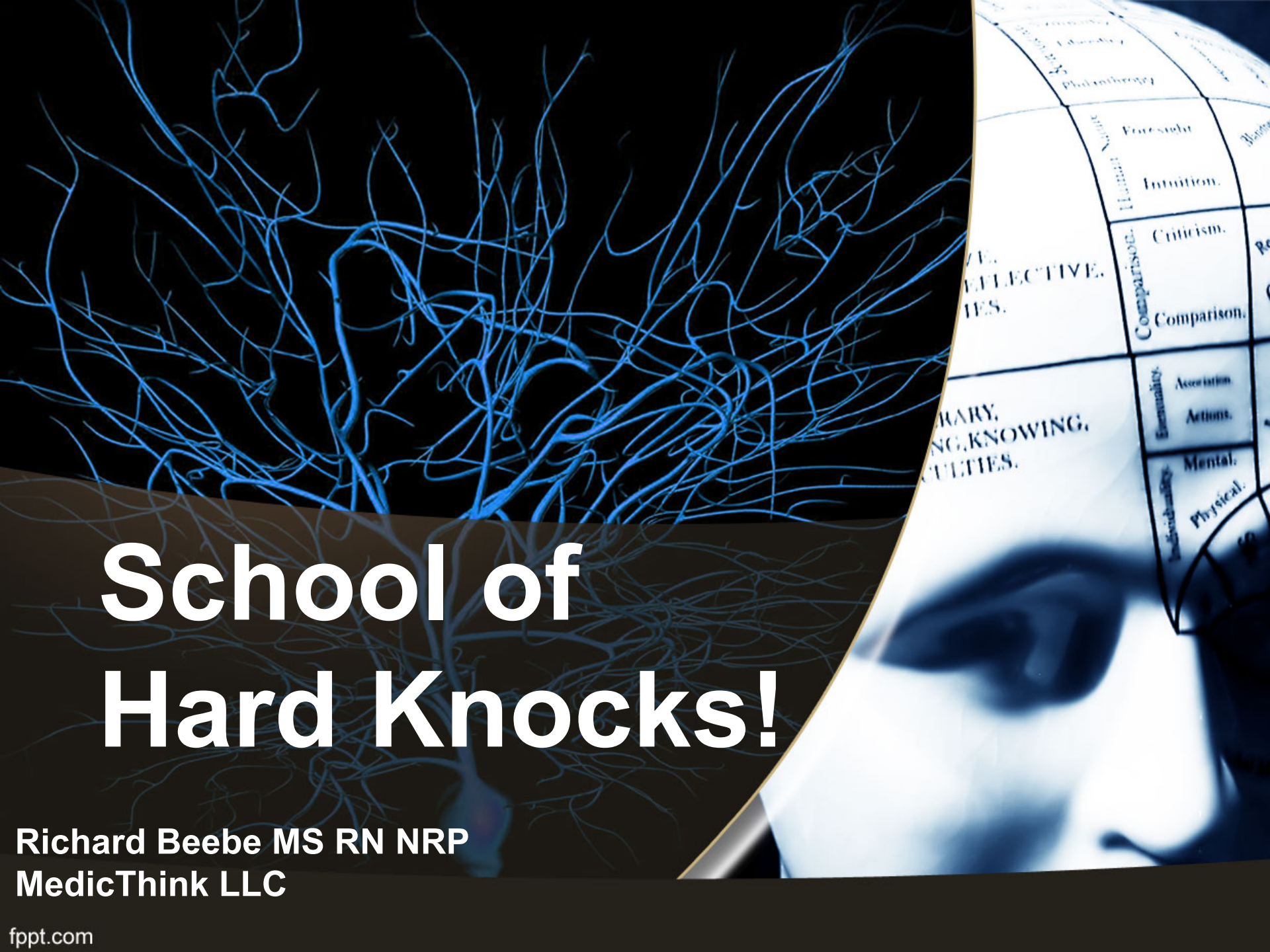



# School of Hard Knocks!

**Richard Beebe MS RN NRP**
**MedicThink LLC**

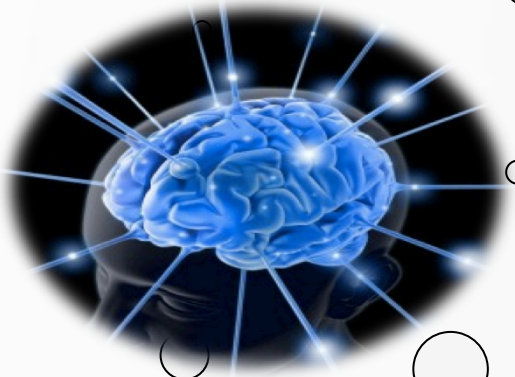
# Fall of a Teton

# PONDER THIS

What REALLY happened inside Johnny's head?

How common are these types of injuries?

How Bad is He Hurt?



What part of the brain gets injured in a concussion?

How are Concussions Evaluated & Treated?

Why can't athletes go back in the game if its only a minor concussion?

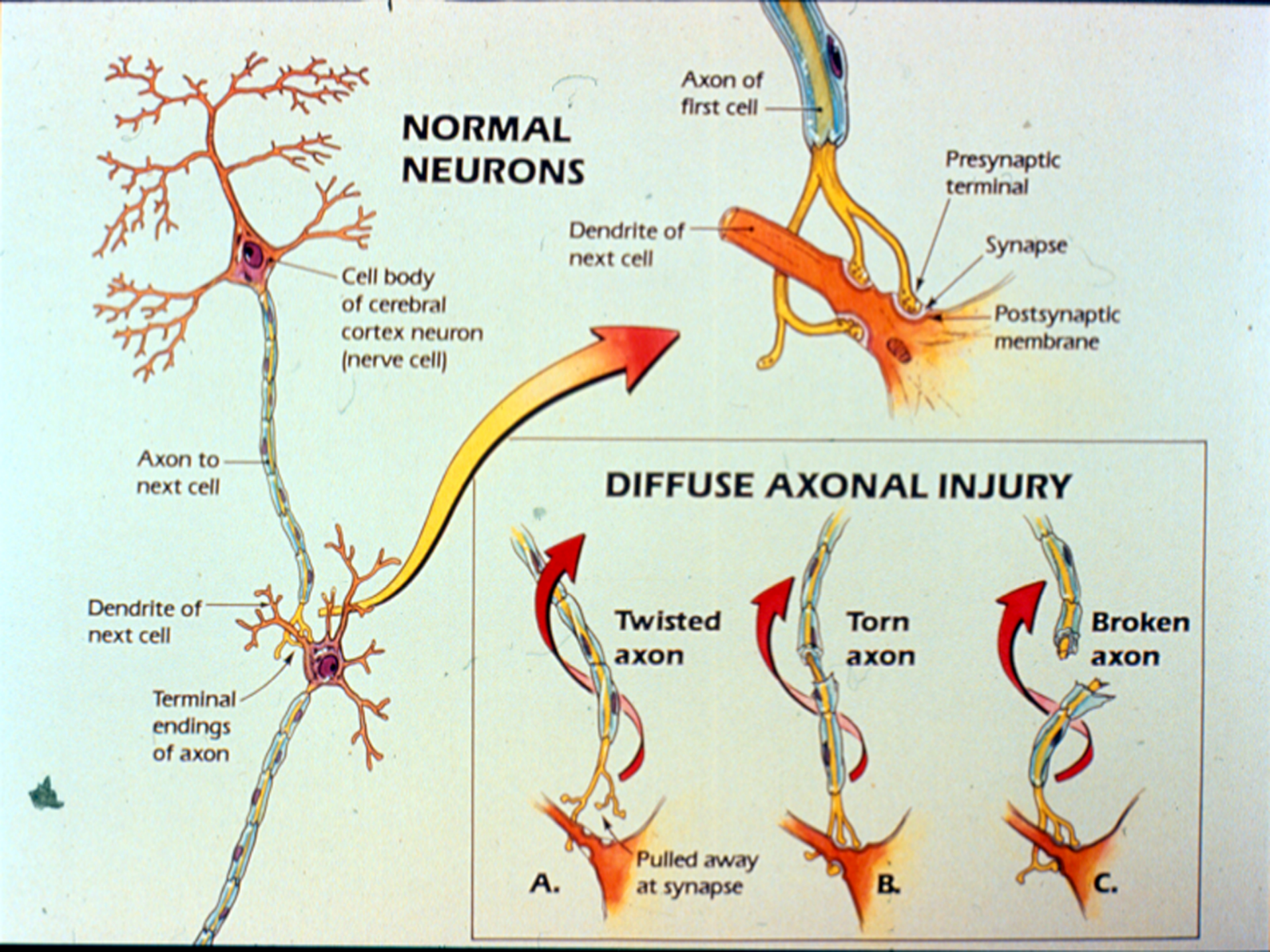
The term, ***mild traumatic head injury*** **(MTHI)** has been applied to patients with certain types of head injuries for many years. MTHI is commonly referred to as concussion or mild traumatic brain injury - the terms are used interchangeably.

# Common Features of MTHI

Most definitions of MTHI include the following elements:

- Involves an impact to, or forceful motion of, the head

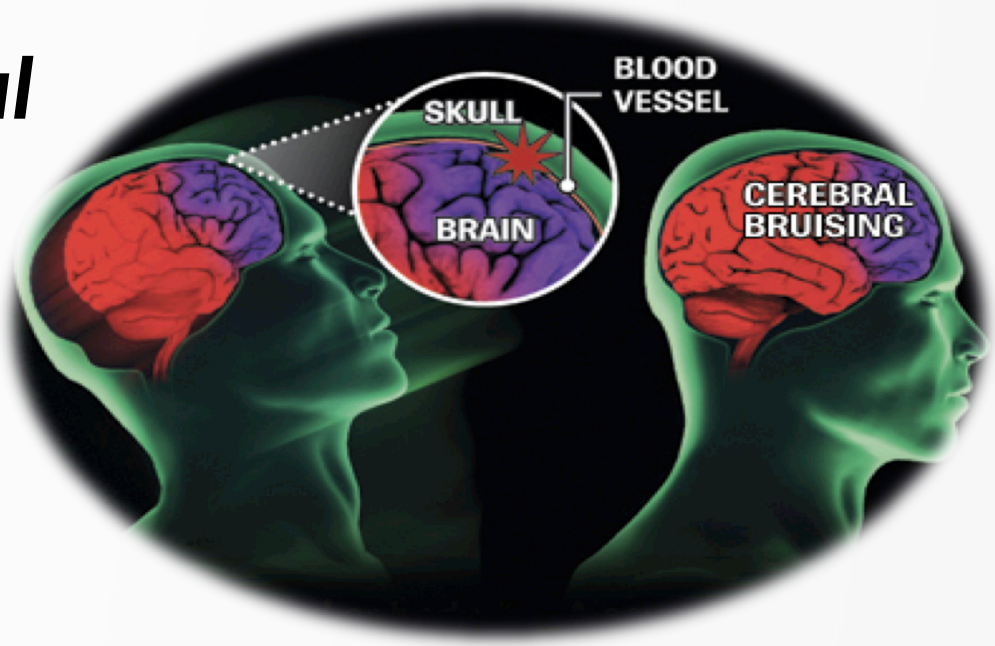
  Results in a brief alteration of mental status such as:
  - confusion or disorientation
  - memory loss immediately before/after injury
  - brief loss of consciousness (if any) less than 20 minutes
- Glasgow Coma Scale score of 13 – 15
  - If hospitalized, admission is brief (e.g., less than 48 hours)
- Possible amnesia – while amnesia does not need to be present, it is a good predictor of brain injury


NORMAL NEURONS
Axon of first cell
Presynaptic terminal
Dendrite of next cell
Synapse
Postsynaptic membrane
Cell body of cerebral cortex neuron (nerve cell)
Axon to next cell
Dendrite of next cell
Terminal endings of axon
DIFFUSE AXONAL INJURY
Twisted axon
Torn axon
Broken axon
Pulled away at synapse
A.
B.
C.

# MTHI vs. Traumatic Brain Injury (TBI)

In MTHI, the brain temporarily becomes functionally impaired ***without structural damage.***

**TBI**, there *is* ***structural damage*** to the brain.



# Simple and Complex Injury

Brain injury can be classified as simple or complex based on clinical presentation.

- Simple: symptoms resolve in 7-10 days
- Complex:
  - Symptoms persist longer that 10 days
  - Multiple concussions
  - Convulsions, coma or loss of consciousness (LOC) greater than 1 minute
  - Prolonged cognitive impairment

***Meehan 2009***

# National Statistics

- Head injury is a leading cause of **morbidity** during childhood in the U.S.
- More than 1.5 million head injuries occur in U.S. children annually, resulting in over 300,000 hospitalizations.
- Males are **twice as likely** as females to sustain a head injury.
- Up to 90% of injury-related deaths among U.S. children are associated with traumatic head injury (leading cause of death in traumatically injured infants).
- Cost of head injury in children living in the U.S. is $78 million per year (based on 2004 data).

***Atabaki 2007; Brener 2004; Berger 2006***

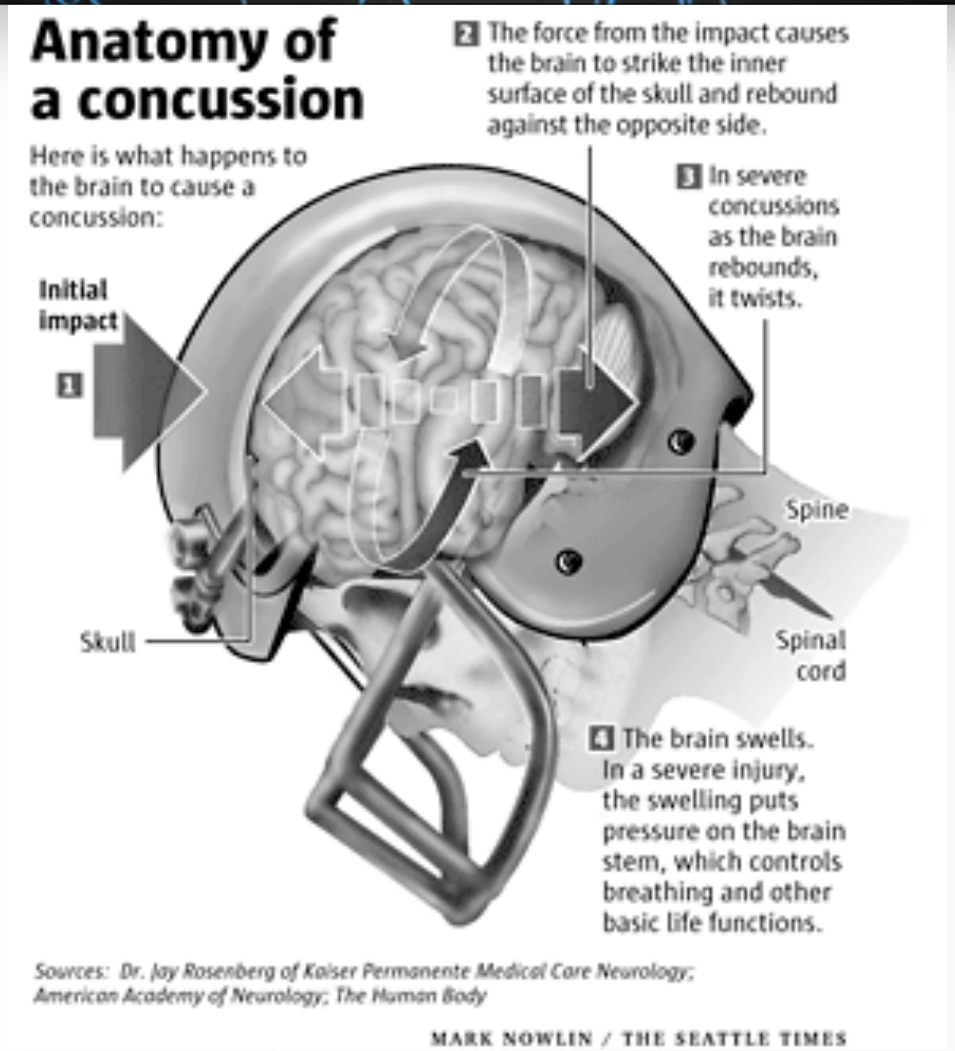
# Epidemiology

Sports rate of concussions/1000 athlete-exposures

| | |
|---|---|
| Ice hockey | 0.27 |
| Football | 0.25 |
| Men's soccer | 0.25 |
| Women's soccer | 0.24 |
| Field hockey | 0.20 |
| Wrestling | 0.20 |
| Men's lacrosse | 0.19 |
| Women's softball | 0.11 |

Brain injuries can be classified as focal or diffuse
When an injury occurs at a specific location, it is called a ***focal*** injury (e.g., being struck on the head with a bat). A focal neurologic deficit is a problem in a nerve function that affects a specific location or function. Examples: Numbness, decrease in sensation, Paralysis, weakness, loss of muscle control
In ***diffuse*** injury, the impact is spread over a wide area, such as being tackled in a game of football that results in a general loss of consciousness

# Man Down on the Field



# AVPU

AVPU is a quick test used to determine level of consciousness. It measures the reaction of the eyes, voice and motor activity in response to stimuli. In the scale, ***A****lert* represents the level of least injury and ***U****nresponsive* the most severe.

**A**lert: fully conscious; may be *mildly* disoriented

**V**oice: responds to verbal stimuli

**P**ain: responds only to pain stimulus

**U**nresponsive: unconscious

AVPU is *not* a replacement for the Glasgow Coma Scale.

# Glasgow Coma Scale (GCS)

**An accurate, commonly used, and easily reproducible tool**

- Commonly used neurologic assessment tool for trauma patients since its development by *Jennett and Teasdale* in the early 1970s
- Is an accurate measure for trauma care practitioners to document level of consciousness over time
- Commonly used in adults - more recently used in children (Pediatric GCS score)

***Sternbach 2000***

# Primary Assessment

- Begin your immediate assessment by following the ABCs:
  - ✓ **A**irway
  - ✓ **B**reathing
  - ✓ **C**irculation
- Always consider the possibility of cervical spinal injury.
- Determine the child's orientation to people, place, and time.
- Perform a test of recent memory - does the child remember events just before injury?

# History

A detailed history is critical in assessing MTHI. Consider:

- Age of child; developmental history/ability
- Medical history:
  - ✓ Medications (prescription, OTC, herbal, etc.)
  - ✓ Past illnesses
  - ✓ Past hospitalizations
  - ✓ Previous head injurie
- History related to event:
  - ✓ Time of injury
  - ✓ Emesis
  - ✓ Loss of consciousness / Amnesia
- Severity and mechanism of injury
- Was injury witnessed by a reliable person?

***Fuchs 2001***

# Amnesia

Post traumatic amnesia (PTA) is more accurate than loss of consciousness in predicting functional recovery. Patients suffering from MTHI may have amnesia of events occurring immediately after injury.

Classification of the severity of amnesia is measured by length of time it occurs:

- Very mild: Less than 5 minutes
- Mild: Less than 1 hour
- Moderate: 1-24 hours
- Severe: Greater than 24 hours
- Very severe: Greater than 1 week

# Loss Of Consciousness (LOC)

- LOC is not a reliable predictor of concussion or length of recovery.
- LOC is not as definitive a predictor of severity as the Pediatric Glasgow Coma Scale.
- Cognitive symptoms such as confusion and disturbance of memory ***can*** occur without LOC.
- However, when the patient ***does*** experience LOC, confusion and memory disturbance almost ***always*** occur.

***Gray 2009; Meehan 2009***

# Sideline evaluation and return to play

## conscious athlete:

- Athlete should be evaluated for 15 minutes minimum
- If asymptomatic at rest, provocative testing should be performed
- Any symptoms with this testing precludes return to play

# Concussion Management: Acute injury

- ANY signs or symptoms of a concussion:
  - Should not be allowed to return to play in the current game or practice
  - Should not be left alone; regular monitoring for deterioration
  - Should be medically evaluated
  - Return to play must follow a medically supervised stepwise process
- "When in doubt, sit them out!"

# Return To Play Guidelines

- Simple – an injury that progressively resolves without complication for 7-10 days. Management based on a step-wise approach until all symptoms resolve.

- Complex – persistent symptoms, specific sequelae (e.g., prolonged LOC), or prolonged cognitive impairment. Consider formal neuropsychological testing beyond return to play guidelines.

***EMSC - Return To Play Guidelines Brochure***

***McCrory 2005***

# Return To Play:
# A Step Wise Approach

***Athletes are <u>NOT</u> be returned to play the same day of injury.***

Recommended stages of progression:

Step #1. Rest until asymptomatic (physical and mental rest)

Step #2. Light aerobic exercise

Step #3. Sport-specific exercise

Step #4. Non-contact training drills (light resistance training)

Step #5. Full contact training ***ONLY AFTER MEDICAL CLEARANCE***

Step #6. Return to competition (game play)

There should be approximately 24 hours (or longer) for each stage and the athlete should return to previous step if symptoms reoccur.

***McCrory 2005***

# Sequelae of concussions

- Second impact syndrome
- Post-concussive syndrome

# Second impact syndrome

- A second injury to the brain during the vulnerable metabolic cascade
- May be a minor / incidental injury
- Can lead to severe worsening of mental status and even death

# Second Impact Syndrome

The effects of multiple injuries to the head are cumulative and potentially more damaging that a single incident. A second blow is more damaging than the "sum" of the two blows.

*Second Impact Syndrome* should be suspected in all children involved in high-risk situations (i.e., contact sports) and with a history of previous head injuries.

Patients experiencing Second Impact Syndrome are:

- More likely to experience post-traumatic amnesia
- More likely to experience mental status disturbance after each new injury
- Often score lower on memory tests

***Second Impact Syndrome can result in fatal brain swelling.***

**CDC's "Heads Up" video (11:38)**

# Post Concussive Syndrome

One potential complication of MTHI is ***Post Concussive Syndrome***. Clinical indications include:

- Dizziness, trouble concentrating
- Changes in sleep pattern
- Any deviation from normal behavior in the days or even weeks following the injury.

Over time, the symptoms *may* eventually lessen. However, parents/caregivers must report any new, continuing, or worsening symptoms to their physician immediately.

***It is critical that parents / caregivers are made aware of this complication at time of discharge.***

# Emotional

- Irritability
- Sadness
- Increased demonstration of emotions
- Nervousness
- Loss of impulse control
- Difficult to console
- Shows lack of interest in favorite toys/activities
- Any deviation from normal/baseline as per parent/ caregiver

CDC. Heads Up: Facts for Physicians

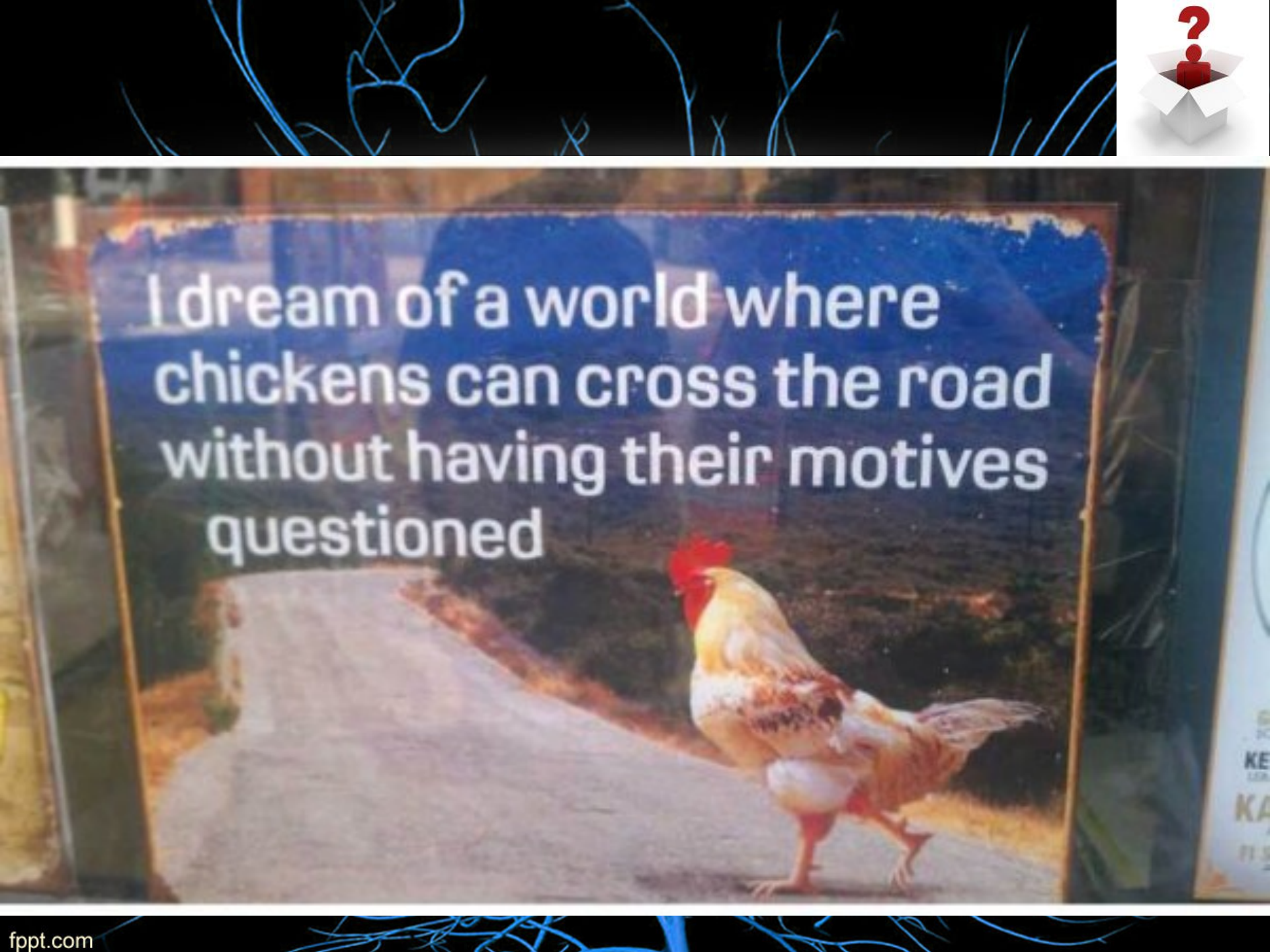
# Cognitive

- Feeling mentally “foggy”
- Feeling slowed down
- Difficulty concentrating
- Difficulty remembering
- Forgetful of recent information or conversations
- Confused about recent events
- Answers questions slowly
- Repeats questions
- Any deviation from normal/baseline as per parent/ caregiver

*CDC Heads Up: Facts for Physicians*

# Sleep

- Drowsiness
- Sleeping less than usual
- Sleeping more than usual
- Trouble falling asleep
- Any deviation from normal/baseline as per parent/ caregiver


I dream of a world where
chickens can cross the road
without having their motives
questioned