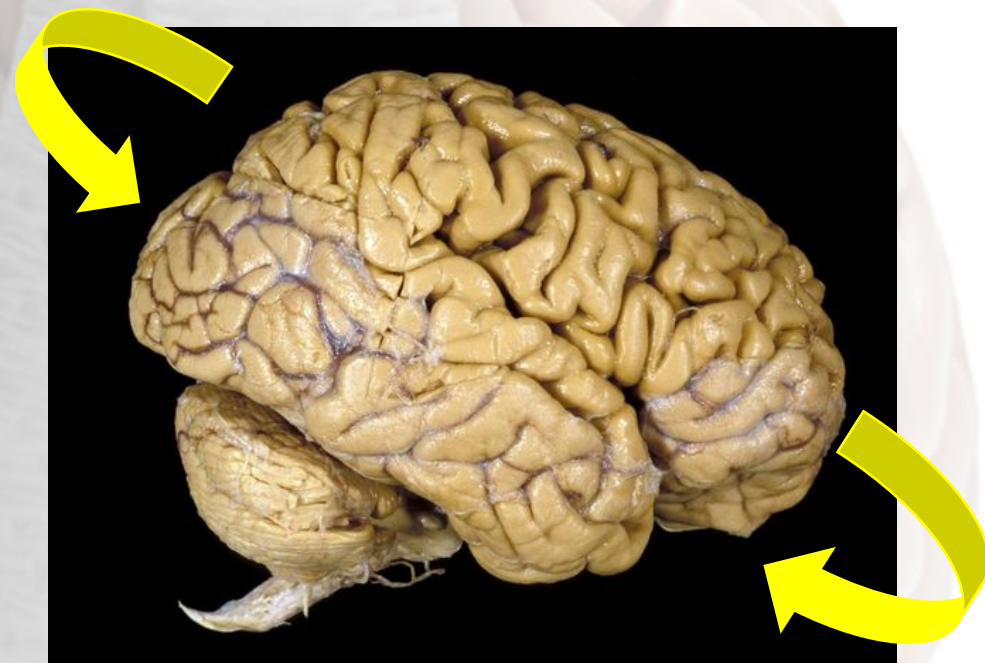


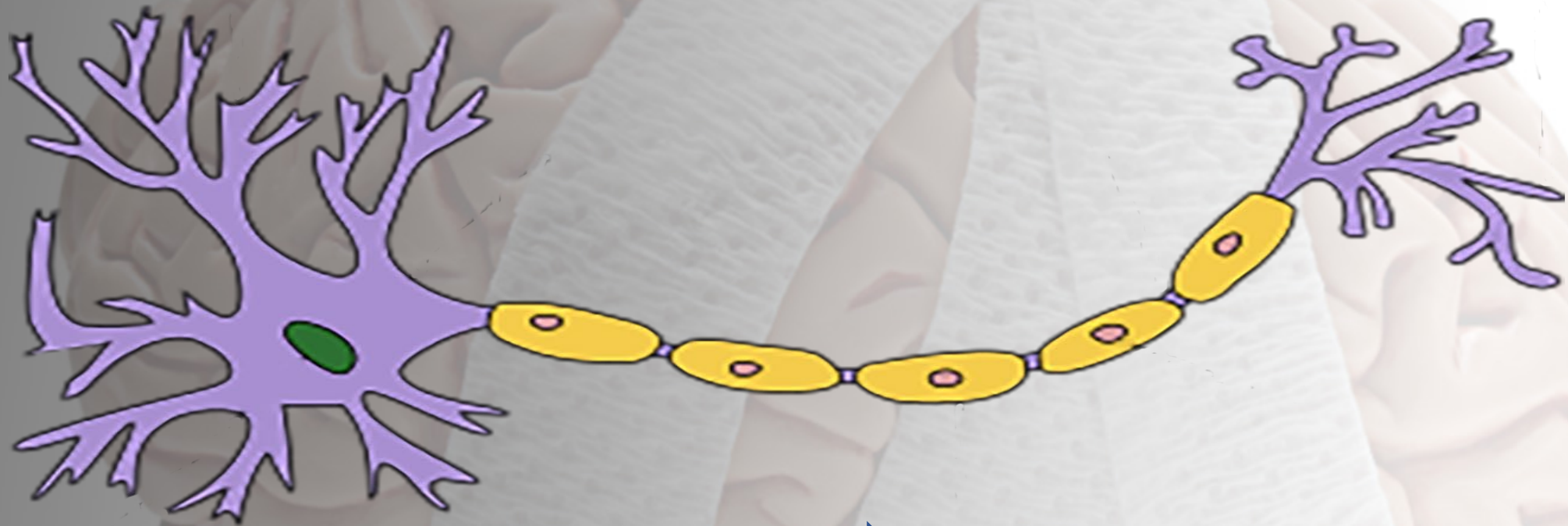
Inertial Forces

Linear



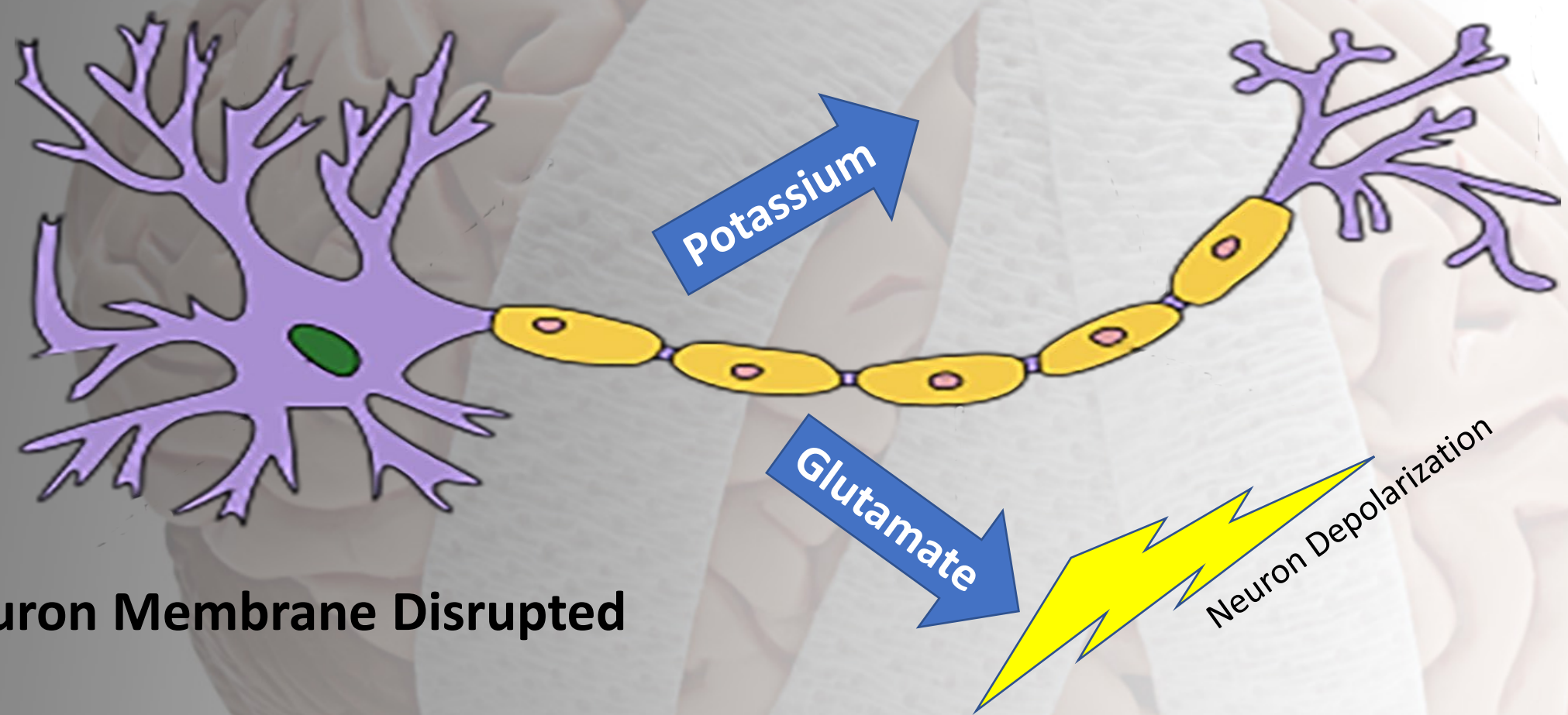
Rotational

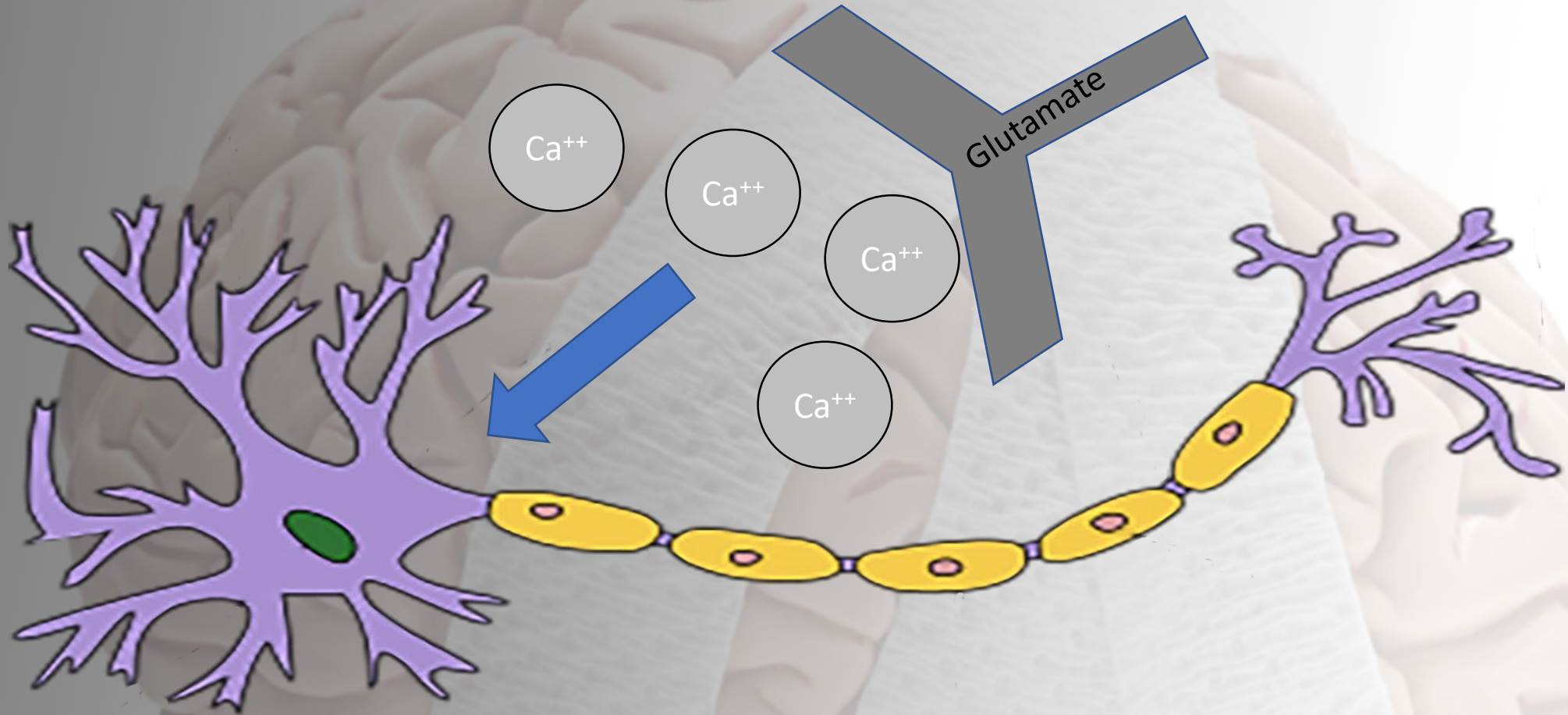




Shear forces

Neuron Membrane Disrupted





Calcium causes neuron damage / death

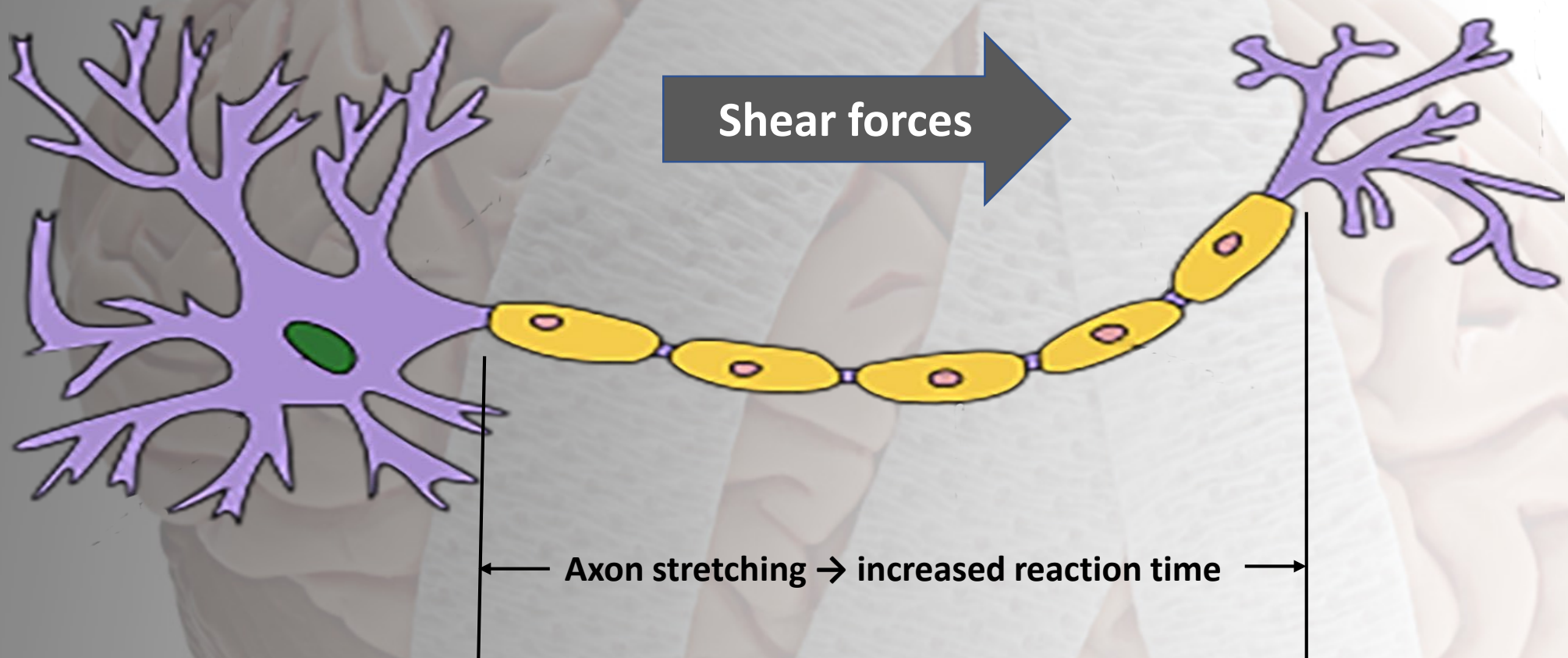
↑ Glucose consumption

The diagram features a human brain in the background. Overlaid on the brain is a flowchart with four rectangular boxes containing text, connected by arrows pointing downwards and to the right. The first box at the top left contains '↑ Glucose consumption'. An arrow points from this box to the second box, 'Restores balance'. Another arrow points from the second box to the third box, '↓ Glucose metabolism'. A final arrow points from the third box to the fourth box, 'Can last up to 7-10 days'. The brain is rendered in a light, semi-transparent style, showing the gyri and sulci. The flowchart elements are in a darker, semi-transparent style.

Restores balance

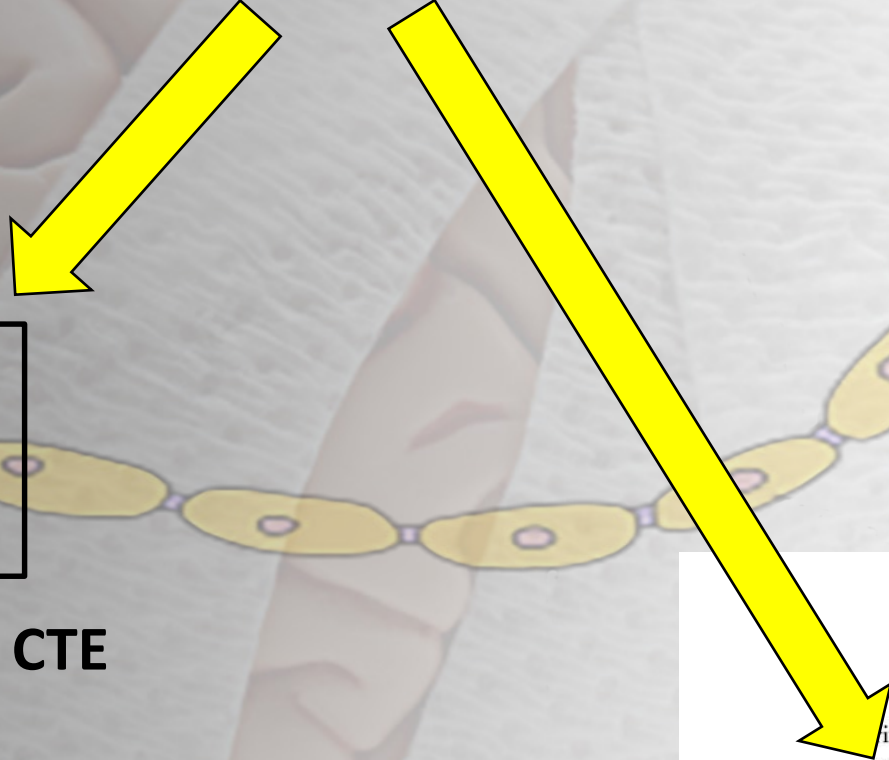
↓ Glucose metabolism

Can last up to 7-10 days



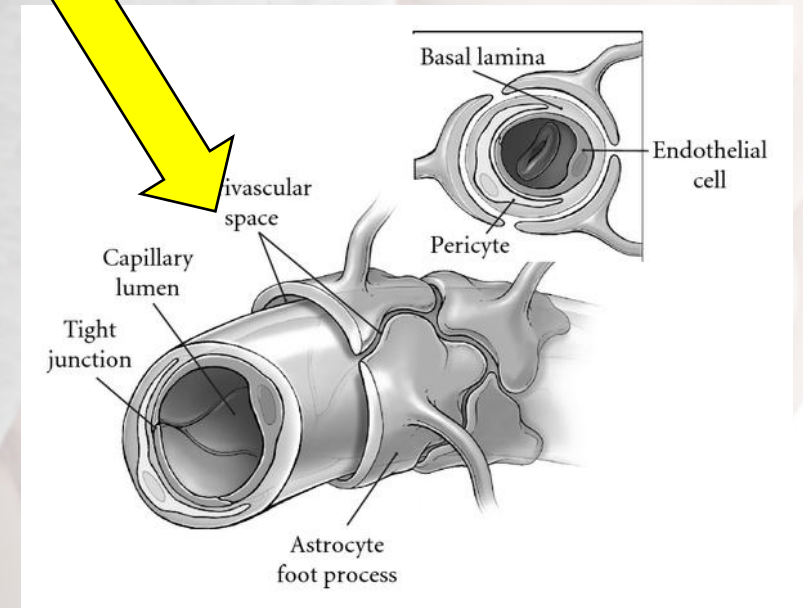
Inflammatory cascade

Localized Acidosis



**Permanent Neuron
Dysfunction / Death**

Clinically: permanent deficits to CTE





Clinical Effects

Clinical Effects



Mood Disturbance

Headache

Frontal Lobe Dysfunction

Vestibular / Ocular

Clinical Effects



Mood Disturbance

Headache

Frontal Lobe Dysfunction

Vestibular / Ocular

- Sleep
- Depression
- Anxiety
- PTSD

Clinical Effects



Mood Disturbance

Headache

Frontal Lobe Dysfunction

Vestibular / Ocular

- Similar to migraine symptoms
- Photophobia (light sensitivity)
- Phonophobia (sound sensitivity)
- Vomiting

Clinical Effects



Mood Disturbance

Headache

Frontal Lobe Dysfunction

Vestibular / Ocular

- Attention
- Focus
- Irritability
- Memory

Clinical Effects



Mood Disturbance

Headache

Frontal Lobe Dysfunction

Vestibular / Ocular

- Dizziness / vertigo
- Impaired balance
- Diplopia
- Blurred vision



On-Field assessment

Initial Approach

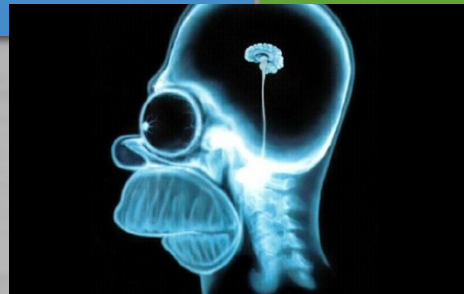


- Airway
- Breathing
- Circulation
- Disability
- Exposure
- Immobilization

Imaging Indications

- Focal neuro deficits
- Post trauma amnesia
- Altered mental status
- Persistent vomiting
- Persistent headache
- GCS < 15

- Seizures
- LOC controversial
- Age > 60
- Drug/ETOH
- Coagulopathy
- Cervical pain



Sideline Concussion Assessment

- Alertness
- Memory & Attention
- Vestibular Function
- Ocular Function



As part of Complete Neuro Exam

History: Suspect Concussion

- Confused
- Dazed
- Mentally “foggy”
- Irritable
- LOC
- Slow to get up from hit
- Blank stare



Alertness: Maddock's Questions

- Where are we?
- What quarter/half/period is it right now?
- Who scored last in the game/period?
- Who did we play in the last game?
- Did we win the last game?

Vestibular Function

Tandem Gait

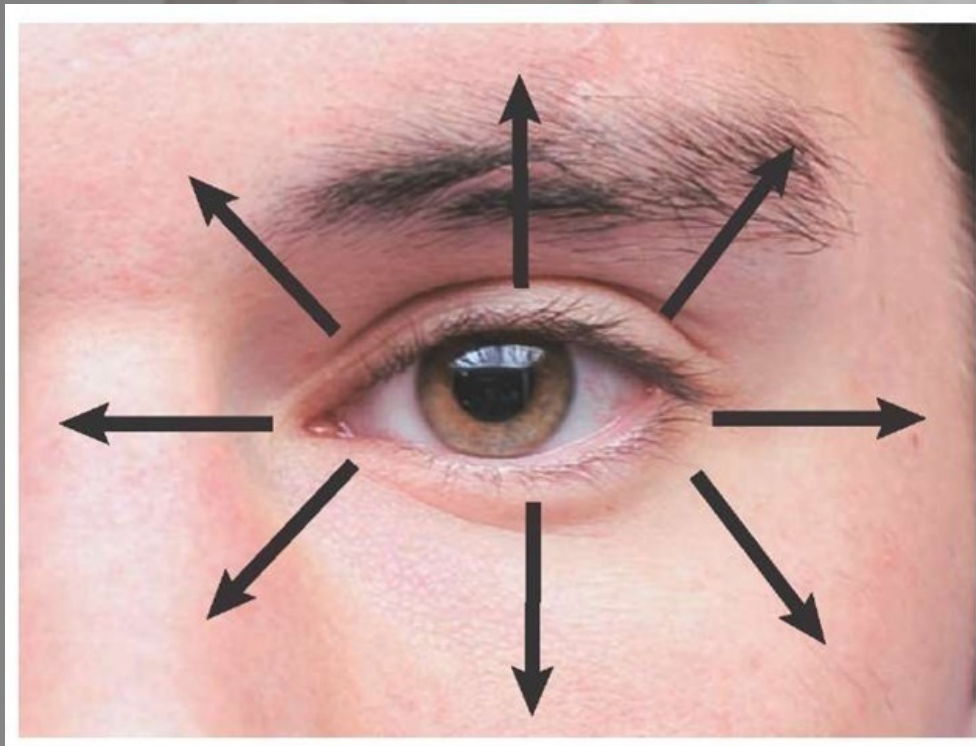


Finger to Nose



Ocular Response

Extraocular Movements



Near Accommodation



Abnormal:
Diplopia > 2.5 inches away
Blurriness > 6 inches away

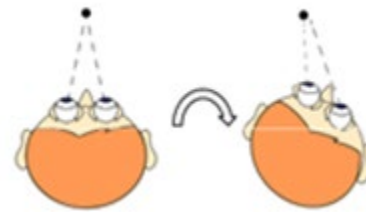
Ocular Response

Saccade

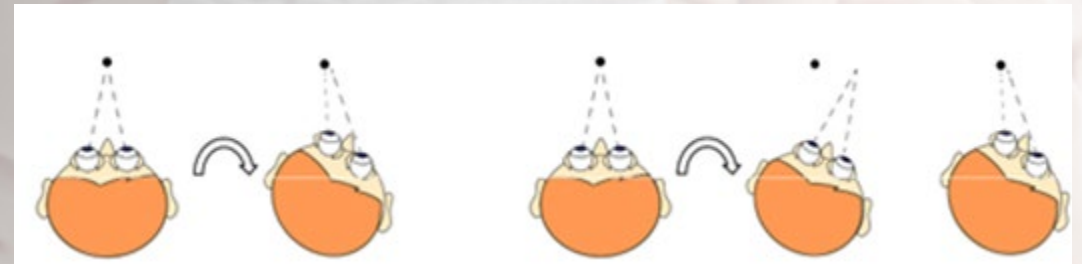


Vestibulocular Reflex

Normal



Abnormal





Return to Play

No same day return

Return to Play Protocol



Return to School Protocol



Graduated Return to School Protocol

RECOVERY STAGE 1	RECOVERY STAGE 2	RECOVERY STAGE 3	RECOVERY STAGE 4
<p><i>Complete Physical and Cognitive Rest until Medical Clearance</i></p> <ul style="list-style-type: none"> - No School Attendance - Strict Limits on Technology Usage - REST 	<p><i>Return to School with Academic Accommodations</i></p> <ul style="list-style-type: none"> - Continue Limits on Technology Usage - Avoid Heavy Backpacks - No Tests, PE, Band or Chorus - Monitor Symptoms - REST at home 	<p><i>Continue Academic Accommodations</i></p> <ul style="list-style-type: none"> - Attend School Full Time if Possible - Increase Work Load Gradually (testing, homework, etc) - Monitor Symptoms - Incorporate light aerobic activity - REST at home 	<p><i>Full Recovery to Academics</i></p> <ul style="list-style-type: none"> - Attend School Full Time - Self-Advocate at School (meet due dates, etc) - Resume Normal Activities - Resume Sports following Graduated Return to Play
<p>Symptom Free for 24 Hours?***</p> <p>Yes: Begin Stage 2</p> <p>No: Continue Resting</p>	<p>Symptom Free for Next 24 hours?***</p> <p>Yes: Begin Stage 3</p> <p>No: Rest Further until Symptom Free</p>	<p>Symptom Free for Next 24 Hours?***</p> <p>Yes: Begin Stage 4</p> <p>No: Return to Stage 2 until Symptom Free</p>	<p>Symptom Free for Next 24 Hours?***</p> <p>Yes: Return to School</p> <p>No: Return to Stage 4 until Symptom Free</p>
Date Attained:	Date Attained:	Date Attained:	Date Attained:

*** Symptom-Free means NO lingering Headaches, Sensitivity to Light/Noise, Fogginess, Drowsiness, etc

Reference: HeadSmart Handbook: A Healthy Transition After Concussion (2010). www.Southshorehospital.org



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