Concussion in Horse Racing

Setting the Pace

Mark R. Lovell, Ph.D., ABN, FACPN
Chairman and Chief Scientific Officer
ImPACT Applications, Inc.

Founding Director and Professor
University of Pittsburgh Sports
Concussion Program (Retired)

Things That Your Need To Know About Concussion

- All concussions are different
- Everyone recovers at own speed
- **The worst thing you can do is have a second concussion when recovering from the first one**.

Definition of Concussion:

A concussion (or mild traumatic brain injury) **is a complex** pathophysiological **process** affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. **Disturbance of brain function** is related to neurometabolic dysfunction, rather than structural brain injury, and is typically associated with normal structural imaging findings (CT Scan, MRI). Concussion may or may not involve a loss of consciousness. Concussion results in a constellation of physical, cognitive, emotional, and sleep-related symptoms. **Recovery** is a sequential process and symptoms **may last from several minutes to days, weeks, months, or even longer in some cases.**

Center of Disease Control , 2007

What Does it Feel Like to Have a Concussion?

- "I have a bad headache"
- "Light hurts my eyes"
- "Everything sounds louder"
- "I cant concentrate or remember things"
- "I feel like I am in slow motion"
- "My balance is off"
- "I feel nauseated"
- "I feel worse when I exercise"
- "My vision is messed up"
  - "Everything looks blurry'
  - "I see double"

Biomechanics of Concussion:

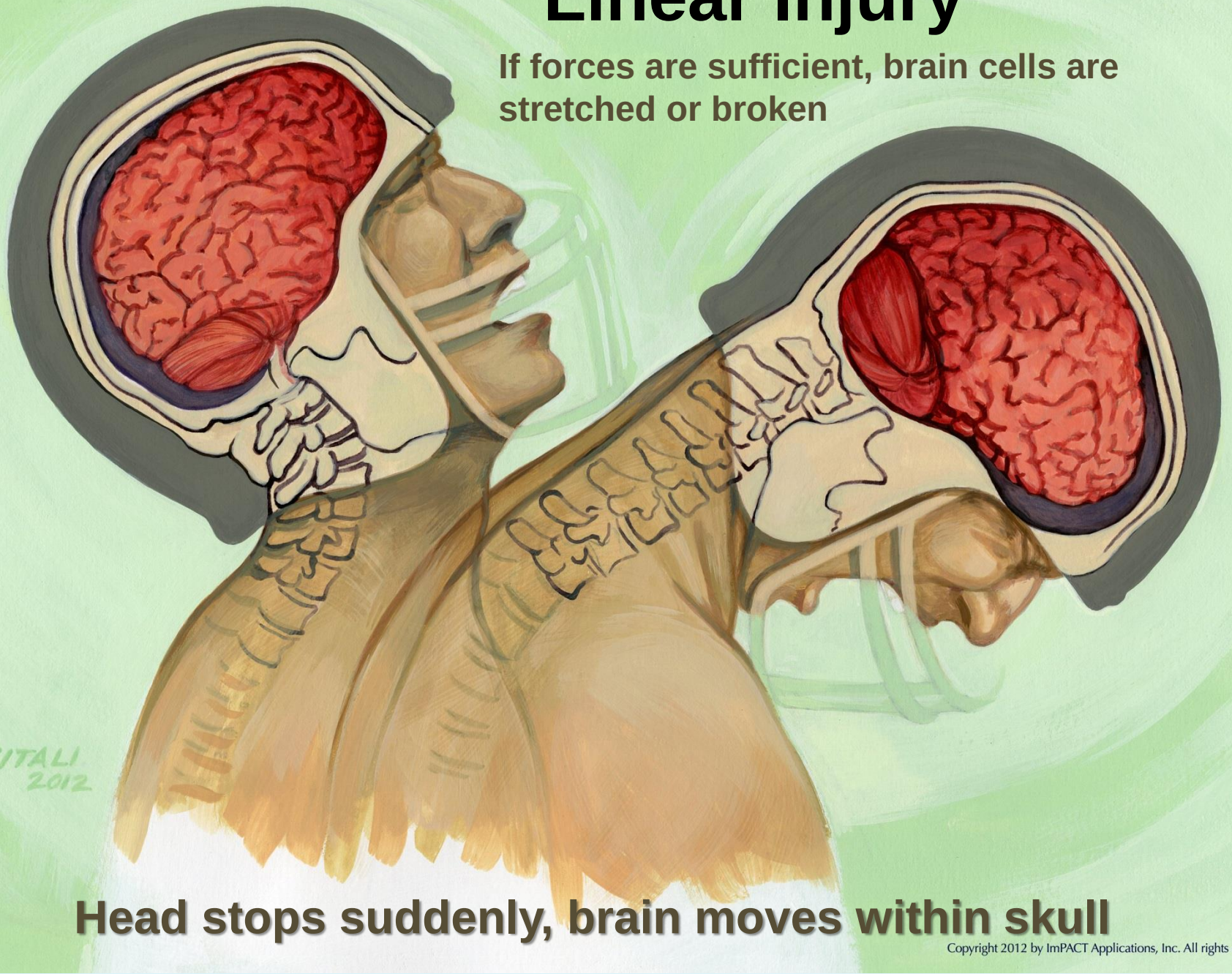
What Causes the Injury?

Forces Involved with Concussion

- **Force Vectors**
  - Newton's 2nd Law (Force = Mass times Acceleration)
- **Linear (translational) force**
  - Compression and stretching of brain cells (neurons)
- **Rotational (angular) force**
  - Rotation of the head stretches neurons

Linear Injury

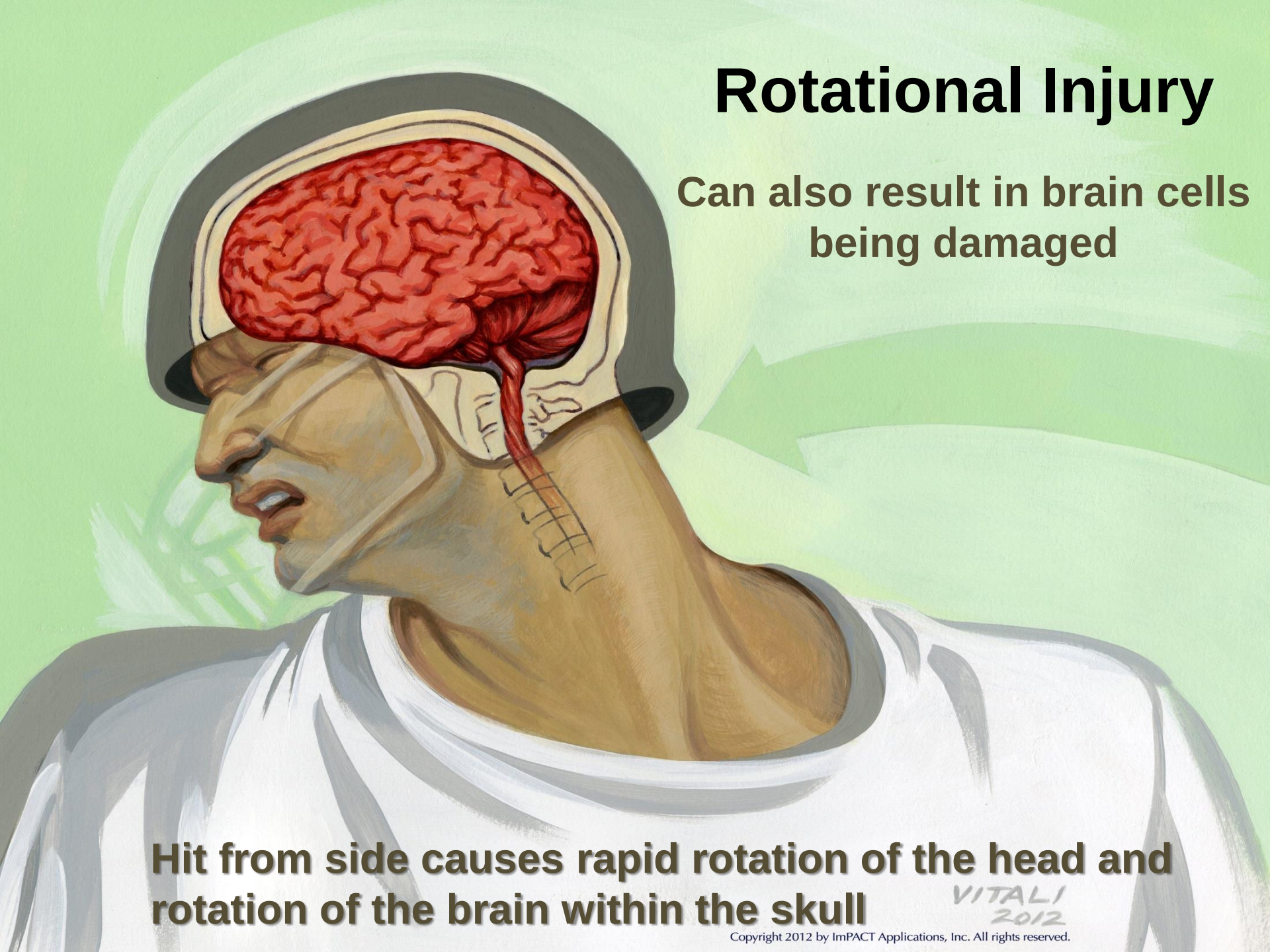
If forces are sufficient, brain cells are stretched or broken



Head stops suddenly, brain moves within skull

Rotational Injury

Can also result in brain cells being damaged

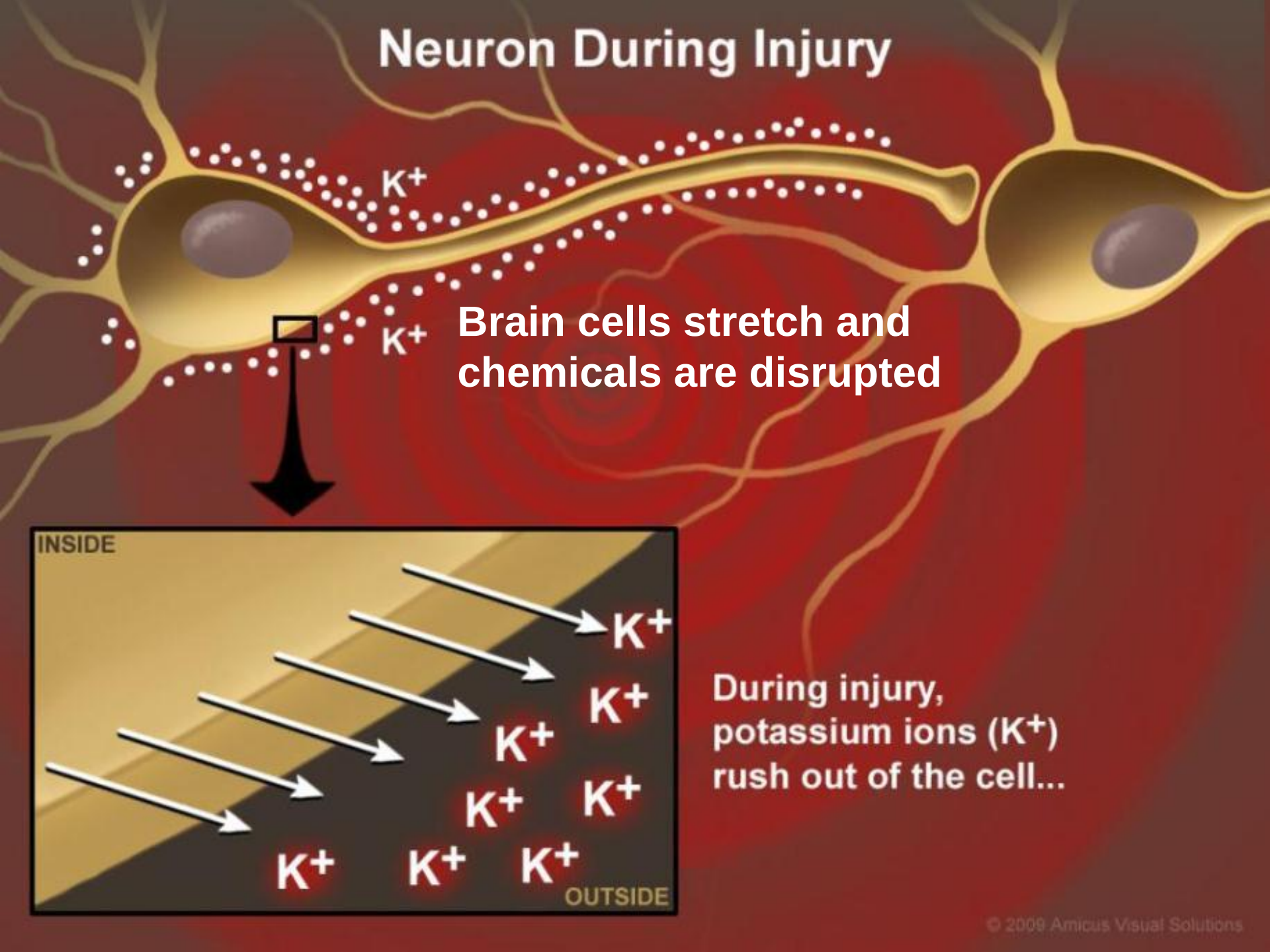


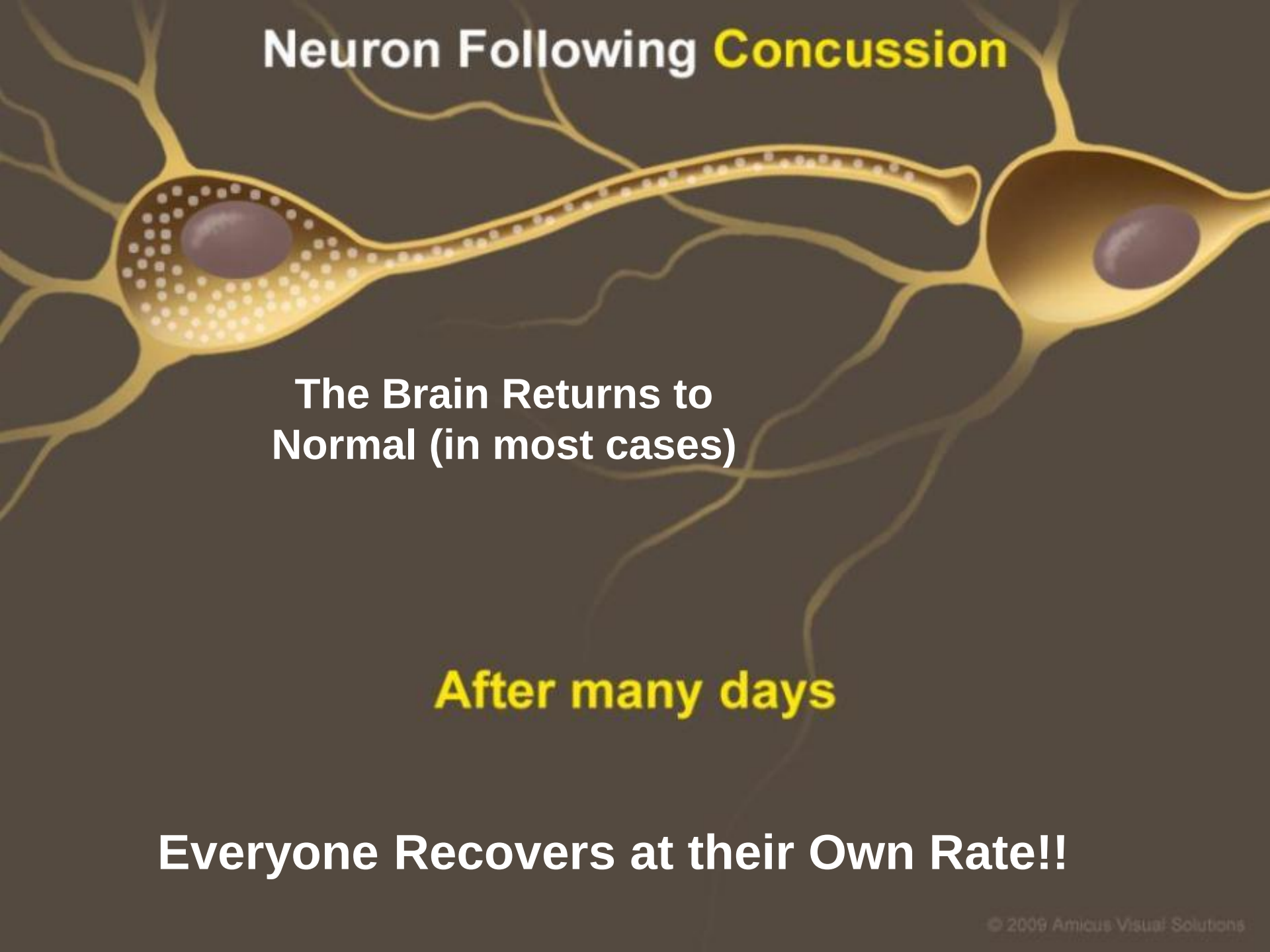
Hit from side causes rapid rotation of the head and rotation of the brain within the skull

Brain Function and Concussion:

What Happens?

Neuron During Injury




Neuron Following Concussion
The Brain Returns to Normal (in most cases)
After many days
Everyone Recovers at their Own Rate!!
© 2009 Amicus Visual Solutions

New Technologies

- New devices to measure force
  - Helmet-based sensors
  - Mouth guard sensors
  - Ear piece sensors
  - Other wearable technologies

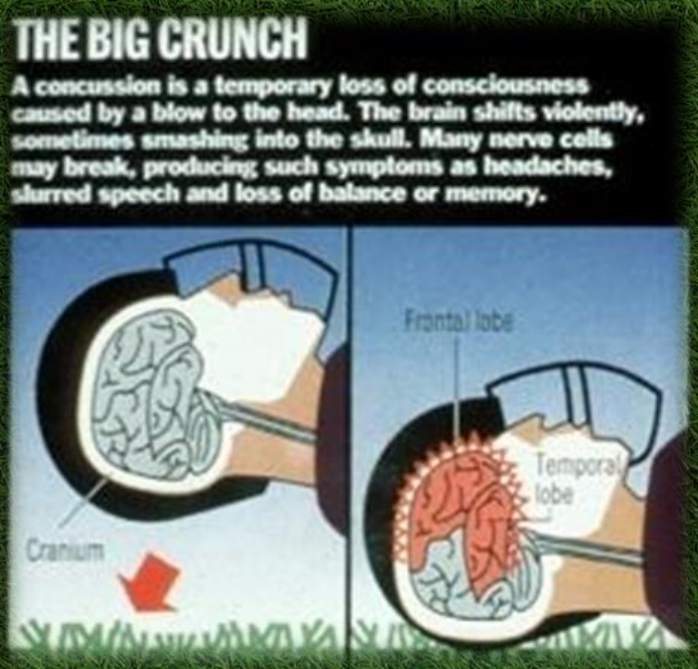
Very useful but never a substitute for diagnosis by healthcare professional

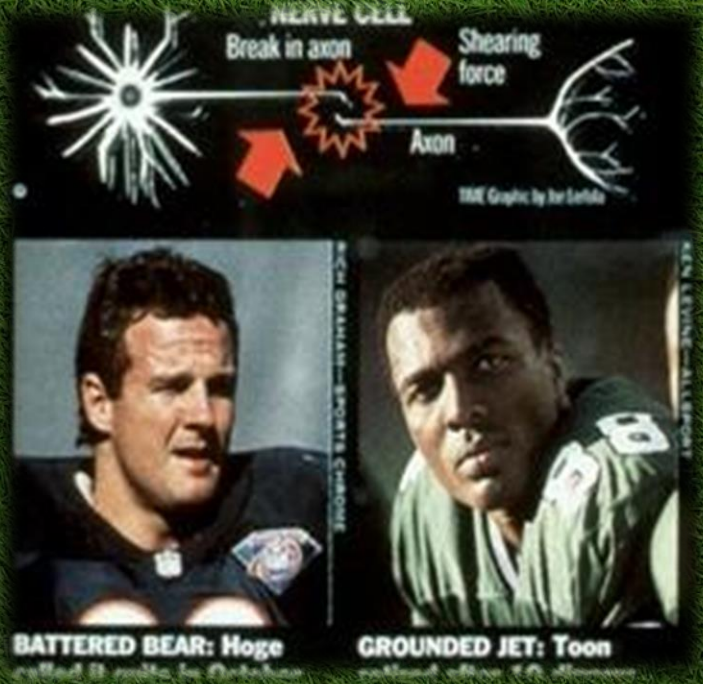
Management of Concussion:

Good Management Results in Better Outcome and Usually Faster Return to Sports

The Pittsburgh Steelers Program (1990's)

- First program to monitor professional athletes
- Resulted in league wide programs in NFL/NHL/MLB
- Resulted in adoption by other sports/leagues/Colleges
- Led to development of ImPACT Program
- Currently over **8 million kids have been tested**





UPMC HEALTH SYSTEM

PITTSBURGH, PENNSYLVANIA

affiliated with the University of Pittsburgh schools of the health sciences

The ImPACT Program

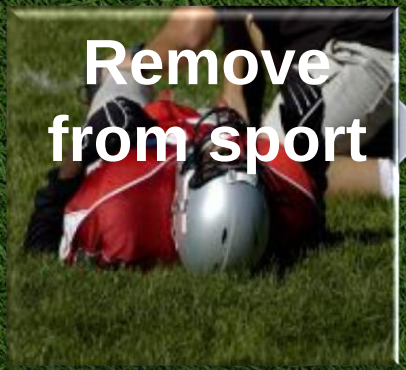
- Invented in the 1990's to better manage concussion.
- Tests brain functions that are affected by concussion.
- Is designed to be used as part of a comprehensive concussion management program.
- Now used by NFL, NHL, MLB, NASCAR, Indy Racing, Motocross, WWE. MLS, thousands of colleges and High Schools and **Jockeys Guild**.
- Available in 14 languages including Spanish, French, Portuguese and almost all European languages.
- **Over 8 million athletes tested.**

Concussion Management

Pre-Season → Concussion → 1-3 Days? → Return to Sports

ImPACT Baseline Testing

Remove from sport



- SCAT-II
- Balance
- Vestibular Testing

First Follow-Up

Evaluation
- ImPACT
- Balance
- Vestibular

Follow-up Testing as needed

- Back to baseline?
- Normal Vest/Balance
- **No symptoms with exertion**

Typical Evaluation

Clinical Interview

✓ **Balance and Vestibular-Ocular (visual) Screening**

✓ **ImPACT testing**

✓ Same day patient feedback

- Severity of Injury?
- Prognosis for Recovery?
- Neuroimaging indicated?
- Referral to Other Doctors?
- Level/type of Physical Exertion Allowed?
- Level of Cognitive Exertion Allowed?
- **Return to Sport?**

Communication to Athlete, Doctors and to staff

Vestibular and Visual Processes

- Dizziness, Fogginess, Feeling detached
- Motion discomfort, Nausea
- Difficulty in busy visual environments
- Anxiety, nervousness, intolerance to busy places
- Blurred vision, Difficulty with Reading

Returning to Sport After Concussion:

Protecting Your Health

Step 1: Light Aerobic Exercise

The Goal: only to increase an athlete's heart rate.

The Time: 5 to 10 minutes.

The Activities: exercise bike, walking, or light jogging.

Absolutely no weight lifting, jumping or hard running.

Step 2: Moderate Exercise

The Goal: limited body and head movement.

The Time: Reduced from typical routine

The Activities: moderate jogging, brief running, moderate-intensity stationary biking, and moderate-intensity weightlifting

Step 3: Non-contact Exercise

The Goal: more intense but non-contact

The Time: Close to Typical Routine

The Activities: running, high-intensity stationary biking, the player's regular weightlifting routine, and non-contact sport-specific drills. This stage may add some cognitive component to practice in addition to the aerobic and movement components introduced in Steps 1 and 2.

Step 4: Practice

The Goal: Reintegrate in full contact practice activity.

Step 5: Return to Sport

The Goal: Return to competition

Pressure to Return to Sports: Can we rely on what the athlete is telling us?

Not Really

- ✓ Athletes should never diagnose their own injury
- ✓ Studies suggest that up to **50%** of athletes experience concussion symptoms per year but only **10 percent report** having an injury
- ✓ **Returning to sport with to early is dangerous and can delay recovery**

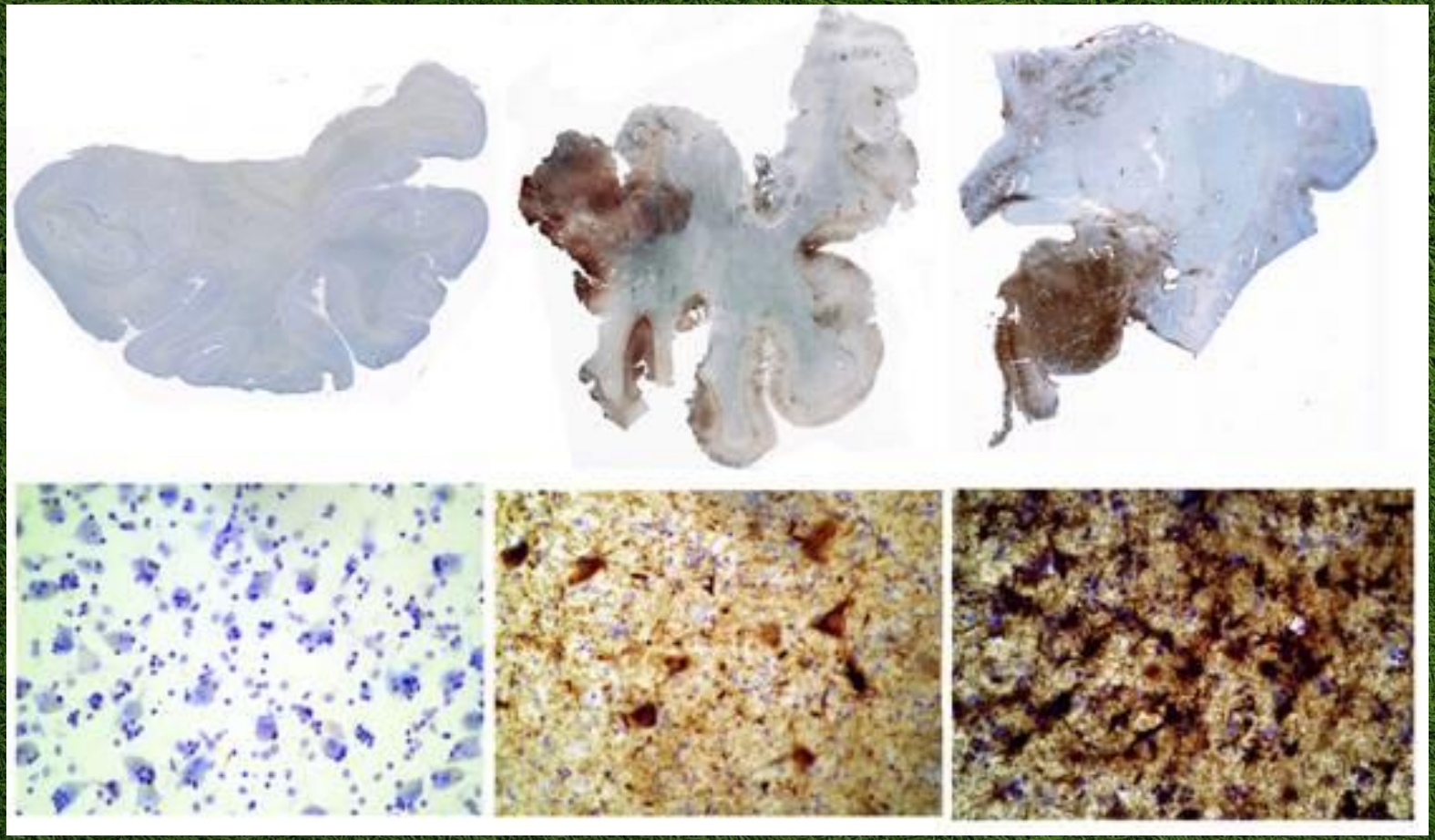
"When it comes to concussion,
I will say anything to
get back on the field"

NFL Athlete

Ongoing Controversies

- How many is too many?
- When is there risk of long-term problems?
- What is the risk of *Chronic Traumatic Encephalopathy (CTE)?*

CTE-What Does it Mean?



Normal Pro-Football Boxing

A Lifespan Model of Understanding Concussion

Genetics?

Migraine HX?

LD/ADD?

Genetic Expression? Brain Development?

Sports?

Bigger? Faster? Stronger? Injury HX? "Natural Selection"

CTE?

Aging?

Other Diseases?

Alzheimer's?

Obesity?

HTN/Stroke

Lovell, 1996

Focused Case Presentation:

How to Use ImPACT to Manage an Injury

Case Example: High School Quarterback

- ✓ 15 year old, Sophomore
  - Honors student, High Average standardized testing
  - No other medical history-no prior concussion
    - Strong migraine history in maternal family
- ✓ In retrospect, difficulties with concussion started on September 11, 2009

He suffered two concussions during season but only reported ***after season***

ImPACT™ Clinical Report

High School Football QB

Exam Type	Baseline	Post-injury	Post-injury	Post-injury	Post-injury	
Date Tested	08/13/2008	11/16/2009	11/30/2009	12/18/2009	01/11/2010	
Last Concussion	11/23/2008	09/11/2009	09/11/2009	09/11/2009	09/11/2009	
Exam Language	English	English	English	English	English	
Test Version	4.5.805	4.5.805	4.5.805	4.5.805	4.5.805	
Normative Comparison Group	M 14-15	M 14-15	M 14-15	M 14-15	M 14-15	

Composite Scores *										
Memory composite (verbal)	91	68%	83	38%	**77**	18%	89	60%	83	38%
Memory composite (visual)†	89	80%	**73**	36%	**55**	5%	83	69%	89	80%
Visual motor speed composite	46.58	95%	**29.05**	19%	**29.05**	19%	47.33	96%	52.68	99%
Reaction time composite	0.49	90%	**0.78**	1%	**0.76**	1%	0.44	97%	0.42	98%
Impulse control composite	4		45		9		2		1	
Total Symptom Score	0		**17**		**18**		7		3	

* Scores in **bold** type indicate scores that exceed the Reliable Change Index score (RCI) when compared to the baseline score. However, scores that do not exceed the RCI index may still be clinically significant. Percentile scores, if available, are listed in small type. Please consult your ImPACT User Manual for more details.

† Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.

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Exam Type	Baseline	Post-injury	Post-injury	Post-injury	Post-injury	
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Symptom Inventory (at time of exam)

Headache	0	0	2	0	0	
Nausea	0	0	0	0	0	
Vomiting	0	0	0	0	0	
Balance Problems	0	0	1	0	0	
Dizziness	0	0	1	0	0	
Fatigue	0	2	2	0	0	
Trouble falling asleep	0	0	0	0	0	
Sleeping more than usual	0	2	2	1	0	
Sleeping less than usual	0	0	0	0	0	
Drowsiness	0	2	2	0	0	
Sensitivity to light	0	1	1	2	0	
Sensitivity to noise	0	0	0	0	0	
Irritability	0	0	0	0	0	
Sadness	0	0	0	0	0	
Nervousness	0	0	0	0	0	
Feeling more emotional	0	0	0	0	0	
Numbness or tingling	0	0	0	0	0	
Feeling slowed down	0	1	0	0	0	
Feeling mentally foggy	0	2	2	0	0	
Difficulty concentrating	0	4	3	2	2	
Difficulty remembering	0	3	2	2	1	
Visual problems	0	0	0	0	0	
Total Symptom Score	**0**	**17**	**18**	**7**	**3**	

Case Example: High School Quarterback

- Athlete had a “mild” injury but did not report it.
- Second injury made things worse
- He put himself at risk for permanent brain injury and required more treatment
- If he would have reported his first injury, he probably would have recovered in a week or two.

Case Example: High School Quarterback

- Initially hid symptoms from Athletic Trainer, coach and parents (told friends)
- Struggled in school and grades dropped
- Severe headaches, dizziness, cognitive problems
- Required vestibular therapy and medical management
- **He risked permanent injury**

Thank you!

Mlovell@impacttest.com