

UNITED STATES DISTRICT COURT

DISTRICT OF MINNESOTA

In re NATIONAL HOCKEY LEAGUE	)	MDL No. 14-2551 (SRN/JSM)
PLAYERS' CONCUSSION INJURY	)	
LITIGATION	)	DECLARATION OF ROBERT C.
_____	)	CANTU, M.A., M.D., FACS, FAANS,
	)	FICS, FACSM
This Document Relates To:	)	
	)	
ALL ACTIONS.	)	
_____	)	

**TABLE OF CONTENTS**

	<b>Page</b>
I. QUALIFICATIONS.....	1
II. SCOPE OF OPINIONS.....	3
III. SUMMARY OF OPINIONS.....	3
IV. BACKGROUND ON CONCUSSIONS .....	4
A. What is a Concussion? .....	4
1. Medical Description .....	4
2. History of Concussions .....	8
3. How Concussions Occur in Sports and in Ice Hockey Particularly .....	12
4. Metabolic Changes.....	13
5. Cellular and Sub-Cellular Changes Following Concussive and Subconcussive Blows.....	14
6. Rest is the Hallmark of Initial Concussion Therapy .....	20
B. Subconcussive Hits.....	21
C. Second Impact Syndrome.....	22
D. Incidence of Concussion and Subconcussive Hits in Contact Sports .....	26
1. Incidence of Concussions and Subconcussive Hits in Ice Hockey .....	26
2. Underreporting of Concussions.....	29
E. The Effects of Repeat Concussions and Subconcussive Hits .....	31
1. Second Impact Syndrome.....	31
2. Post-Concussion Syndrome .....	32
3. Chronic Traumatic Encephalopathy and Other Long-Term Neurodegenerative Diseases .....	33

V.	INCREASED RISK OF DEVELOPING A NEURODEGENERATIVE DISEASE AS A RESULT OF PLAYING PROFESSIONAL ICE HOCKEY .....	38
VI.	MEDICAL MONITORING FOR RETIRED NHL PLAYERS .....	41
A.	Retired NHL Players Require Medical Monitoring More than the Average Person or General Population .....	41
B.	Purpose and Goals of a Medical Monitoring Program for Retired NHL Players .....	42
C.	Benefits to Retired NHL Players of Early Intervention through a Medical Monitoring Program.....	45
D.	Recommended Medical Monitoring Program and Associated Costs .....	46
1.	Overview of Scope and Costs .....	46
2.	Neurological Assessment .....	48
3.	Neurocognitive Assessment (a/k/a neuropsychological testing).....	50
4.	Blood and Urine Testing .....	52
5.	MRI Testing .....	52
6.	Testing for Neurodegenerative Diseases.....	52
VII.	CONCLUSION .....	54

## I. QUALIFICATIONS

1. I am a physician licensed by the states of Massachusetts and California to practice medicine. I have been practicing medicine in Massachusetts since 1964 and have practiced in the specialty of Neurosurgery for over 45 years. I have been Chief of Neurosurgery Service at the Emerson Hospital in Boston, MA since 1968. Over the last 35 years, I have acquired particular experience in sports-related athletic cervical spine and head injuries.

2. I have authored over 400 publications in the form of book chapters, refereed peer-reviewed articles, books, abstracts and free communications, as well as educational videos. Many of those publications have been specifically on the topic of athletic head injuries, epidemiology, diagnosis, treatment, rehabilitation, and prevention.

3. Over the last 35 years, I have given hundreds of lectures, and spoken and participated in hundreds of scientific meetings, devoted to athletic injuries including head injuries.

4. I am currently an Adjunct Professor of Exercise and Sports Science at the University of North Carolina, Chapel Hill, NC.

5. For nearly two decades, I have served as the Medical Director of the National Center for Catastrophic Sports Injury Research, an ongoing registry instituted in 1982 predominantly for data collection and analysis of head and cervical spine injuries.

6. I am currently Senior Advisor to the Brain Injury Center at Children's Hospital in Boston, MA.

7. I am currently a Clinical Professor of Neurology and Neurosurgery at Boston University School of Medicine, Boston, MA.

8. I am the Co-Founder, and Clinical Diagnostics and Therapeutics Leader, of the Chronic Traumatic Encephalopathy – Alzheimer's Disease (CTE-AD) Center at Boston University Medical Center, Boston, MA.

9. Since 1994, I have served on the Board of Trustees of the National Operating Committee on Standards for Athletic Equipment (NOCSAE), and since 2001, I have served

as its Vice President. Most recently, I also served as Chairman of its Scientific Advisory Committee. NOCSAE is responsible for establishing standards for football helmets as well as other athletic equipment.

10. For many years, I have been involved with the American College of Sports Medicine and have served on its Board of Trustees for more than ten years. I have also served as President of the American College of Sports Medicine from 1992 to 1993 and Treasurer from 1996 to 1999.

11. From 1998 to 2001, I was a member of the Advisory Committee for Injury Prevention at the Centers for Disease Control (“CDC”), Atlanta, GA.

12. From 2000 to 2002, I was a member of the Executive Committee, Joint Section of Trauma, for the Congress of Neurological Surgeons/American Association of Neurological Surgeons.

13. I have served as a consultant to many scholastic and professional athletes following severe, athletic cervical spine injuries regarding return-to-play issues. I have also served as a treating physician to numerous scholastic and professional athletes who have sustained sports-related head injuries.

14. I have authored numerous textbook chapters and articles discussing the causes, epidemiology, biomechanics, and pathology of athletic head injuries. I was a principal editor of the Journal of Neurosurgery from 2003 to 2010 and have been section editor for World Neurology from 2011 to the present.

15. Attached as **Exhibit 1** is my most recent Curriculum Vitae, which includes a comprehensive list of my publications in the last ten years. Attached as **Exhibit 2** is a list of all civil cases in the last four years in which I testified as an expert at deposition or trial. Attached as **Exhibit 3** is a list of materials reviewed in preparing this declaration.

16. I am being paid \$800 per hour for all of my services, except for deposition testimony which will be billed at a rate of \$5,000 per half-day (4 hours), trial testimony which will be billed at a rate of \$10,000 per day (8 hours), and non-working travel time, which will be billed at \$400 per hour. I have billed \$62,500.00 to date.

17. My opinions are based upon my specialized knowledge, skill, expertise, and education in the field of concussion diagnosis, management, and treatment, and the diagnosis of neurodegenerative diseases associated with head trauma and the treatment of their accompanying symptoms. My opinions are also based on the data and articles described herein and I have applied reliable principles to reach my conclusions, all of which are stated to a reasonable degree of scientific certainty.

## II. SCOPE OF OPINIONS

18. Plaintiffs have requested that I provide answers to the following questions:

- (a) What is a concussion and a subconcussive impact, how do concussions and subconcussive impacts occur in contact sports and in ice hockey particularly, what is the incidence of concussions and subconcussive impacts in contact sports and ice hockey particularly, and what are the effects of repeat concussions and subconcussive impacts on individuals, including ice hockey players and other professional athletes?
- (b) Do retired NHL hockey players have an increased risk of developing permanent neurodegenerative impairment, disease, or condition as a result of playing professional ice hockey, and if so, which impairments, diseases, and conditions?
- (c) What is an appropriate medical monitoring program for retired NHL hockey players, why is it important to have such a program, and how should the program be administered?

19. The documents I considered in forming my opinions, including those produced by the parties and third parties in this case, are listed in **Appendix C**, which is attached.

## III. SUMMARY OF OPINIONS

20. Concussions and subconcussive impacts are dangerous, with both temporary and permanent effects on the concussed individual, whether an athlete or not. Following a concussive or subconcussive impact, an individual may experience disruption in both

cognition and sleep, emotional disturbance, and physical symptoms ranging from head and neck pain to disorientation. These acute symptoms generally subside in days, but in some circumstances can linger as post-concussion syndrome, which typically subsides in weeks, and in rarer circumstances can linger for years. The most effective initial means of reducing symptom duration is rest; both physical and mental.

21. Following a concussive or subconcussive blow, metabolic, cellular, and subcellular changes in the brain occur, some of which may be permanent. These permanent changes include, among other things, a decline in white matter integrity and neuronal cells in the brain (known as cognitive, cellular, functional, or cerebral reserve), and this decline accelerates the adverse effects of aging on the brain and accelerates the rate at which neuropathologies manifest clinical symptoms. These changes that follow one or many concussive or subconcussive blows increase the risk of developing long term neurodegenerative diseases.

22. Contact sport athletes are at heightened risk of concussive and subconcussive impacts compared to the general population, and typically experience many impacts in a single playing season. NHL players are within the upper tier of risk for concussive and subconcussive blows among these contact sport participants, and are therefore at particular risk for suffering both the acute and permanent effects associated with these blows. Accordingly, a medical monitoring program that can account for the risk of long-term or permanent injury is medically recommended, and essential, for the supervision, diagnosis, and ultimate treatment of retired NHL players.

#### **IV. BACKGROUND ON CONCUSSIONS**

##### **A. What is a Concussion?**

###### **1. Medical Description**

23. Concussion or mild traumatic brain injury (mTBI) has been defined as “a complex pathophysiological process affecting the brain, induced by traumatic biomechanical

forces.”<sup>1</sup> Although concussion most commonly occurs after a direct blow to the head, it can occur after a blow elsewhere that is transmitted to the head or through rotational forces.<sup>2</sup> Concussions can be defined by the clinical features, pathophysiological changes, biomechanical forces, or a combination of these, that occur, which have each been described in the literature. The neurochemical and neurometabolic changes that occur in concussive injury have recently been more fully explored and explained, though the clinical features of concussions have been known for centuries.

24. Concussions are most commonly characterized by the rapid onset of cognitive impairment that is self-limited and, for most individuals, spontaneously resolves. The acute symptoms of concussion, listed below, are felt in most instances to reflect a functional disturbance in cognitive functioning instead of structural abnormalities, which is why diagnostic tests such as magnetic resonance imaging (MRI) and computerized tomography (CT) scans following concussive or subconcussive impacts most often appear normal. These studies may have their role in assessing and evaluating the head-injured individual whenever there is concern for the associated injuries of skull fracture, when there is intracranial bleeding or seizures, where there is concern for structural abnormalities, or when the symptoms of an individual persist or deteriorate. Notwithstanding the normalcy of diagnostic tests following the occurrence of a concussion, as explained below, there are significant, devastating, and permanent cellular and subcellular changes that take place as a result of suffering from a concussion or, albeit at a decreased level, a sub-concussive hit.

25. According to the Centers for Disease Control (CDC), the following are recognized as symptoms indicative of a concussion:

---

<sup>1</sup> R.C. Cantu et al., *An overview of concussion consensus statements since 2000*, 21 NEUROSURG. FOCUS 4 (2006).

<sup>2</sup> D.F. Meaney et al., *Biomechanical analysis of experimental diffuse axonal injury*, 12 J. NEUROTRAUMA 4 (1995).

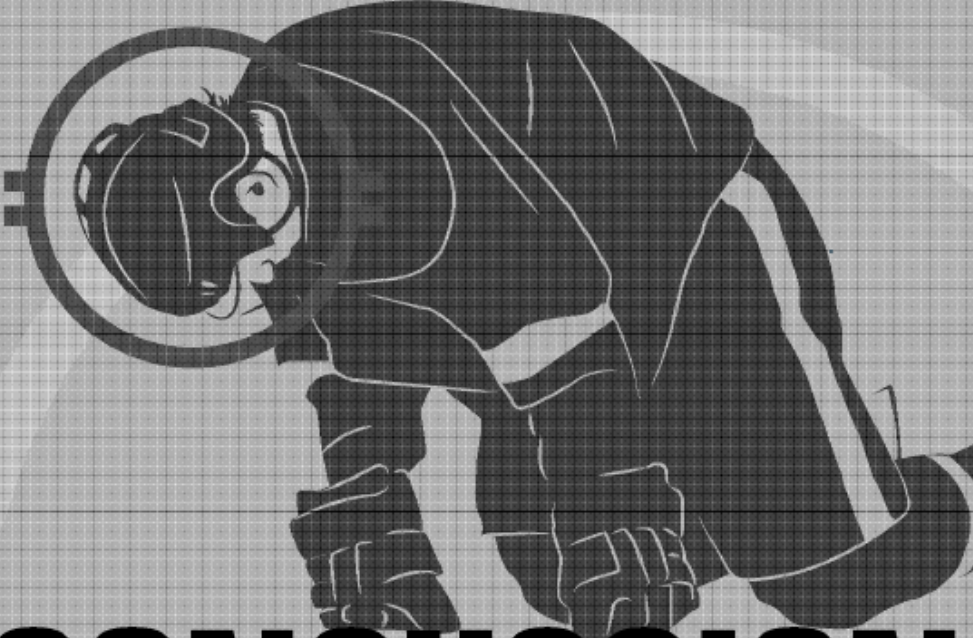


Thinking/ Remembering	Physical	Emotional/ Mood	Sleep
Difficulty thinking clearly	Headache	Irritability	Sleeping more than usual
	Fuzzy or blurry vision		
Feeling slowed down	Nausea or vomiting (early on)	Sadness	Sleep less than usual
	Dizziness		
Difficulty concentrating	Sensitivity to noise or light	More emotional	Trouble falling asleep
	Balance problems		
Difficulty remembering new information	Feeling tired, having no energy	Nervousness or anxiety	

26. The NHL itself, albeit only in recent years, has identified the following symptoms as being associated with concussions in its Fact-Sheet for Athletes:<sup>3</sup>





---

<sup>3</sup> NHL0040512.



# CONCUSSION

**RECOGNIZE THE SIGNS**  
ONE OR MORE OF THESE MAY BE A CONCUSSION


-  **Knocked out (even briefly)**  
**Pressure in the Head**  
**Headache**
-  **Dizziness**  
**Nausea or Vomiting**  
**Feeling Sluggish or Groggy**  
**Move Clumsily**
-  **Vision Changes**  
**Sensitive to Light**  
**Sensitive to Noise**
-  **Behavior or Personality Changes**  
**Confusion or Memory Difficulties**  
**Answer Questions Slowly**

**REPORT THE SYMPTOMS**  
TELL YOUR ATHLETIC TRAINER OR DOCTOR

You can sustain a concussion without a direct hit to the head (e.g., whiplash injury).  
Every player is unique and each concussion is different.  
Symptoms may not appear right away and may change over time.

**RECOVER COMPLETELY**  
BEFORE RETURNING TO PLAY

Contact practice or play while still experiencing symptoms can prolong the time it takes to recover and return to play.  
Unlike other injuries, there may be significant consequences to "playing through" a concussion.  
The time to recover varies among Players.



## KEEP CONCUSSIONS OFF THE ICE

27. These changes in alertness and cognition can be relatively mild (such as a slight daze) or profound (unconsciousness), yet both situations are defined as concussions.

These clinical presentations may clear spontaneously, or may linger for prolonged periods of time. For some, the symptoms can last a lifetime.

## 2. History of Concussions

28. Dating as far back as the time of Hippocrates, concussions were recognized as a “commotion of the brain” that resulted in a loss of speech, hearing, and motor function.<sup>4</sup> The term “concussion” has been recognized since at least the 16th century,<sup>5</sup> though its formal description has evolved over time.

29. The understanding of the effects of concussions evolved significantly in the early 20th century. In the first quarter of the 20th century, many believed that concussions were caused by deformation of, or a temporary change in, the form or shape of the skull, causing an anemia of the brain.<sup>6</sup> In 1926, neurologists Osnato and Giliberti first suggested that exposure to mTBI may lead to neurodegenerative changes.<sup>7</sup> Then, in 1928, Martland, a New Jersey pathologist, described “punch drunk syndrome,” a chronic motor and neuropsychiatric condition caused by concussive and subconcussive blows in retired boxers,<sup>8</sup> coined as “dementia pugilistica” in a subsequent study in 1937,<sup>9</sup> and later as chronic traumatic encephalopathy (CTE) in 1949.<sup>10</sup>

30. In 1964, the Congress of Neurological Surgeons updated the definition of concussions to: “[A] clinical syndrome characterized by immediate and transient impairment

---

<sup>4</sup> P.R. McCrory & S.F. Berkovic, *Concussion: the history of clinical and pathophysiological concepts and misconceptions*, 57 NEUROLOGY 12 (2001).

<sup>5</sup> A. Paré, *The workes of that famous chirurgion Ambrose Parey. Translated out of Latin and compared with the French*, LONDON: COTES & YOUNG (1579).

<sup>6</sup> J.L. Stone, V. Patel, & J.E. Bailes, *The history of neurosurgical treatment of sports concussion*, NEUROSURGERY 75 (2014).

<sup>7</sup> M. Osnato & V. Giliberti, *Postconcussion neurosis-traumatic encephalitis: a conception of postconcussion phenomena*, 18 ARCH. NEUROL. PSYCH. 2 (1927).

<sup>8</sup> H.S. Martland, *Punch drunk*, 91 JAMA 15 (1928).

<sup>9</sup> J.A. Millspaugh, *Dementia pugilistica*, 35 U.S. NAVAL MED. BULL. 297 (1937).

<sup>10</sup> M. Critchley, *Punch-drunk syndromes: the chronic traumatic encephalopathy of boxers*, HOMMAGE A CLOVIS VINCENT (1949).

of neural function, such as alteration of consciousness, disturbance of vision, equilibrium, etc., due to mechanical forces.”<sup>11</sup> This definition was updated shortly thereafter to include three grades of severity, with associated clinical presentations.<sup>12</sup> This same paper suggested that, based on the increased danger of multiple concussions in a short duration, a football player concussed three times in a single year should be removed from the sport permanently.<sup>13</sup> It was further posited that it would be “wise to exclude the player permanently from any further play after only *one severe* concussion.”<sup>14</sup>

31. As early as 1968, Oppenheimer discovered microscopic axonal injury in the brain after mild head injury in humans and animals in post-mortem study,<sup>15</sup> later confirmed by Sekino *et al.*<sup>16</sup> Other studies during the 1980s and 1990s demonstrated that concussive injury results in ionic flux and hyperacute indiscriminate glutamate release, which can then trigger voltage- or ligand-gated ion channels, creating a diffuse “spreading depression-like” state.<sup>17</sup> Further discussion of these cellular and metabolic changes is found below in Section IV(A)(4–5).

---

<sup>11</sup> *Committee on Head Injury Nomenclature of the Congress of Neurological Surgeons. Glossary of head injury, including some definitions of injury to the cervical spine*, CLIN. NEUROSURG. 12 (1966).

<sup>12</sup> R.C. Schneider & F.C. Kriss *Decisions concerning cerebral concussions in football players*, 1 MED. SCI. SPORTS 2 (1969); R.C. Cantu, *Guidelines for return to contact sports after a cerebral concussion*, 14 PHYSICIAN SPORTSMED. 10 (1986).

<sup>13</sup> *Id.*

<sup>14</sup> *Id.*

<sup>15</sup> D.R. Oppenheimer et al., *Microscopic lesions in the brain following head injury*, 31 J. NEUROL., NEUROSURG. PSYCHIATRY 4 (1968).

<sup>16</sup> H. Sekino et al., *Brain lesions detected by CT scans in cases of minor head injuries*, 21 NEUROLOGIA MEDICO-CHIRURGICA 7 (1981).

<sup>17</sup> Y. Katayama et al., *Massive increases in extracellular potassium and the indiscriminate release of glutamate following concussive brain injury*, 112 J. NEUROSURG. 2 (1990); H. Takahashi et al., *Changes in extracellular potassium concentration in cortex and brain stem during the acute phase of experimental closed head injury*, 116 J. NEUROSURG. 6 (1981).

32. In 2001 and 2004, the First and Second International Symposia on Concussion in Sport, which were held in Vienna, Austria, and Prague, Czech Republic, respectively, defined sports concussion as: “[A] complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.”<sup>18</sup> Along with the revised definition, the Symposia also refined concussion classification by abandoning a grading scheme for concussions, instead favoring use of combined measures of recovery to determine injury severity or prognosis, and hence individually guide return-to-play decisions.<sup>19</sup>

33. The following chart details the evolved grading of concussions in the 20th century:<sup>20</sup>

---

<sup>18</sup> P. McCrory et al., *Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004*, 39 BR. J. SPORTS MED. 4 (2005).

<sup>19</sup> M. Aubry, et al., *Summary and agreement statement of the First International Conference on Concussion in Sport, Vienna 2001*, 36 BR. J. SPORTS MED 1 (2002).

<sup>20</sup> Millspaugh, *supra* n.9.

**TABLE 1. The Evolving Definition and Grading of Sports Concussion**

<b>Thorndike<sup>126</sup> grading system for concussion, 1948</b>	
Mild type	Athlete is "momentarily knocked unconscious" and immediately recovers or regains all of his intellectual functions of initiative, planning, thinking and attention.
Mild (boxing) type	Athlete is "knocked out on his feet" but never loses consciousness completely and retains some of his intellectual and all of his vegetative consciousness.
Severe type	The "period of unconsciousness is obvious and exists for a minute or longer," and the patient suffers from the residual symptoms of headache, dizziness, and complete or incomplete loss of intellect.
<b>Schneider and Kriss<sup>129</sup> grading system for concussion, 1969</b>	
Mild	No loss of consciousness but other symptoms or signs
Moderate	Loss of consciousness for 3-4 min and mild posttraumatic amnesia
Severe	Loss of consciousness for >5 min and prolonged posttraumatic amnesia
<b>Cantu<sup>154</sup> grading system for concussion, 1986</b>	
Grade I	No loss of consciousness; posttraumatic amnesia lasting <30 min
Grade II	Loss of consciousness for <5 min or posttraumatic amnesia lasting >30 min but <24 h
Grade III	Loss of consciousness for >5 min or posttraumatic amnesia lasting >24 h
<b>Kelly et al (Colorado)<sup>128</sup> grading system for concussion, 1991</b>	
Grade I	Confusion without amnesia; no loss of consciousness
Grade II	Confusion with amnesia; no loss of consciousness
Grade III	Loss of consciousness
<b>American Academy of Neurology Practice Parameters (Kelly and Rosenberg)<sup>131</sup> grading system for concussion, 1997</b>	
Grade I	Transient confusion; no loss of consciousness; concussion symptoms or mental status abnormalities on examination resolve in <15 min
Grade II	Transient confusion; no loss of consciousness; concussion symptoms or mental status abnormalities on examination last >15 min
Grade III	Any loss of consciousness, either brief (seconds) or prolonged (minutes)
<b>Cantu<sup>132</sup> grading system for concussion (revised) 2001</b>	
Grade I	No loss of consciousness; posttraumatic amnesia/postconcussion signs or symptoms <30 min
Grade II	Loss of consciousness <1 minute or posttraumatic amnesia >30 min but <24 hours, or postconcussion signs or symptoms >30 min but <7 d
Grade III	Loss of consciousness ≥1 min or posttraumatic amnesia ≥24 h; postconcussion signs or symptoms >7 d

34. In 2013, the most recent Fourth International Conference on Concussion in Sport, McCrory *et al.*, defined concussion as a brain injury classified by "a complex pathophysiological process affecting the brain, induced by biomechanical forces," with the following features: (1) being caused by blunt force trauma to the head, "or elsewhere on the body with an 'impulsive' force transmitted to the head"; (2) typically resulting in the rapid onset of neurologic impairment, which may resolve spontaneously or up to a number of hours later; (3) may result in neuropathology that clinically reflects functional deficiencies



over structural injury; and (4) results in a graded set of symptoms, with or without loss of consciousness, which may also be prolonged.<sup>21</sup>

35. Notwithstanding the evolving definition of “concussion” among clinicians and researchers over the course of many decades (indeed, centuries), there have been at least two constants: that trauma to the head, whether in sport, falling off a horse, or from a motor vehicle accident, is exceptionally dangerous, particularly if not treated properly, and that repetitive head trauma may lead to catastrophic sequelae.

### **3. How Concussions Occur in Sports and in Ice Hockey Particularly**

36. Concussions occur when linear and rotational accelerations are imparted to the brain from either direct impacts to the head or indirect impacts that whiplash the head. The source of impact, however, is immaterial. It may come from a boxing glove, a football helmet, a bare knuckled fist in a hockey fight, or a hockey player’s head hitting the ice, glass, or another player. The material issue is the resulting neuronal and axonal disruption (*i.e.*, the concussion) that puts athletes at imminent risk of serious injury or death, as well as a heightened risk of long-term neurodegenerative disease (LTND).

37. During the course of an NFL season, for example, studies have shown that athletes receive more than 1,000 impacts greater than 10 G force, which is slightly more than a fighter pilot receiving doing maximal maneuvers. However, most of the football-related hits to the head exceed 20 G force, and those that result in concussion exceed 60 G.

38. Professor Blaine Hoshizaki of the University of Ottawa School of Human Kinetics and founder of the Neurotrauma Impact Laboratory has opined that during the course of the 1986-87 NHL season, it is believed that athletes receive more than 680 head impacts greater than 9% strain over a 30 game period, imputed to approximately 0.98 impacts per player per game. In the higher range of the periods studied, Professor Hoshizaki reported that athletes receive more than 1674 head impacts greater than 9% strain over a 30

---

<sup>21</sup> P. McCrory et al., *Consensus statement on concussion in sport: The 4th international conference on concussion in sport, Zurich, November 2012*, 48 J. ATHLETIC TRAINING 4 (2013).

game period, imputed to approximately 2.56 impacts per player per game. A strain in excess of 18% is considered likely to result in a concussion, though it has been reported that strain figures between 5% and 8% result in changes to white matter cells, explored *infra* section IV.A.5.<sup>22</sup>

39. While helmets are effective in virtually eliminating skull fractures and dramatically reducing linear forces, they are ineffective in reducing the rotational forces that result in a concussion.

40. Indeed, the NHL's own concussion consultants have acknowledged on several occasions that helmets worn by NHL players were designed to "mitigate impact energy"<sup>23</sup> and not to prevent or reduce concussions, [REDACTED]

#### 4. Metabolic Changes

41. After concussion, there is a significant K<sup>+</sup> efflux from cells, owing to mechanical membrane disruption, axonal stretch, and opening of voltage-dependent K<sup>+</sup> channels. Nonspecific depolarization of neurons leads to release of the excitatory neurotransmitter glutamate, which compounds the K<sup>+</sup> flux by activating N-methyl-D-aspartate (NMDA) and D-amino-3-hydroxy-5-methyl-4-isoxazole-propionic acid (AMPA) receptors. In an attempt to restore the membrane potential, the Na<sup>+</sup>, K<sup>+</sup>-ATPase works overtime, consuming increasing amounts of ATP. To meet these elevated ATP requirements, there is a marked upregulation of cellular glycolysis, which occurs within minutes after concussion. During this period of hyperglycolysis, there is a commensurate increase in lactate production.

42. In addition to K<sup>+</sup> efflux, NMDA receptor activation permits a rapid and sustained influx of Ca<sup>2+</sup>. Elevated intracellular Ca<sup>2+</sup> can be sequestered in mitochondria,

---

<sup>22</sup> T. Yuen et al., *Sodium channelopathy induced by mild axonal trauma worsens outcome after a repeat injury*, 87 J. NEUROSCI. RES. 16, 3620–25 (2009).

<sup>23</sup> NHL2054172.

<sup>24</sup> [REDACTED]



eventually leading to dysfunction of oxidative metabolism and further increasing the cell's dependence on glycolysis-generated ATP. Calcium accumulation may also activate proteases that eventually lead to cell damage or death and, in axons, excess  $Ca^{2+}$  can lead to dysfunction and breakdown of neurofilaments and microtubules.

43. These ionic shifts and acute alterations in cellular energy metabolism occur in a posttraumatic setting where cerebral blood flow (CBF) is diminished, although not to ischemic levels. Rather, it is the mismatch between glucose delivery and glucose consumption that may predispose to secondary injury. CBF may remain depressed for several days after TBI, possibly limiting the ability of the brain to respond adequately to subsequent perturbations in energy demand. If increased energy demands are not satisfied there is the potential for increased numbers of neurons and glial cells to enter an injury cascade.

44. After the initial period of profound post-injury ionic disturbance and resultant increase in glucose metabolism, the local cerebral metabolic rate for glucose decreases significantly below baseline, as does oxidative metabolism. Then, gradually in most instances of concussion, these metabolic changes revert to baseline over a 10-day period.

##### **5. Cellular and Sub-Cellular Changes Following Concussive and Subconcussive Blows**

45. As postulated by Randolph & Kirkwood in 2009,<sup>25</sup> concussive and subconcussive blows sustained over the course of an athletic career cause permanent damage to white matter and likely result in a diminishing of the cerebral reserves<sup>26</sup> in the athlete's

---

<sup>25</sup> C. Randolph & M.W. Kirkwood, *What are the real risks of sport-related concussion, and are they modifiable?*, 15 J. INT'L NEUROPSYCHOLOGICAL SOC'Y 4 (2009).

<sup>26</sup> "Cerebral reserve" refers to a combination of brain reserve capacity, cognitive reserve capacity, and functional reserve, represented by quantitative measures such as brain size, white and grey matter volume, or neuronal count, and can simplistically be viewed as the number of reserve grey matter and white matter cells in a brain. Those with more cerebral reserve tend to have better clinical outcomes for any given level of pathology. Accordingly, there is some threshold at which clinical deficits will become apparent and those individuals with more cerebral reserve can withstand greater pathology before appearing symptomatic. For example, in the case of Alzheimer's, the disease will progress longer and more pathology

brain, thereby exacerbating or accelerating the effects of aging on the brain, and leaving the athlete particularly vulnerable to neurodegenerative disorders.

46. Following a concussive or subconcussive event, there is a destructive pathophysiological and biomechanical response that initiates a chain of neurometabolic and neurochemical reactions that include:

- Activation of inflammatory response;
- Imbalance of ionic concentrations;
- Increase in the excitatory amino acids;
- Dysregulation of neurotransmitter release and synthesis;
- Imbalance of mitochondrial functions and energy metabolism; and
- Productions of free radicals.

47. Even after resolution of all clinical symptoms associated with a concussive (or subconcussive) event, there may be long-lasting ultrastructural and functional brain alteration. In fact, several studies in boxers<sup>27</sup> and football players<sup>28</sup> support the interpretation that even asymptomatic subconcussive head trauma, accumulated over the course of an athletic career, can cause long-term brain damage. Such long-term damage, however, may only become apparent once the normal ageing process has contributed to neuronal degeneration.

48. The normal ageing process is associated with significant changes in both grey and white matter in the brain.<sup>29</sup> Grey matter volume loss is susceptible to the effects of ageing, and is particularly salient within the parenchyma of both the frontal and temporal

---

will accumulate before the appearance of clinical symptoms in those who have greater cerebral reserve than in those with less cerebral reserve.

<sup>27</sup> M.H. Chappell et al., *Distribution of microstructural damage in the brains of professional boxers: a diffusion MRI study*, 24 J. MAGNETIC RESONANCE IMAGING 3 (2006).

<sup>28</sup> J. Hart, *Neuroimaging of cognitive dysfunction and depression in aging retired National Football League players: a cross-sectional study*, 70 JAMA NEUROL. 3 (2013).

<sup>29</sup> N. Raz et al., *Differential aging of the brain: patterns, cognitive correlates and modifiers*, 30 NEUROSCI. BIOBEHAV. REV. 6 (2006); A.M. Fjell et al., *Critical ages in the life course of the adult brain: nonlinear subcortical aging*, 34 NEUROBIOL. AGING 10 (2013).

lobes of the brain.<sup>30</sup> White matter is also highly vulnerable to the ageing process, with an estimated volume loss of 45% between the ages of 20 and 80 years.<sup>31</sup> Age-related white matter loss is thought to contribute to the decline in cognitive function typically associated with the normal ageing process, which encompasses domains of information processing speed, psychomotor speed, postural stability, memory, attention, and executive functions.<sup>32</sup>

49. Through the use of diffusion tensor imaging (DTI), researchers have been able to measure changes to cerebral reserve and white matter volume loss by studying and modeling the quantification of water molecules' diffusion across brain tissues. A key indicator of white matter decline is a decrease in fractional anisotropy, which refers to the measure of diffusion along the longitudinal axis of the axon. An additional indicator of white matter loss is an increase in mean diffusivity; greater diffusion can be found in membrane-free areas of the brain, compared to the restricted diffusion in areas containing grey and white matter. An increase in mean diffusivity indicates a greater proportion of membrane-free areas present in the subject brain.

50. In testing the brains of contact sport athletes, Tremblay *et al.* found significant abnormal changes in DTI MRIs, including a decline in fractional anisotropy and an increase in mean diffusivity.<sup>33</sup> These changes to fractional anisotropy and mean diffusivity were

---

<sup>30</sup> N. Raz et al., *Selective aging of the human cerebral cortex observed in vivo: differential vulnerability of the prefrontal gray matter*, 7 CEREBRAL CORTEX 3 (1997); D.J. Tisserand et al., *Regional frontal cortical volumes decrease differentially in aging: an MRI study to compare volumetric approaches and voxel-based morphometry*, 17 NEUROIMAGE 2 (2002); E. Masliah et al., *Synaptic remodeling during aging and in Alzheimer's disease*, 9 J. ALZHEIMERS DIS. 3 (2006); A.M. Fjell et al., *High consistency of regional cortical thinning in aging across multiple samples*, 19 CEREBRAL CORTEX 9 (2009).

<sup>31</sup> D.H. Salat et al., *Age-related alterations in white matter microstructure measured by diffusion tensor imaging*, 26 NEUROBIOL. AGING 8 (2005).

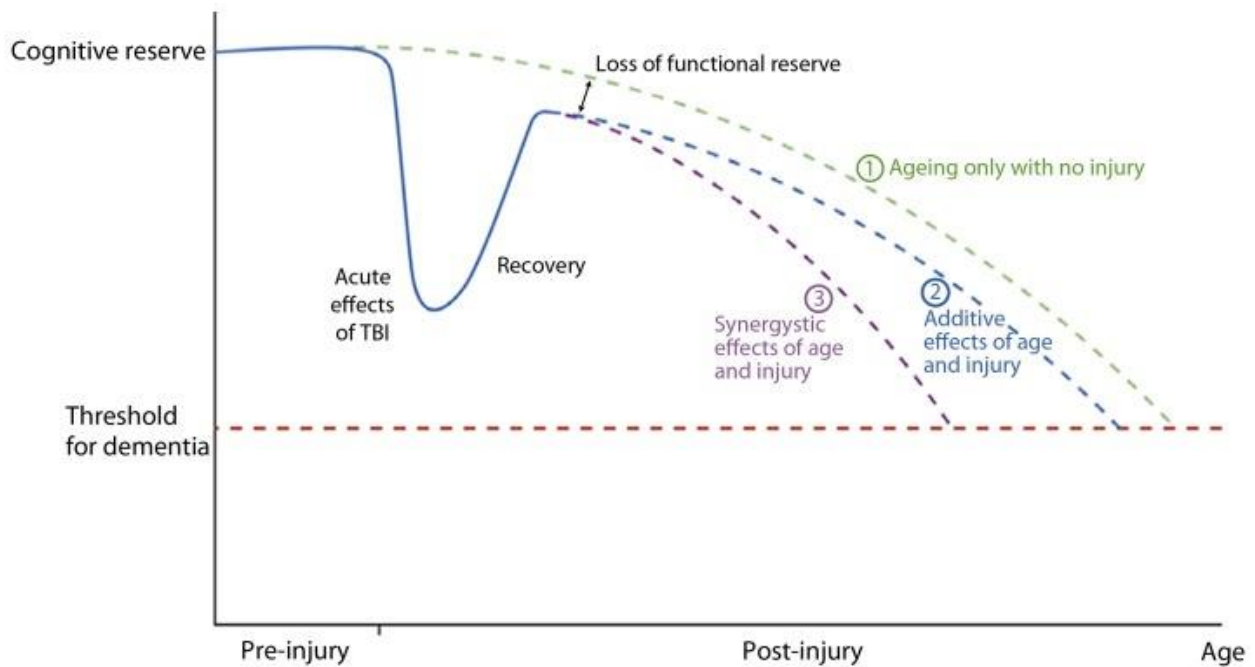
<sup>32</sup> F.M. Gunning-Dixon et al., *Aging of cerebral white matter: a review of MRI findings*, 24 INT'L J. GERIATR. PSYCHIATRY 2 (2009); D.J. Madden et al., *Cerebral white matter integrity and cognitive aging: contributions from diffusion tensor imaging*, 19 NEUROPSYCHOL. REV. 415 (2009).

<sup>33</sup> S. Tremblay et al., *Diffuse white matter tract abnormalities in clinically normal ageing retired athletes with a history of sports-related concussions*, BRAIN (2014).

indicative of damage to the white matter of the athletes’ brains as a result of their participation in contact sports.

51. Tremblay’s detected anomalies were related to multiple cognitive and brain structure variables, which, in addition to previous functional and structural characterizations, reveal a clinical profile that fits with the pattern of changes that are typically observed in normal ageing. From this understanding, it is likely that the nature of the interaction between ageing and a history of concussions involves a latent microstructural injury that leaves the brain more vulnerable to the deleterious effects of ageing. Thus, while ageing exerts its own effects on the brain, concussive and subconcussive impacts act synergistically with the normal ageing process, resulting in detectable decline in both structure and function.

52. The following chart, illustrated in “Review: the long-term consequences of microglial activation following acute traumatic brain injury,” demonstrates the impact that a TBI has on short and long term cerebral reserve, thereby accelerating the risk of dementia:



53. DTI metrics, that are sensitive to small alterations in white matter microstructure, allow important parallels to be drawn between normal ageing and ageing with a history of concussive and subconcussive impacts. The reported group differences between older retired athletes that have suffered concussions and those that have not suffered

concussions match a pattern of anomalies that is consistent with the effects of normal ageing. However, studies suggest that the concussed brain is more vulnerable to the pathological effects of normal ageing. This interpretation would be in line with findings of exacerbated cortical thinning and ventricular expansion with advancing age in the same sample of former concussed athletes.<sup>34</sup>

54. Overall, Tremblay's results support the notion that structural injury from concussive and subconcussive blows, even if not grossly apparent, might reduce the resilience of the brain and expedite, or compound, the degenerative effects of ageing.<sup>35</sup> The consequence of this, in practical terms, is that those individuals who have sustained concussive and subconcussive blows will most likely experience age-related cognitive alterations earlier in life compared to those individuals who have not sustained concussive and subconcussive blows. Each concussive or subconcussive blow that affected white matter would, in turn, accelerate the individual's decline towards a state where neuropathologies clinically manifest.

55. These present, and permanent, changes to white matter have been observed in a variety of studies tracking athletes in contact sports. In fact, a study of varsity university (CIS) hockey players observed an increase in diffusivity in major white matter tracts in the right hemisphere after a single season of hockey, even though CIS hockey is played at a slower and less violent pace than NHL hockey.<sup>36</sup> Of the 25 players studied, only three reported suffering from a diagnosed concussion, even though the changes to diffusivity were similarly significant in players that did not suffer from a diagnosed concussion. As concluded therein, "[t]his suggests that white matter alterations occur even in the absence of

---

<sup>34</sup> S. Tremblay et al., *Sports concussions and aging: a neuroimaging investigation*, 23 CEREBRAL CORTEX 5, (2013).

<sup>35</sup> L. Moretti et al., *Cognitive decline in older adults with a history of traumatic brain injury*, 11 LANCET NEUROL. 12 (2012).

<sup>36</sup> I.K. Koerte et al, *A prospective study of physician-observed concussion during a varsity university hockey season: white matter integrity in ice hockey players. Part 3 of 4*, 33 NEUROSURGICAL FOCUS 6 (2012).

a diagnosed concussion, which is in accordance with other studies in contact sports where concerns have been raised about the cumulative effects of frequent brain trauma.”<sup>37</sup>

56. In another study, comparing white matter changes in varsity soccer players without diagnosed concussions (yet, who frequently endure concussive and subconcussive blows while “heading” the ball) and varsity swimmers, the researchers detected an “increase in radial diffusivity in soccer players, consistent with findings observed in patients with mild TBI.”<sup>38</sup>

57. As discussed in the study by Professor Blaine Hoshizaki, the average NHL player sustains approximately 0.98 to 2.56 concussive or subconcussive blows to the head – above the minimum threshold for causing white matter damage – in a typical game, depending on the decade of play (with a noted upward trend over time). This would be consistent with findings that athletes in other contact sports, such as boxing and football, suffer thousands of blows to the head over the course of an athletic career.<sup>39</sup>

58. All head trauma, even at the subconcussive level, can result in permanent cellular changes in the brain. This conclusion is consistent with the findings of Tremblay,<sup>40</sup> Zhou (“Our observations demonstrate that after a single concussive episode, there is measurable atrophy 1 year after injury. . . These changes are greater than those we would normally expect to see after 1 year in a control population.”),<sup>41</sup> Smith (discussing that “[a]fter an episode of traumatic brain injury there is a significant decline in cognitive function which recovers, the degree of recovery being dependent on the severity of the head

---

<sup>37</sup> *Id.*

<sup>38</sup> I.K. Koerte et al, *White matter integrity in the brains of professional soccer players without a symptomatic concussion*, 308 JAMA 18 (2012).

<sup>39</sup> A.C. McKee et al., *Chronic traumatic encephalopathy in athletes: progressive tauopathy following repetitive head injury*, 68 J. NEUROPATHOL. EXP. NEUROL. 7 (2009).

<sup>40</sup> A.C. McKee et al., *TDP-43 Proteinopathy and Motor Neuron Disease in Chronic Traumatic Encephalopathy*, 69 J. NEUROPATHOL. EXP. NEUROL. 918 (2010).

<sup>41</sup> Y. Zhou et al., *Mild traumatic brain injury: longitudinal regional brain volume changes*, 267 RADIOLOGY 3 (2013).

injury. Recovery is, however, not complete, resulting in a loss of functional reserve.”),<sup>42</sup> Bigler (finding that “[a]lthough the brain adapts when injured except in cases of severe catastrophic injuries, the individual may never return to baseline and then as depicted in the illustration the adverse effects may be either synergistic or additive. Regardless of the mechanism, having a brain injury shortens the time for when the dementia threshold would be achieved.”), and all of the aforementioned studies detecting changes to diffusivity following contact sport participation.<sup>43</sup>

## 6. Rest is the Hallmark of Initial Concussion Therapy

59. Physical and cognitive rest is the hallmark of initial concussion management.<sup>44</sup> Acutely, either physical or cognitive exertion may greatly exacerbate concussion symptoms and retard recovery. A 2014 study, assessing the impact of cognitive rest on recovery time for youths, identified a strong correlation between the benefits of cognitive rest and the duration of concussion symptoms or Post-Concussion Syndrome (PCS), including the following graph displaying the duration of symptoms by quartile of cognitive activity-days (shaded areas representing 95% confidence intervals):<sup>45</sup>

---

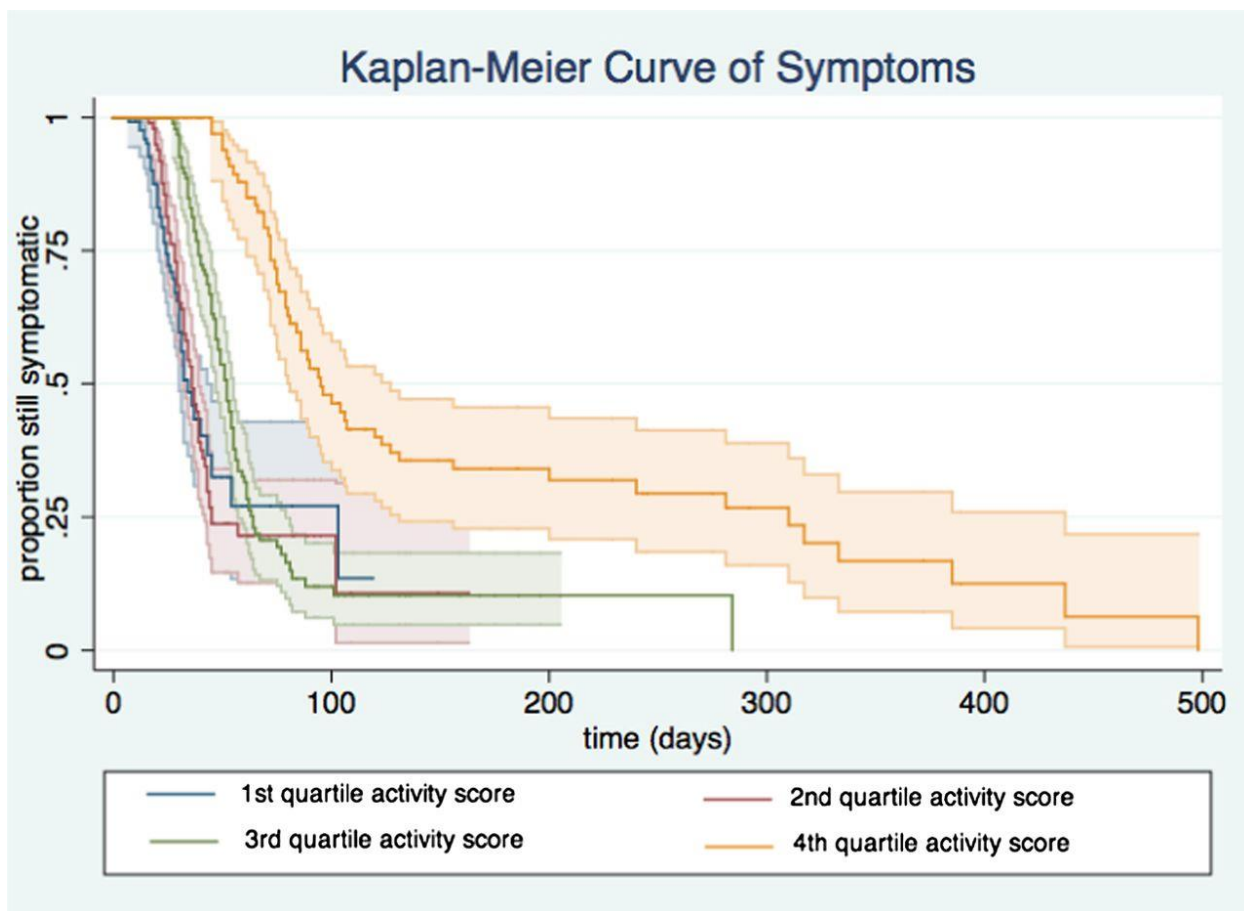
<sup>42</sup> C. Smith, *Review: the long-term consequences of microglial activation following acute traumatic brain injury*, 39 NEUROPATHOL. APPL. NEUROBIOL. 1 (2013).

<sup>43</sup> E. Bigler, *Traumatic brain injury, neuroimaging, and neurodegeneration*, 7 FRONTIERS IN HUMAN NEUROSCIENCE 395 (2013).

<sup>44</sup> C.W. Majerske et al., *Concussion in sports: postconcussive activity levels, symptoms, and neurocognitive performance*, 43 J. ATHL. TRAIN. 3 (2008).

<sup>45</sup> N.J. Brown et al., *Effect of cognitive activity level on duration of post-concussion symptoms*, 133 PEDIATRICS 2 (2014).





## B. Subconcussive Hits

60. Subconcussive hits, or impacts that do not produce any clinical concussion symptoms, may also adversely affect cerebral function.<sup>46</sup> Evidence that subconcussive hits may adversely affect cerebral function has been reflected in documented changes in cerebral function (*e.g.*, visual working memory declines) and altered dorsolateral prefrontal cortex activation, as assessed by functional MRI imaging in high school football athletes in the absence of clinical signs of concussion.<sup>47</sup> In lay terms, the study on high school football

<sup>46</sup> B.E. Gavett et al., *Chronic Traumatic Encephalopathy: A Potential Late Effect of Sport-Related Concussive and Subconcussive Head Trauma*, 30 *CLINICAL SPORTS MED.* 179 (2011); A.C. McKee et al., *Chronic Traumatic Encephalopathy in Athletes: Progressive Tauopathy after Repetitive Head Injury*, 68 *J. NEUROPATHOL. EXP. L NEUROL.* 709 (2009).

<sup>47</sup> T.M. Talavage et al., *Functionally-Detected Cognitive Impairment in High School Football Players Without Clinically-Diagnosed Concussion*, 31 *J. NEUROTRAMA* 4 (2013).



players found that players who received normal football brain trauma and did not report any concussion symptoms still had functional MRI changes that mimicked concussed players.<sup>48</sup>

61. Similarly, in a 2013 study of college football players, researchers found that the more hits to the head a player absorbed, the higher the levels of a particular brain protein, S100B, that is known to leak into the bloodstream after an athletic head injury. Even though none of the football players in the study suffered a concussion during the season, four players showed signs of an autoimmune response, the presence of S100B antibodies, which has been associated with brain disorders. Brain scans (using diffusion tensor imaging) showed structural brain tissue damage comparable to what one typically observes in the scan of a concussion victim.

62. Studies have concluded that concussion, repeated subconcussive head impacts, or a combination of such impacts, leads to permanent neurodegenerative conditions such as early-onset Alzheimer's and CTE,<sup>49</sup> mild cognitive impairment,<sup>50</sup> and/or depression.<sup>51</sup>

### **C. Second Impact Syndrome**

63. What Saunders and Harbaugh<sup>52</sup> called “the second-impact syndrome of catastrophic head injury” in 1984 was first described by Schneider in 1973.<sup>53</sup> Second impact syndrome (SIS) occurs when an athlete who sustains a head injury – often a concussion or

---

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> Gavett, *supra* n. 46.

<sup>51</sup> K.M. Guskiewicz et al., *Association Between Recurrent Concussion and Late-Life Cognitive Impairment in Retired Professional Football Players*, 57 *NEUROSURGERY* 4 (2005).

<sup>52</sup> R.L. Saunders & R.E. Harbaugh, *Second Impact in Catastrophic Contact-Sports Head Trauma*, 252 *JAMA* 538 (1984).

<sup>53</sup> R.C. Schneider, *Head and Neck Injuries in Football: Mechanisms, Treatment, and Prevention* (1973).

worse injury, such as a cerebral contusion – sustains a second impact before symptoms associated with the first injury have cleared.<sup>54 55 56</sup>

64. Typically, the athlete suffers postconcussion symptoms after the first head injury. These may include headache, labyrinthine dysfunction, visual, motor, or sensory changes, or mental difficulty, especially the thought and memory process. Before these symptoms resolve, which may take days or weeks, the athlete returns to competition and receives a second blow to the head.

65. The second blow may be remarkably minor, perhaps only involving a blow to the chest that jerks the athlete's head and indirectly imparts accelerative forces to the brain. Affected athletes may appear stunned, but usually do not lose consciousness, and often complete the play. The athletes usually remain on their feet for approximately 15 seconds to one minute, but seem dazed. Often, affected athletes remain on the playing field or walk off under their own power.

66. What happens in the next 15 seconds to several minutes sets this syndrome apart from a concussion. Usually within seconds to minutes of the second impact, the athlete – conscious yet stunned – quite precipitously collapses to the ground, semicomatose with rapidly dilating pupils, loss of eye movement, and evidence of respiratory failure.

67. The pathophysiology of SIS is thought to involve a loss of autoregulation of the brain's blood supply. This loss of autoregulation leads to vascular engorgement within the cranium, which, in turn, markedly increases intracranial pressure and leads to herniation either of the medial surface (uncus) of the temporal lobe or lobes below the tentorium of the cerebellar tonsils through the foramen magnum (Fig. 1). Animal research has shown that vascular engorgement of the brain after a mild head injury is difficult, if not impossible, to

---

<sup>54</sup> R.C. Cantu, *Second Impact Syndrome: Immediate Management*, 20 PHYSICIAN SPORTSMED. 55 (1992).

<sup>55</sup> R.C. Cantu & R. Voy, *Second Impact Syndrome: A Risk in any Contact Sport*, 23 PHYSICIAN SPORTSMED. 27 (1995).

<sup>56</sup> J.B. McQuillen, E.N. McQuillen & P. Morrow, *Trauma, Sports, and Malignant Cerebral Edema*, 9 AM. J. FORENSIC MED. PATHOLOGY 12 (1988).

control.<sup>57 58</sup> The usual time from second impact to brainstem failure is rapid, taking 2 to 5 minutes. Once brain herniation and brainstem compromise occur, ocular involvement and respiratory failure precipitously ensue. Demise occurs far more rapidly than usually seen with an epidural hematoma. MRI imaging and CT scans are the neuroimaging studies most likely to demonstrate SIS. Although MRI imaging is more sensitive to traumatic brain injuries, especially true edema,<sup>59 60</sup> the CT scan is usually adequate to show bleeding or midline shifts of the brain requiring neurosurgical intervention.

---

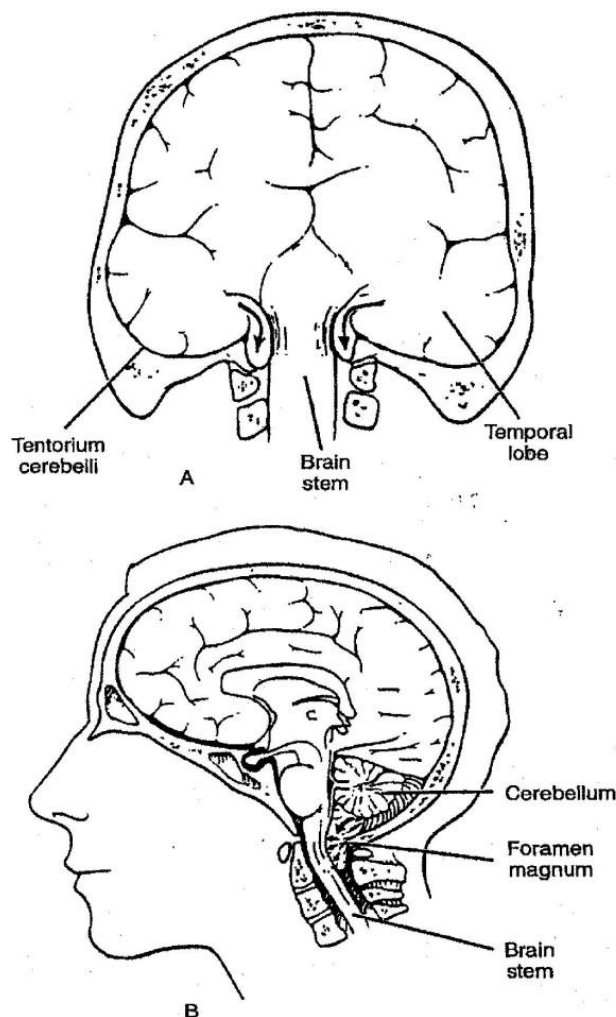
<sup>57</sup> T.W. Langfitt et al., *Cerebral Vasomotor Paralysis Produced by Intracranial Hypertension*, 15 NEUROLOGY 622 (1965).

<sup>58</sup> R.A. Moody et al., *An Evaluation of Decompression in Experimental Head Injury*, 29 J. NEUROSURG. 586 (1968).

<sup>59</sup> L.R. Gentry et al., *Prospective Comparative Study of Intermediate Field MR and CT in Evaluation of Closed Head Trauma*, 150 AM. J. ROENGENOLOGY 673 (1988).

<sup>60</sup> A. Jenkins et al., *Brain Lesions Detected by Magnetic Resonance Imaging in Mild and Severe Head Injuries*, LANCET 445 (1986).

**Figure 1**



**Figure** In second impact syndrome, vascular engorgement within the cranium increases intracranial pressure, leading to herniation of the uncus of the temporal lobe (arrows) below the tentorium in this frontal section (A), or to herniation of the cerebellar tonsils (arrows) through the foramen magnum in this midsagittal section (B). These changes compromise the brain stem, and coma and respiratory failure rapidly develop. The shaded areas of the brain stem represent the areas of compression.

68. While SIS typically does not occur with intracranial bleeding, a number of cases of SIS have been reported where acute hemisphere swelling has occurred in association with a thin subdural hematoma in athletes receiving the second injury while still symptomatic from the first.<sup>61</sup>

<sup>61</sup> T. Mori, Y. Katayama & T. Kawamata, *Acute Hemisphere Swelling Associated with Thin Subdural Hematomas: Pathophysiology of Repetitive Head Injury in Sports*, 96 ACTA NEUROCHIR. SUPPL. 40 (2006).

69. Fundamentally, SIS is a particular danger for athletes who are not given appropriate medical care, and rest, following an initial concussive event, particularly among younger athletes. Thus, proper education of both athletes, coaching staff, and medical staff is crucial to recognize concussive events and prevent their rapid recurrence. Unfortunately, for much of the NHL's (and other professional sports leagues) history, a concussion was regarded as little more than "getting your bell rung" and return-to-play protocols were limited-to-non-existent. This exposed players to the greatest likelihood of suffering from SIS.

#### **D. Incidence of Concussion and Subconcussive Hits in Contact Sports**

##### **1. Incidence of Concussions and Subconcussive Hits in Ice Hockey**

70. The CDC estimates that 1.6 to 3.8 million concussions occur in sports and recreational activities annually. This figure is likely underestimated, however, as many individuals suffering from mild or moderate concussions do not seek medical care and thus go undiagnosed.<sup>62</sup>

71. Studies have demonstrated that the rate of concussions in ice hockey at the high school and collegiate level is relatively high, though the sport has a comparatively lower participation rate than other contact sports such as football or soccer. Furthermore, concussions have been demonstrated to be more prevalent in full-check hockey than in non-check hockey, more common in games than in practices, and are positively correlated with the competitive level of hockey being played.<sup>63</sup>

72. Although I am not able to personally opine to the average number of concussions sustained in an NHL season, some researchers have attempted to study the frequency and rate of concussions in the NHL. Initially, Wennberg and Tator studied ten seasons between 1998 and 2008, finding the mean incidence over the ten seasons to be 1.45

---

<sup>62</sup> D.H. Daneshvar et al., *Helmets and Mouth Guards: The Role of Personal Equipment in Preventing Sport- Related Concussions*, 30 CLINICAL SPORTS MED. 1 (2011).

<sup>63</sup> *Id.* at 7.

concussions per 1000 athletic exposures (nearly double the reported figure of 0.72 per 1000 athletic exposures, as reported in a study measuring concussion rates among NCAA hockey players).<sup>64</sup> Various studies have also sought to calculate the average number of concussions in an NHL season, which have reported concussion incidence as follows:<sup>65</sup>

Summary of reported concussion incidence

	Wennberg & Tator (2003)	Meeuwisse, Burke & Benson (2003)	Stevens et al (2008)	Wennberg & Tator (2008)	Benson et al (2011)	Hutchison et al (2013)	Izraelski et al (2013)
	<b>Concussions</b>						
<b>Season</b>							
1986/1987	Mean: 11.6/season						
1987/1988							
1988/1989							
1989/1990							
1990/1991							
1991/1992							
1992/1993							
1993/1994							
1994/1995 <sup>64</sup>							
1995/1996							
1996/1997	Mean: 55.8/season	Mean: 97/season		Mean: 68.8/season	Mean: 80/season		
1997/1998							
1998/1999							
1999/2000							
2000/2001							
2001/2002			44				
2002/2003							
2003/2004							
2005/2006							
2006/2007							
2007/2008			Mean: 74.2/season				
2008/2009					Mean: 63.8/season		
2009/2010							
2010/2011							
2011/2012							

<sup>64</sup> R.A. Wennberg & C.H. Tator, *Concussion incidence and time lost from play in the NHL during the past ten years*, 35 CAN. J. NEUROL. SCIS. 5 (2008); J. Agel & E. J. Harvey, *A 7-year review of men’s and women’s ice hockey injuries in the NCAA*, 53 CAN. J. SURG. 5 (2010).

<sup>65</sup> J. Izraelski, *Concussions in the NHL: A Narrative Review of the Literature*, 58 J. CAN. CHIROPRACTIC ASS’N 4 (2014).

73. According to Izraelski, however, these estimates may not accurately reflect the true number of concussion-induced retirements, which some have speculated could be double (or more) the officially recorded rates.<sup>66</sup>

74. In addition to reviewing scientific literature, I have also reviewed certain documents produced by the NHL and third parties that show the common occurrence of concussions in professional ice hockey specifically.

75. In 1997, the NHL launched its flagship “Concussion Program,” which lasted until 2004. According to the Concussion Program Report, disseminated in 2011, NHL team physicians reported 559 concussions during regular season games over the Program’s 7 year period.<sup>67</sup> The estimated incidence was 1.8 concussions per 1,000 player-hours and 5.8 concussions per 100 players per season.<sup>68</sup>

76. From 1997 to 2001, NHL player concussions increased steadily, from 56 recorded concussions in 1997 to 109 in 2001.<sup>69</sup> From 2001 to 2009, NHL player concussions leveled-off to roughly 70 recorded concussions per year, not accounting for 2005 and 2006.<sup>70</sup>

77. The Concussion Program Report also found that 20% of NHL players returned to play during the same game in which they suffered a concussion, and in nearly 10% of cases, they returned to play after seeing a team physician.<sup>71</sup> Additionally, video analysis conducted by the NHL of games from 2006 to 2014 shows that 101 out of 186 NHL players who showed visible signs of concussion returned to play later in the same game.<sup>72</sup>

---

<sup>66</sup> *Id.* This conclusion is bolstered by reports, such as those from the New York Times, which indicate that NFL concussion research was critically flawed throughout the 1990’s and 2000’s. See A. Schwarz et al., *N.F.L.’s Flawed Concussion Research and Ties to Tobacco Industry*, N.Y. TIMES, Mar. 24, 2016.

<sup>67</sup> NHL0025775.

<sup>68</sup> *Id.*

<sup>69</sup> NHL0072530-531.

<sup>70</sup> *Id.*

<sup>71</sup> NHL0025775.

<sup>72</sup> NHL1827768, at 771.

78. In 2010, the NHL created a “Concussion Protocol.” After launching the Protocol, NHL player concussions and man games lost to concussion increased. In 2010, 88 NHL players suffered concussions and 418 man games lost were reported.<sup>73</sup> In 2011, 142 NHL players suffered concussions and 1,267 man games lost were reported.<sup>74</sup> Finally, in 2012, 130 NHL players suffered concussions and 1,536 man games lost were reported.<sup>75</sup>

79. I also reviewed documents produced by the NHL confirming its knowledge regarding the commonality of concussions among its players. For example, internal correspondence amongst NHL employees confirms that the League was aware of the risk concussions posed to its business, stating: “We [the NHL] need to protect our players (if necessary from themselves). Our cost from concussions every season is probably millions. What concussions do to prematurely shorten the careers of our good players is also a hidden but real cost. I think the time is right to make the effort to improve what is presently an unacceptable situation.”<sup>76</sup> Another NHL executive was more direct, stating: “I think it simply goes back to concussions [suffered by players] and brain injuries.”<sup>77</sup>

80. Further, the NHL has acknowledged internally that fighting causes concussions and long-term mental health issues, stating: “Fighting raises the incidence of head injuries/concussions, which raises the incidence of depression onset, which raises the incidence of personal tragedies.”<sup>78</sup>

## **2. Underreporting of Concussions**

81. Underreporting of concussions exists in all sports and is a special challenge in a few sports such as football and ice hockey. Football’s rules and rhythms camouflage the problem. In a football game, there is more “stop time” than “go time” – 30 seconds between

---

<sup>73</sup> NHL0098266, at 268.

<sup>74</sup> *Id.*

<sup>75</sup> *Id.*

<sup>76</sup> NHL2477910, at 914.

<sup>77</sup> NHL0034241.

<sup>78</sup> NHL0155220.



plays and 4 or 5 seconds for the average play. Unless he's the quarterback, a concussed player isn't usually speaking in the huddle. He's wearing a huge helmet, so no one can look into his eyes if they are trying, which they probably are not. Line up these factors and a running back might be able to play a series or even a half before it is discovered he was playing impaired. The similarly armored and unsupervised hockey player faces similar factors, which mask the visible symptoms of concussion.

82. Underreporting of concussions in youth ice hockey has also been documented in several studies, and a recently published one suggests the problem is significant. The study's primary author, Dr. Paul Echlin, a physician from London, Ontario, worked with researchers from an organization called the Hockey Concussion Education Program.<sup>79</sup> Dr. Echlin and his colleagues followed two junior hockey teams in Ontario throughout the 2009-10 season. These were highly competitive teams – a number of players hoped to graduate to college hockey programs. The players' ages ranged from 16 to 21.

83. The purpose of the study was straightforward: to track the number of concussions reported among the players on the two teams. Just as importantly, Dr. Echlin was also looking for evidence of possible concussions that were missed by either coaches, medical personnel, or the players themselves. Or ones that were simply ignored.

84. When the study was released in 2010, it garnered a great deal of attention. Most significantly, the study empirically proved that ice hockey is very dangerous, in terms of the frequency and severity of head impacts.

85. An earlier study looking at NCAA Division I ice hockey programs observed that the rate of concussions reported was 3.1 concussions per 1,000 man-games played. The Echlin study, observing athletes of roughly the same age playing the exact same sport, found an actual rate nearly 7 times greater than that – 21.5 concussions per 1,000 man-games played.

---

<sup>79</sup> P.S. Echlin et al., *A Prospective Study of Physician-Observed Concussions During Junior Ice Hockey: Implications for Incidence Rates*, 29 NEUROSURG. FOCUS 5 (2010).

86. The Echlin study, however, was more troubling than just the greater number. The study described a culture in which concussions were not treated as a serious health issue or, it seemed, an issue at all. Players described being under pressure from their coaches to continue playing even when they had been told by medical professionals that they had suffered concussions and should take time off and rest. The attitudes of some of the players' parents were even more puzzling. One told the Echlin research team that it should stop conducting research on the team and let his son go back to thinking about hockey instead of the potential for injury, stating: "He needs to play on instincts and can't be worried about getting a concussion every time he goes into the corner." The researchers might have heard more comments like that had they been allowed to complete the season with both teams – they were not. The general manager of one team pulled his team out of the study midway through the season, telling the researchers that he no longer wanted his players submitting to in-game examinations.

87. An interesting angle of the Echlin study is the way in which the researchers collected information. At the hockey games, physician-observers were placed in the stands. When one saw a player get up slowly or noticed that a player seemed stunned from a blow, the observer would note it and, between periods, go to the locker room to examine the player involved. The examinations often turned up concussions that coaches, players, and on-the-bench medical personnel themselves had overlooked. For every one concussion identified by the coaches, players, and training staff, the physician-observers identified seven.

88. Not surprisingly, the NHL has internally acknowledged that underreporting of concussions exists in the league.<sup>80</sup>

## **E. The Effects of Repeat Concussions and Subconcussive Hits**

### **1. Second Impact Syndrome**

89. As mentioned above, SIS is a rare but widely feared complication of mTBI. SIS refers to situations where "an athlete who has sustained an initial head injury, most often

---

<sup>80</sup> NHL0035193.

a concussion, sustains a second head injury before the symptoms associated with the first have fully cleared.”<sup>81</sup>

90. SIS typically presents as a concussive blow, followed by a second, comparatively minor blow to the head and subsequent lapse into a coma. It is believed that severe cerebrovascular engorgement and cerebral oedema ensue following the second impact leading to brain herniation.<sup>82</sup>

## 2. Post-Concussion Syndrome

91. When post-concussion symptoms persist beyond one month, most refer to this condition as PCS. It can be thought of as a very severe concussion and its presence should be recorded in the medical records. Persistent PCS beyond one year is felt by some to be a contraindication to ever return to a collision sport, and is observed in 10%-15% of mTBIs.<sup>83</sup> While most cases of PCS eventually recover, not every case does in fact recover. These instances of Chronic PCS (CPCS) can be distinguished from CTE by the relative prominence of headaches in CPCS and immediacy of symptoms, as compared to the relative lack of headaches and delayed – often for decades – insidious symptom onset of CTE.<sup>84</sup>

92. PCS symptoms can include headaches, fatigue, memory problems, feeling in a fog, depression, impulsivity, and other physical, cognitive, mood, and behavioral problems. There may be treatments that can alleviate some or all of these symptoms and, in almost all cases, they resolve eventually.

---

<sup>81</sup> R.C. Cantu, *Second-impact syndrome*, CLIN. SPORTS MED. 17 (1998).

<sup>82</sup> H. Ling et al., *Neurological consequences of traumatic brain injuries in sports*, MOLECULAR CELLULAR NEUROSCI. 66 (2015).

<sup>83</sup> W.H. Williams et al., *Mild traumatic brain injury and Postconcussion Syndrome: a neuropsychological perspective*, J. NEUROL. NEUROSURG. PSYCHIATRY 81 (2010).

<sup>84</sup> J.D. Barry, *The clinical spectrum of sport-related traumatic brain injury*, 9 NATURE REVIEWS NEUROLOGY 4 (2013).

93. Although predictors of PCS are not known with certainty, a history of prior concussions appears to increase the risk of PCS.<sup>85</sup> No study has identified the severity of concussive or subconcussive impact as a factor contributing to the development of PCS.

94. The connection between persistent cases of PCS and CTE at this time is not clear, as CTE develops years after PCS exposure and presents with primarily cognitive, behavioral, and mood symptoms.<sup>86</sup>

### 3. Chronic Traumatic Encephalopathy and Other Long-Term Neurodegenerative Diseases

95. Repetitive mTBI can trigger the development of CTE, a progressive neurodegeneration characterized by the widespread deposition of hyperphosphorylated tau (p-tau) as neurofibrillary tangles that begin at the depths of cerebral sulci in a patchy perivascular distribution.<sup>87</sup> CTE was originally reported in its earliest understanding in 1928

---

<sup>85</sup> J. Ponsford et al., *Factors influencing outcome following mild traumatic brain injury in adults*, 6 J. INT'L NEUROPSYCHOL. SOC. 5 (2000); K.M. Guskiewicz et al., *Cumulative effects associated with recurrent concussion in collegiate football players: the NCAA Concussion Study*, 290 JAMA 19 (2003).

<sup>86</sup> K.G. Harmon et al., *American Medical Society for Sports Medicine position statement: concussion in sport*, 47 BR. J. SPORTS MED. 1 (2013).

<sup>87</sup> J.A. Corsellis & J.B. Brierley, *Observations on the Pathology of Insidious Dementia Following Head Injury*, 105 J. MENTAL SCI. 714 (1959); J.A. Corsellis, C.J. Bruton & D. Freeman-Browne, *The Aftermath of Boxing*, 3 PSYCHOL. MED. 3 (1973); P.R. Hof, R. Knabe, P. Bovier & C. Bouras, *Neuropathological Observations in a Case of Autism Presenting With Self-Injury Behavior*, 82 ACTA NEUROPATHOLOGY 321 (1991) (Eur.); J.F. Geddes et al., *Neuronal Cytoskeletal Changes are an Early Consequence of Repetitive Head Injury*, 98 ACTA NEUROPATHOLOGY 171 (1999); B.I. Omalu et al., *Chronic Traumatic Encephalopathy in a National Football League Player*, 57 NEUROSURG. 128 (2005); B.I. Omalu et al., *Chronic Traumatic Encephalopathy in a National Football League Player: Part II*, 59 NEUROSURG. 1086 (2006); B.I. Omalu et al., *Chronic Traumatic Encephalopathy, Suicides and Parasuicides in Professional American Athletes: The Role of the Forensic Pathologist*, 31 AM. J. FORENSIC MED. PATHOLOGY 130 (2010); A.C. McKee et al. (2009); A.C. McKee et al., *TDP-43 Proteinopathy and Motor Neuron Disease in Chronic Traumatic Encephalopathy*, 69 J. NEUROPATHOLOGY EXPERIMENTAL NEUROLOGY 918 (2010); B.E. Gavett et al., *Mild Traumatic Brain Injury: A Risk Factor for Neurodegeneration*, 2 ALZHEIMER'S RES. THERAPY 18 (2010); Gavett et al. (2011); D.H. Daneshvar et al., *Helmets and Mouth Guards: The Role of Personal Equipment in Preventing Sport- Related*

by Harrison Martland, describing the clinical aspects of a progressive neurological deterioration that occurred after repetitive brain trauma in boxers in his seminal study, “Punch Drunk.”<sup>88</sup> Later termed “dementia pugilistica,”<sup>89</sup> only isolated cases were discussed in medical literature until Corsellis *et al.* published a series of 15 cases describing the clinical and pathological features, causing dementia pugilistica to be differentiated from other neurodegenerative diseases.<sup>90</sup> Corsellis *et al.* further opined:

“It may well be, therefore, as it is sometimes claimed, that the introduction of stricter medical and administrative control of the number and the nature of contests has considerably reduced the prevalence of cerebral damage. It seems, however, unlikely that all risk can have been eliminated. A single punch, or even many punches, to the head need not visibly alter the structure of the brain, but there is still the danger that, at an unpredictable moment and for an unknown reason, one or more blows will leave their mark. The destruction of cerebral tissue will have then begun and, although this will usually be slight enough in the early stages to be undetectable, it may build up, if the boxing continues, until it becomes clinically evident.”<sup>91</sup>

---

*Concussions*, 30 CLINICAL SPORTS MED. 1 (2011); D.H. Daneshvar et al., *The Epidemiology of Sport-Related Concussion*, 30 CLINICAL SPORTS MED. 1 (2011); A. Costanza et al., *Review: Contact Sport-Related Chronic Traumatic Encephalopathy in the Elderly: Clinical Expression and Structural Substrates*, 37 NEUROPATHOLOGY APPLIED NEUROBIOLOGY 570 (2011); R.A. Stern et al., *Longterm Consequences of Repetitive Brain Trauma: Chronic Traumatic Encephalopathy*, 3 PHYSICAL MED. REHABILITATION S460 (2011); L.E. Goldstein et al., *Chronic Traumatic Encephalopathy in Blast-Exposed Military Veterans and a Blast Neurotrauma Mouse Model*, 72 SCI. TRANSLATIONAL MED. 134 (2012); T. Saing et al., *Frontal Cortex Neuropathology in Dementia Pugilistica*, 29 J. NEUROTRAUMA 1054 (2012).

<sup>88</sup> Osnato, *supra* n.7.

<sup>89</sup> H.L. Parker, *Traumatic encephalopathy ('punch drunk') of professional pugilists*, 15 J. NEUROL. PSYCHOPATHOL. 57 (1934).

<sup>90</sup> J.A. Corsellis et al., *The aftermath of boxing*, 3 PSYCHOL. MED. 3 (1973).

<sup>91</sup> *Id.*

96. During this era, researchers also recognized that activities other than boxing were associated with dementia pugilistica's development, which led to the preferred use of terms such as progressive traumatic encephalopathy, and ultimately, CTE.<sup>92</sup>

97. Alongside the study of boxing-related disability, in 1962 Symonds postulated that, "[i]n the most severe degree of concussion there is widespread irreparable damage. In the slightest degree there may be rapid and complete recovery of cerebral function; but this does not necessarily exclude the possibility that a small number of neurons may have perished – a number so small as to be negligible at the time, but leaving the brain more susceptible as a whole to the effects of further damage of the same kind."<sup>93</sup> Symonds' findings were later supported in a study published Rimel *et al.* in 1981, noting that "[i]t is questionable whether the effects of concussion, however slight, are ever completely reversible,"<sup>94</sup> and again by Ommaya and Gennarelli in 1983.<sup>95</sup>

98. In fact, in 1975, studies were touting evidence of intellectual dysfunction as a result of cumulative concussions, as Gronwall and Wrightson concluded that, "[w]hatever the mechanism for this fall-off in intellectual performance, doctors do have a duty to convince the controlling bodies and participants in sports where concussion is frequent that the effects are cumulative and that the acceptance of concussion injury, though gallant, may be very dangerous."<sup>96</sup> In light of the scientific developments forming the foundation for the modern understanding of LTND, the modern definition of CTE merely memorialized the panoply of definitions and studies.

---

<sup>92</sup> M. Critchley, *Punch-Drunk Syndromes: The Chronic Traumatic Encephalopathy of Boxers*, HOMMAGE À CLOVIS VINCENT (1949) (Fr.); M. Critchley, *Medical Aspects of Boxing, Particularly from a Neurological Standpoint*, BR. MED. J. 357 (1957).

<sup>93</sup> C. Symonds, *Concussion and its sequelae*, 279 LANCET 7219 (1962).

<sup>94</sup> R.W. Rimel et al., *Disability caused by minor head injury*, 9 NEUROSURGERY 3 (1981).

<sup>95</sup> A. K. Ommaya, *The Head: Kinematics and Brain Injury Mechanisms*, THE BIOMECHANICS OF IMPACT TRAUMA 120 (B. Aldman and A. Chapon ed., 1984).

<sup>96</sup> D. Gronwall & P. Wrightson, *Cumulative effects of concussion*, 306 LANCET 7943 (1975).

99. CTE may manifest in cognitive, mood, behavioral, and motor disorders and is clinically associated with symptoms of irritability, impulsivity, aggression, depression, short-term memory loss, and heightened suicidality.<sup>97</sup>

100. Often there can be a delay of years, or even decades, between the end of the repetitive head impacts (*i.e.*, the end of playing the contact sport) and the beginning of the symptoms. CTE often presents with recent memory loss and other cognitive impairments similar to those experienced by people with Alzheimer's disease. People with CTE can also have changes in behavior (*e.g.*, impulsivity, rage, aggression, having a short fuse) and mood (*e.g.*, depression, hopelessness, feeling suicidal). Less commonly, there can be movement disorders such as parkinsonism (*i.e.*, tremor, difficulty walking or speaking, stiffness). Some people with CTE may first have behavior or mood problems. Others may first have cognitive difficulties, with changes in mood and behavior later.

101. With advancing disease, more severe neurological changes develop that include dementia, gait and speech abnormalities, and Parkinsonism. In late stages, CTE may be clinically mistaken for Alzheimer's disease or frontotemporal dementia.<sup>98</sup> A subset of cases with CTE is associated with motor neuron disease<sup>99</sup> that could be diagnosed clinically as Amyotrophic Lateral Sclerosis (ALS) or "Lou Gehrig's Disease."

102. The neuropathological changes of CTE are distinctive and easily distinguished from other tauopathies, including Alzheimer's disease and frontotemporal dementia. With CTE, there is atrophy of the cerebral cortex, medial temporal lobe, diencephalon, and mammillary bodies with enlarged ventricles; cavum septum pellucidum, often with fenestrations; extensive p-tau-immunoreactive neurofibrillary tangles and astrocytic tangles in the frontal and temporal cortices, particularly around small cerebral vessels and at the

---

<sup>97</sup> A.C. McKee et al., *Chronic Traumatic Encephalopathy in Athletes: Progressive Tauopathy after Repetitive Head Injury*, 68 J. NEUROPATHOLOGY EXPERIMENTAL NEUROL. 709 (2009).

<sup>98</sup> B.E. Gavett et al., *Mild Traumatic Brain Injury: A Risk Factor for Neurodegeneration*, 2 ALZHEIMER'S RES. THERAPY 18 (2010); Gavett, *supra* n. 46.

<sup>99</sup> McKee, *supra* note 39.



depths of cerebral sulci; extensive p-tau-immunoreactive neurofibrillary tangles in limbic regions, diencephalon, and brainstem nuclei; extensive degeneration of axons and white matter fiber bundles; TAR DNA-binding protein 43 (TDP-43) immunoreactive intraneuronal and intraglial inclusions occur in most cases with absent or minimal amyloid-B peptide deposits.<sup>100</sup>

103. In 2008, the Center for the Study of Traumatic Encephalopathy (CSTE) at Boston University School of Medicine established the CSTE brain bank at the Bedford VA Hospital in Bedford, MA under the direction of Dr. Ann McKee to analyze the brain and spinal cords after death of athletes, military veterans, and civilians who experienced repetitive mTBI. Through this effort, CSTE has comprehensively analyzed the brain and spinal cord of 165 donors for evidence of CTE, as well as for all other neurodegenerative diseases including Alzheimer's disease, frontotemporal lobar degeneration, Parkinson's disease, Lewy body disease, and multiple system atrophy.

104. The CSTE reported the results of their initial analysis of donated brains in the aptly-named journal, *Brain*.<sup>101</sup> CTE was found in 68 of 85 cases including 64 athletes, 21 military veterans, and 1 individual who indulged in serious head-banging behavior. Of the athletes, 49 were football players, 34 were former professional football players, 9 had played only college football, and 6 had played only high school football. Later, in 2015, McKee *et al* examined an additional cohort of NFL player brains, and CTE was found in 87 out of 91 brains examined by the CSTE.<sup>102</sup>

---

<sup>100</sup> Corsellis & Brierley, (1959); Corsellis et al., (1973); Hof et al., (1991); Geddes et al., (1999); Omalu et al., (2005, 2006, 2010); McKee et al., (2009, 2010); Gavett et al., (2010, 2011); Daneshvar et al., (2011); Costanza et al., (2011); Stern et al., (2011); Goldstein et al., (2012); Saing et al., (2012).

<sup>101</sup> A.C. McKee et al., *The Spectrum of Disease in Chronic Traumatic Encephalopathy*, 136 *BRAIN* 1 (2013).

<sup>102</sup> J. M. Breslow, *New: 87 Deceased NFL Players Test Positive for Brain Disease*, *FRONTLINE* (Sept. 18, 2015), <http://www.pbs.org/wgbh/frontline/article/new-87-deceased-nfl-players-test-positive-for-brain-disease/>.



105. Though widespread studies of deceased NHL player brains have not been performed at a similar rate as in the NFL, several NHL players have been posthumously diagnosed with CTE. This includes Bob Probert, Reggie Fleming, Rick Martin, Steve Montador, and Derek Boogaard, with other suspected-yet-undiagnosed cases such as the suicides of enforcers Rick Rypien and Wade Belak.

106. In a December, 2015 study published by the Mayo Clinic, researchers analyzed 1,721 donated brains, identifying 66 males who participated in contact sports during their youth and young adult years.<sup>103</sup> Of these 66 brains, 32% had CTE pathology, whereas **none** of the 198 brains of individuals without documentation of participation in contact sports exhibited CTE pathology.

#### **V. INCREASED RISK OF DEVELOPING A NEURODEGENERATIVE DISEASE AS A RESULT OF PLAYING PROFESSIONAL ICE HOCKEY**

107. Participating in a contact sport has been known for decades to increase an individual's risk for developing a LTND disease. These athletes, particularly those who make it to the professional level, are exposed to thousands of blows to the head over the course of many years. CTE, among other LTND diseases, has been diagnosed in a wide range of individuals with a history of head trauma, including football players, soccer players, hockey players, boxers, wrestlers, and soldiers who have received battlefield mTBIs and TBIs.<sup>104</sup> It is typically diagnosed in older retirees, but has been reported in athletes as young as 17, who only played sports in high school or college. Given the wide range of people that are diagnosed, and the ever-growing increase in reported cases, CTE is clearly more prevalent than previously thought, and the same is certainly true of other LTND diseases.

---

<sup>103</sup> K.F. Bieniek et al., *Chronic traumatic encephalopathy pathology in a neurodegenerative disorders brain bank*, 130 ACTA NEUROPATHOLOGICA 6 (2015).

<sup>104</sup> A.C. McKee et al., *The spectrum of disease in chronic traumatic encephalopathy*, 136 BRAIN 1 (2013).

108. Though limited studies have been performed of the risks of neurodegenerative disease specifically associated with a career in NHL hockey, numerous studies on NFL players provide an excellent parallel through which risks can be inferred for NHL players.

109. In one recent cohort mortality study of 3,439 former NFL players, the mortality rate for retired players was significantly lower to that of U.S. men, yet mortality was significantly higher for all neurodegenerative causes combined.<sup>105</sup> Specifically, mortality attributed to neurodegenerative disease was discovered to be three times greater than that of the general population.<sup>106</sup>

110. Using a retrospective self-report study sent to the National Football League Retired Player's Association, Guskiewicz *et al.* found a higher incidence of mild cognitive impairment (MCI) and depression in former NFL athletes with a history of concussion compared to those who did not have a history of concussion. More specifically, retired players with three or more reported concussions had a fivefold prevalence of being diagnosed with MCI and a threefold prevalence of reported significant memory problems compared with those players without a history of concussion.<sup>107</sup>

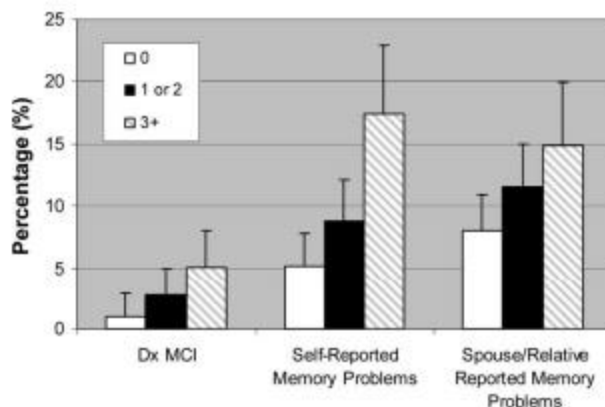
111. The following chart, included in Guskiewicz's paper, demonstrates the relationship between cognitive impairment and the number of self-reported sustained concussions. Whether the cognitive impairment was diagnosed by a doctor, self-reported, or reported by a spouse or relative, Guskiewicz identified a clear correlation between number of self-reported concussions and cognitive impairment:

---

<sup>105</sup> E.J. Lehman et al., *Neurodegenerative causes of death among retired National Football League players*, 79 NEUROLOGY 19 (2012).

<sup>106</sup> *Id.*

<sup>107</sup> Guskiewicz, *supra* n. 51.



112. In a later follow-up study specifically analyzing the relationship between self-reported concussions and depression, Guskiewicz again submitted questionnaires to retired NFL athletes and interpreted those results.<sup>108</sup>

113. When asked if their TBIs affected their cognitive abilities, of the retirees who had sustained one or two self-reported previous concussions, 11.5% (95% CI: 9.4, 13.6) reported that the injuries have had a permanent effect on their thinking and memory skills as they aged. This increased to 31.1% (95% CI: 27.4, 34.8) in those with three or more self-reported previous concussions, again suggesting a positive correlation between a higher number of concussions, and the perception that those concussions impair cognitive functioning, consistent with Guskiewicz's previous study.<sup>109</sup>

114. Likewise, retired NFL players reporting three or more prior concussions were three times more likely to be diagnosed with depression, and those with one or two prior concussions were one and a half times more likely to have been diagnosed with depression, relative to retirees with no concussion history.<sup>110</sup>

115. In another study examining chronic depression among World War II retirees, after accounting for age, education, and health conditions, an 18.5% lifetime prevalence of depression was observed in veterans who suffered a head injury during their military service,

<sup>108</sup> K.M. Guskiewicz et al., *Recurrent concussion and risk of depression in retired professional football players*, 39 MED. SCI. SPORTS EXERC. 6 (2007).

<sup>109</sup> *Id.*

<sup>110</sup> *Id.*

which was significantly higher than the observed 13.4% lifetime prevalence for those without a history of head injury.<sup>111</sup>

116. This link between repeated concussive and subconcussive blows and an increased risk of developing an LTND disease has been recently acknowledged by Jeff Miller, the NFL's senior vice president of health and safety, in the case of retired NFL players.<sup>112</sup>

## **VI. MEDICAL MONITORING FOR RETIRED NHL PLAYERS**

### **A. Retired NHL Players Require Medical Monitoring More than the Average Person or General Population**

117. As discussed above, the majority of NHL players are exposed to multiple – in many cases hundreds, if not thousands – of blows to the head over the course of their NHL careers. This is due to the high number of full-contact activities to which NHL players are exposed. First, NHL players compete in 82 regular season games, all full-contact, every NHL season. Additionally, NHL players compete in numerous pre-season and mid-season practice activities, including full-contact scrimmages. Many also compete in the NHL playoffs, which is also full-contact. Finally, the average NHL player participates in numerous seasons during his NHL career.

118. Given this high level of activity, and given the physical way in which professional hockey is played (*see supra* Section IV(D)(1)), I believe NHL players as a group have suffered cellular and subcellular injuries from repeated concussive and subconcussive blows, from which the general population does not suffer.

---

<sup>111</sup> T. Holsinger et al., *Head injury in early adulthood and the lifetime risk of depression*, 59 ARCH. GEN. PSYCHIATRY 1 (2002).

<sup>112</sup> Nancy Armour, *Armour: NFL exec's admission of link between football and CTE long*, USA TODAY, Mar. 16, 2016 12:15 a.m. EDT, <http://www.usatoday.com/story/sports/nfl/2016/03/15/nfl-cte-concussions-congress/81799838/>.

**B. Purpose and Goals of a Medical Monitoring Program for Retired NHL Players**

119. Concussions and sub-concussive hits that are unrecognized put athletes at considerable risk of potentially catastrophic sequelae from re-injury. Repetitive head trauma – whether concussion or subconcussive hits – from participation in contact sports such as football, soccer, ice hockey, basketball, field hockey, lacrosse, and wrestling can lead to a permanent decrease in brain function, including, among others: memory loss, early Alzheimer’s disease, early Alzheimer’s-like disease called CTE, movement disorders such as parkinsonism, ALS, and emotional disturbances. Also, as discussed above, one of the most notable complications of concussion is SIS. In this syndrome, an athlete who is recovering from an initial concussion sustains a subsequent concussive injury, resulting in diffuse brain swelling and severe, permanent neurological dysfunction or death. Thus, timely diagnosis and prompt treatment can help prevent more serious concussion complications.

120. Here, the purpose of a medical monitoring program for retired NHL players is to determine whether they are suffering from PCS or a neurodegenerative disease or condition resulting in cognitive impairments or behavioral or mood disturbances. Athletes may not have any idea that the debilitating symptoms that they are experiencing were caused by their head injuries – and thus are not seeking the available treatments and counseling that they need to ease their symptoms associated with their head injuries.

121. Specifically, armed with a diagnosis of PCS or a neurodegenerative disease such as CTE or early Alzheimer’s, NHL retirees will be able to seek the intervention and treatment they need. Treatment of PCS or treatment of the symptoms of a neurodegenerative disease focuses on helping the person return to an active, functional lifestyle. Treatment incorporates physical and cognitive therapy and counseling programs to help alleviate difficulties associated with mTBI (for PCS) or the cognitive, behavioral, or mood symptoms associated with a neurodegenerative disease. It may include physical therapy for difficulties with motor and vestibular sensitivity; occupational therapy to address daily activities and functional vision deficits; speech and language therapy to improve language skills and cognitive deficits; and psychological counseling to cope with impulse control problems,

depression, anxiety, panic attacks, or simply concerns at home or work. Athletes may be prescribed medication in cases that fail to respond to physical, cognitive or psychological therapy alone. This is especially true when one symptom dominates all others.

122. Treatments for PCS or the cognitive, behavioral, or mood symptoms of a neurodegenerative disease are aimed at easing the specific symptoms in order to allow the injured person to lead a more normal life. Moreover, the symptoms of PCS or a neurodegenerative disease often improve after the affected person learns that there is a cause for his or her symptoms. This is particularly true with PCS, where the symptoms may improve with time. Education about the disorder or disease can ease a person's fears and help provide peace of mind, including gaining the knowledge that their symptoms are not genetic and will not pass down to children.

123. For example, one symptom of PCS is headaches. Many athletes with headaches may try to self-medicate, but overuse of over-the-counter and prescription pain relievers may actually contribute to persistent post-concussion headaches. Thus, a diagnosis of PCS will allow an athlete to seek proper treatment for their headaches. Medications commonly used for migraines or tension headaches, including some antidepressants, appear to be effective when these types of headaches are associated with PCS. These medications may include Amitriptyline, which has been widely used for post-traumatic injuries, as well as for symptoms commonly associated with PCS such as headaches, irritability, dizziness, and depression. Amantadine, Nortriptyline, Propranolol, or Verapamil can also help greatly.

124. Another symptom of PCS, as well as of CTE, Alzheimer's, Lewy Body Dementia, and Frontal Lobe Dementia, is a problem with memory and thinking, such as an inability to organize or multitask. Athletes with these problems may believe that they are suffering from Attention-Deficit Disorder (ADD) or Attention-Deficit/Hyperactivity Disorder (ADHD) but in fact, with an appropriate diagnosis of PCS or a neurodegenerative disease, could obtain cognitive therapy. Cognitive rehabilitation can address thinking problems through a number of treatment approaches.

125. Cognitive rehabilitation may include education in order to improve an individual's understanding of thinking processes. With increased awareness, people may

start to feel a sense of control and support and will realize their symptoms are not uncommon or genetic.

126. Cognitive rehabilitation may include compensating. Therapists can provide individuals with practical ideas they can implement to compensate for cognitive difficulties. These suggestions are tailored to meet each person's specific needs for improving functioning at home and/or work. The use of memory aids and time management techniques are examples of compensatory strategies.

127. Cognitive rehabilitation may include process-specific training, which consists of intensive exercises designed to provide repetitive practice in identified problem areas such as attention. Through this practice, individuals develop a greater understanding of where breakdowns occur and how to manage them outside of the treatment setting. The overall goal of cognitive therapy is to increase the individual's ability to meet the cognitive demands of daily life.

128. For difficult cognitive or thought symptoms (*e.g.*, feeling in a fog) or problems with concentration or memory, the neurostimulants in the methylphenidate group—Ritalin, Adderall, Concerta, Strattera, and Amantadine—can also be very beneficial.

129. Specific mood symptoms of PCS and CTE include severe depression, anxiety, and panic attacks. Some treatment options include psychotherapy and/or medication such as Lexapro or Zoloft. Trouble falling asleep can be helped by melatonin and the prescription medications Trazodone or Ambien. Other non-medical therapies that are employed with success in persons suffering from mood problems include vestibular therapy (*i.e.*, head and eye exercises) if dizziness or balance are primary symptoms, and upper cervical spine physical therapy for pain in the upper neck and back of the head.

130. Specific behavioral symptoms of those clinically diagnosed with PCS or a neurodegenerative disease include anger management and impulse control problems. Psychotherapy and counseling is often the first step in treatment of these behavioral symptoms. Pharmaceuticals such as Lexapro may also be employed by clinicians if therapy and counseling prove not to be adequate at alleviating the symptoms.



131. Ultimately, the goal of a medical monitoring program, in determining whether a retired NHL player has PCS, a mid- to late-onset neurodegenerative condition, or other neurological condition associated with head trauma, is to provide the retired NHL players with the information that they need to seek and receive treatment outside the confines of this medical monitoring program.<sup>113</sup>

**C. Benefits to Retired NHL Players of Early Intervention through a Medical Monitoring Program**

132. A medical monitoring program will benefit Retired NHL Players in numerous ways. First, medical monitoring will categorize Retired Players according to their specific medical condition. This categorization is useful because it will identify Retired Players who may benefit from new treatments aimed at addressing, and ideally alleviating, their specific medical condition.

133. Next, medical monitoring will assist in identifying and modifying Retired Players' behavior for known or suspected contributory comorbidities (*e.g.*, alcohol use, smoking, etc.). Identification and modification is useful because it can ultimately lead to correction and elimination of potential comorbidities.

134. Finally, medical monitoring will potentially qualify Retired Players for various other medically necessary interventions (*e.g.*, psychological examinations, support groups for individuals, supports groups for families, life planning, etc.). Intervention opportunities are useful because they provide a long-term care plan for Retired Players, not simply a “one-and-done” testing situation.

---

<sup>113</sup> The proposed medical monitoring program is similar to the NHL's independent medical examinations (“IMEs”) in both function and purpose. The NHL's expert, Dr. C. Warren Olanow, suggested that the IMEs feature “a neurological examination, bloodwork, brain imaging (MRI), neuropsychological testing and psychiatric evaluation.” *See* Dkt. 403-6 ¶23. The goals of these tests were to determine the presence of symptoms and rule out causes other than LTNDs, and “diagnos[e] disorders of the central and peripheral nervous systems, determin[e] the need for investigations to establish or confirm a diagnosis, and plan[] therapy for these disorders” *Id.* at ¶25. These are the same goals of the proposed medical monitoring program discussed below.



135. At bottom, while there is at present no cure for any of the neurodegenerative diseases associated with repetitive head trauma, there are many ways in which individuals clinically diagnosed with a neurodegenerative disease may alleviate some or all of the cognitive, behavioral, or mood symptoms associated with such a disease and function better in their daily lives.

#### **D. Recommended Medical Monitoring Program and Associated Costs**

##### **1. Overview of Scope and Costs**

136. In my opinion, based on my experience and consensus best practices, the medical monitoring program should include focused neurocognitive, visual, and balance assessments as part of the overall neurological examination. Specifically, it would be reasonable to perform (a) a comprehensive history and neurological examination (to be done by a board certified neurologist, neurosurgeon, or physician trained in concussion management), (b) blood tests of pituitary function, (c) a neuropsychological examination, and (d) a standard MRI with susceptibility weighted imaging with medial temporal lobe (hippocampus) volume averaging.

137. Concussion and subconcussive hits may cause trauma to the calcarine cortex, which is in the back of the brain and controls vision, and the cerebellum, which is at the top of the neck and where balance and coordination are measured. These areas are assessed in the neurological assessment. Concussions and subconcussive hits may also cause trauma to the thinking and reasoning parts of the brain (*i.e.*, the medial temporal and frontal lobes). These areas are assessed in the neurocognitive assessment.

138. The neurological assessment would include a detailed prior concussion history; assessment of conditions that affect concussion recovery such as ADD, ADHD, depression, anxiety disorder, panic attacks, migraine, seizure disorders; a symptom checklist; a detailed neurological examination with special focus on cognitive, visual eye tracking with smooth pursuit and saccadic assessment or use of the King-Devick Test; and a balance assessment, such as with the Modified Balance Error Scoring System. Based on my experience, as well as published costs, the estimated physician cost for the neurological assessment is \$3,000.00

per person. The neurological assessment would be conducted by a physician with experience in the diagnosis, treatment, and management of concussion.

139. A comprehensive neuropsychological assessment should be carried out by a neuropsychologist experienced in concussion, PCS, and degenerative brain disorders carrying and utilizing a full battery of cognitive, behavioral, and mood tests. This testing will likely cost \$3,500.00. In my opinion, retired NHL players should be examined at the outset of the program and then should return for the same examination once every five years or when symptomatic.

140. A standard MRI with susceptibility weighted imaging with medial temporal lobe (hippocampus) volume averaging should also be a part of the baseline assessment. The MRI itself would cost approximately \$2,350.00, and the professional radiology services for reviewing the MRI would cost approximately \$260.00.

141. Blood work to assess Pituitary gland function, T-4, TSH, ACTH, cortisol, growth hormone, testosterone and the genetic marker apolipoprotein E should also be done and would cost approximately \$1,140.00.

142. If this medical monitoring program were approved, Request for Proposals would be issued to regional hospitals or centers across the United States and Canada to provide the described tests by the medical personnel described within the range of costs described. It is well known that such centers would include, but not be limited to, tertiary institutions (*i.e.*, teaching hospitals or trauma centers).

143. Moreover, prior to the initial appointment of each retired NHL player, the NHL would facilitate the transfer of the files and data maintained by the NHL (such as baseline and post-injury neuropsychological testing) and respective Club Teams (such as files maintained by the Team's athletic trainer(s)) reflecting the individual retired NHL player's medical history, testing, and care to the physician conducting the medical monitoring program.

144. The tests and examinations to be conducted at each retired NHL player's appointment(s) are described in detail below.

## 2. Neurological Assessment

145. The first component of the medical monitoring program is the neurological assessment, which should be performed by a board-certified neurologist or neurosurgeon specializing in concussions or CTE. The neurological assessment measures critical brain functions that can be adversely affected by head trauma, such as thought, balance, and vision.

146. The neurological assessment first includes a concussion history, a medical history with respect to conditions that may affect concussion recovery, and an assessment of current symptoms. In accordance with the consensus best practices, the retired NHL player would complete an intake sheet. Attached as Appendix D is an example of a concussion intake sheet that I use in my practice and I recommend for use here.

147. On the first page, the retired NHL player would list every single concussion they have ever had, the date of each concussion, and every single symptom they experienced for each concussion. For every symptom, the retired NHL player scores the symptom on a scale of 0 (not present) to 6 (severe). Based on that page, the physician scores the symptom load and score and determines not just how many previous concussions the patient had, but also how severe they were. This is important as a tool because not all concussions are equal and those with higher symptom scores, and those that last a long time, are of more concern.

148. On the second page, the retired NHL player would disclose conditions which affect concussion recovery and which will affect when the patient is truly asymptomatic. For example, if a patient has a history of migraines, the migraines may get worse from a concussion. However, the patient would be considered asymptomatic once the migraines were reduced back to the pain level, or baseline level, that preexisted the concussion. This is important as a tool to allow the physician to determine when the patient is asymptomatic as it relates to the concussions.

149. On the third page, the retired NHL player would disclose the symptoms they are experiencing on the day of presentment. While this third page lists the same symptoms as on the first page, the information sought is limited to that day's symptoms. This is

important as a baseline to compare with in the future to determine whether symptoms have improved or completely resolved.

150. Next, the physician would conduct a complete neurological examination, which includes three key parts that tend to have a great chance to show abnormalities.

151. First is the cognitive part, in which the physician tests memory, attention, and learning, all of which is tested in greater detail by the neurocognitive assessment tool described below.

152. The second part tests eye-tracking and vision and can be done using the King-Devick Test.<sup>114</sup> Published studies show that deficiencies in saccadic eye movements can be an indicator of mTBI. Studies published in *Neurology* and the *Journal of the Neurological Sciences* have determined that post head-trauma related deficiency in the King-Devick Test is an indicator of mTBI or concussions. The King-Devick Test is based on the time needed to perform rapid number naming. The Test involves reading aloud a series of single digit numbers from left-to-right on three test cards as quickly as possible without making any errors. The King-Devick Test takes two minutes to complete. The cost of the Test is \$1.75 per player for 1,000 players.

153. The third part tests balance and can be done using the Modified Balance Error Scoring System (BESS). Balance assessment or posturography integrates three systems in the body: somatosensory (*i.e.*, an individual's ability to determine touch, temperature, and their body's position in space); visual (*i.e.*, an individual's ability to see movement); and vestibular (*i.e.*, an individual's ability to balance or maintain equilibrium). Concussed athletes have difficulty integrating information from the three components of the balance mechanism. The Zurich Consensus Statement provides that "postural stability testing provides a useful tool for objectively assessing the motor domain of neurologic functioning, and should be considered a reliable and valid addition to the assessment of athletes suffering from concussion, particularly where symptoms or signs indicate a balance component." The

---

<sup>114</sup> K.M. Galetta et al., *The King-Devick test as a determinant of head trauma and concussion in boxers and MMA fighters*, 76 *NEUROLOGY* 17 (2011).

Modified BESS consists of two stances—standing on one leg and standing with one foot in front of the other—on a firm, foam surface. A study published in the *Clinical Journal of Sports Medicine* demonstrates that the Modified BESS provides reliable, objective information for clinicians.<sup>115</sup> This test takes approximately five minutes to complete.

### **3. Neurocognitive Assessment (a/k/a neuropsychological testing)**

154. The second component of the medical monitoring program is the neurocognitive assessment or neuropsychological (NP) testing performed by a neuropsychologist with specialized training in concussions or CTE. The NP assessment tests cognitive functioning or the thinking and reasoning parts of the brain (*i.e.*, medial temporal and frontal lobes). The Zurich Consensus Statement confirms that “[t]he application of NP testing in concussion has been shown to be of clinical value and continues to contribute significant information in concussion evaluation.” The NP assessment should include a combination of paper-and-pencil and computer-based testing. The testing can be carried out by a trained technician. If the results are abnormal, however, the results would need to be interpreted by a neuropsychologist.

155. Standard pencil-and-paper NP tests have proven useful for identifying cognitive deficits resulting from concussions. The tests are designed to assess various domains of cognitive functioning such as short-term memory, working memory, attention, concentration, visual spatial capacity, information processing speed, and reaction time. The tests assist in quantifying the severity of the brain injury. The paper-and-pencil tests take approximately one hour to administer and complete. The standard tests that would be used include:<sup>116</sup>

---

<sup>115</sup> T.N. Hunt et al., *The Reliability of the Modified Balance Error Scoring System*, 19 CLINICAL J. SPORT MED. 471 (2009).

<sup>116</sup> K.M. Guskiewicz et al., *National Athletic Trainers’ Association Position Statement: Management of Sport-Related Concussion*, 39 J. ATHLETIC TRAINING 280 (2004).

<b>Neuropsychological Domains Examined and Tests</b>	
<b>Domain</b>	<b>Test</b>
<b>Effort/Symptom Validity</b>	Word Memory Test (WMT)
<b>Estimated Premorbid Intelligence</b>	Wide Range Achievement Test (WRAT-4)
<b>Attention and Psychomotor Speed</b>	Trail Making Part A
	WAIS-IV Digit Span Test
	WAIS-IV Coding Subtest
<b>Executive Function</b>	Controlled Oral Word Association Test (COWAT)
	Trail Making Test, Part B
	Delis-Kaplan Executive Function System Color-Word Interference
	Wisconsin Card Sorting Test (WCST)
	Rey-Osterrieth Complex Figure (ROCF) with Boston Qualitative Scoring System (BOSS) Copy Condition
<b>Memory</b>	Neuropsychological Assessment Battery (NAB) List Learning
	NAB Story Learning
	ROCF-BOSS Immediate and Delayed Recalls
<b>Language</b>	Animal Fluency
	NAB Naming Test
<b>Visuospatial Ability</b>	ROCF-BOSS Copy Condition
<b>Dementia Severity</b>	Functional Activities Questionnaire (FAQ) – Informant Based
	Clinical Dementia Rating (CDR)

156. The NP testing should include a mood and behavioral evaluation. The assessment of mood and behavioral functioning would include: the *Hamilton Depression*

*Rating Scale* and the *Columbia Suicide Severity Rating Scale*, both structured interviews; and the *Brief Inventory of Executive Functioning – Adult Version*, a paper and pencil rating scale that has a self-rating and an informant-rating, the latter to be completed by a spouse, significant other, adult child, friend, or other individual close to the retired NHL player when available. The neuropsychologist trained in concussions or CTE should conduct the interview, but may also be conducted by a neuropsychiatrist with similar training.

#### **4. Blood and Urine Testing**

157. Laboratory testing of blood and urine should also be included in any medical monitoring program. Such testing is used to assist in better diagnosis of a neurodegenerative disease, to better understand the disease process, and to monitor levels of therapeutic drugs.

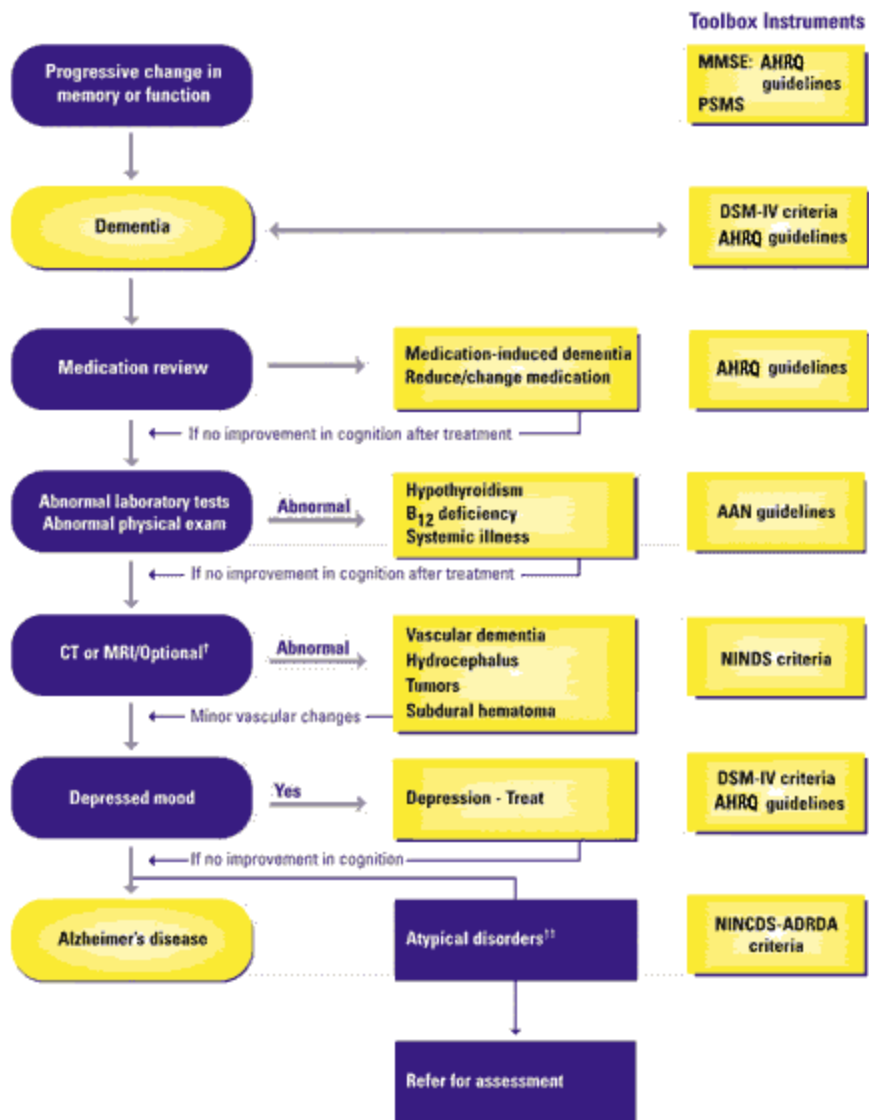
#### **5. MRI Testing**

158. MRI testing of retired NHL hockey players' brains should also be included in any medical monitoring program. Such testing is used to rule out other causes of symptoms (*e.g.*, a brain tumor) similar to those symptoms of an individual suffering from a neurodegenerative disease.

#### **6. Testing for Neurodegenerative Diseases**

159. The aforementioned testing serves as effective differential diagnosis; many of the neurodegenerative diseases that NHL players are particularly susceptible to can only be diagnosed with medical certainty post-mortem, at the time of this declaration. For example, Alzheimer's disease can only be definitively diagnosed post-mortem, though a doctor may be able to diagnose Alzheimer's disease with reasonable medical likelihood based on the assessment of clinical symptoms and differential diagnosis, as demonstrated in the below chart.





\* Developed and endorsed by the *TriAD* Advisory Board. ©1996 Pfizer Inc and Eisai Inc., with special thanks to J. L. Cummings. Algorithm reprinted from *TriAD*, Three for the Management of Alzheimer's Disease, with permission.

† It is required in patients with focal signs, rapid progression, and headache.

¹¹ This category will contain rare dementias (e.g., frontotemporal degenerations, Jakob-Creutzfeldt disease, Parkinson's disease [and other movement disorders that present with dementias]) that should be considered when unusual clinical features are present or a rapidly progressive course is noted.

160. Diagnosis of CTE, similarly, cannot yet be completed with absolute certainty unless tested post-mortem.<sup>117</sup> Further, differential diagnosis of CTE will often include

<sup>117</sup> Multiple avenues of research are presently being explored to find ways to either definitively diagnose CTE *in vivo*, or at least provide greater diagnostic precision in living

Alzheimers disease and frontotemporal dementia, as well as other, more rare forms of neurodegenerative disease such as Parkinson’s disease and amyotrophic lateral sclerosis (ALS). Testing for symptoms, signs, and in some cases images of these and other LTNDs currently allows one to make findings consistent with probable neurodegenerative disease, and allows one to move from a “possibility” of LTND, to a “probability” and thereby initiate more targeted clinical and diagnostic treatment. In the near future, it is hopeful that definitive diagnosis will be available in living patients, thereby providing greater certainty and flexibility in managing LTNDs.

## VII. CONCLUSION

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 11.9.16




---

ROBERT C. CANTU, M.A., M.D., FACS,  
FAANS, FICS, FACSM

---

patients suspected to be suffering from LTNDs. Researchers at Mount Sinai are researching the use of PET scans with T807 ligands, to identify abnormalities in the brain structure, with promising initial results. See D. Dickstein et al., *Structural MRI and Molecular PET Imaging (AV45 and AV1451) in the Diagnosis of Chronic Traumatic Encephalopathy In Vivo: Study of a Retired NFL Player*, 86 NEUROLOGY 16, SUPPL. P4-046 (2016). Dr. Robert Stern of Boston University is currently in the nascent stages of a multi-year project, entitled “Diagnostics, Imaging, and Genetics Network for the Objective Study and Evaluation (DIAGNOSE) of Chronic Traumatic Encephalopathy (CTE),” which seeks to develop in vivo biomarkers for CTE and improve clinical diagnostic criteria. *DIAGNOSE CTE Research Project*, BOSTON U., <https://www.bu.edu/cte/our-research/diagnose-cte-research-project/> (last visited June 30, 2016). Likewise, UCLA is exploring the use of [F-18] FDDNP to bind with tau proteins, which can thereby be detected on a PET scan and potentially reveal patterns of tau protein tangles consistent with CTE or other forms of LTND. See J.R. Barrio et al., *In vivo characterization of chronic traumatic encephalopathy using [F-18] FDDNP PET brain imaging*, 112 PROC. NAT’L ACAD. SCI. 16 (2015).

# **EXHIBIT “1”**

**CURRICULUM VITAE**

**ROBERT CLARK CANTU, M.A., M.D., FACS, FAANS, FICS, FACSM**

**NAME:** Robert Clark Cantu, MA, M.D., F.A.C.S., .F.A.A.N.S., F.I.C.S., F.A.C.S.M.  
**DATE OF BIRTH:** August 31, 1938  
**BIRTHPLACE:** Santa Rosa, California  
**PRESENT** Medical Director and Director of Clinical Research for the Dr. Robert C. Cantu Concussion Center, Chief, Neurosurgery Service, Associate Chairman Department of Surgery  
**POSITIONS:** Director, Service of Sports Medicine  
Emerson Hospital, Concord, MA 01742  
 Telephone: 1-978-369-1386  
 Facsimile: 1-978-287-0047

**Clinical Professor Neurology and Neurosurgery, Boston University School of Medicine, Co-Founder Center for The Study of Traumatic Encephalopathy (CSTE), Boston University Medical Center, Boston, MA**  
**Senior Advisor to NFL’s Head, Neck and Spine Committee**  
**Member/Co-Chair Equipment and Rules Committee NFLPA Mackey/White TBI Committee**  
**Adjunct Staff Department Neurosurgery, Senior Advisor Brain Injury Center Children’s Hospital Boston, Boston, MA**  
**Adjunct Professor, Exercise and Sport Science, University North Carolina, Chapel Hill, NC**  
**Medical Director, National Center for Catastrophic Sports Injury Research, Chapel Hill, NC**  
**Clinical Instructor in Pediatrics, Boston University School of Medicine**  
**Neurosurgical Consultant Boston College Eagles football team**  
**Co-Director, Neurologic Sports Injury Center at Brigham and Women’s Hospital, Boston, MA**  
**Co-Founder and Medical Director Sports Legacy Institute (SLI), Waltham, MA**

**EDUCATION:** 1960 B.A. University of California, Berkeley  
 1962 M.A. University of California, San Francisco  
 1963 M.D. University of California, San Francisco

**PROFESSIONAL EXPERIENCE:**

1963 - 1964 **Intern in Surgery, Columbia-Presbyterian Hospital, New York, NY**  
 1964 - 1967 **Assistant Resident in Neurosurgery, Massachusetts General Hospital**  
 1964 - 1967 **Research Fellow in Physiology, Harvard Medical School**  
 1967 - 1968 **Chief Resident in Neurosurgery, Boston City Hospital**  
 1967 - 1968 **Teaching Fellow in Surgery, Harvard Medical School**  
 1967 - 1968 **Clinical Assistant in Neurosurgery, Massachusetts General Hospital**  
 1968 - 1973 **Clinical and Research Fellow in Neurosurgery, Massachusetts General Hospital**  
 1968 - 1969 **Assistant in Surgery, Harvard Medical School**  
 1969 - 1973 **Instructor in Surgery, Harvard Medical School**  
 1968 - 1970 **Acting Assistant Director Neurosurgery, Boston City Hospital**  
 1968 - 1970 **Director of Pediatric Neurosurgery, Boston City Hospital**  
 1968 - 1973 **Clinical Associate in Neurosurgery, Massachusetts General Hospital**  
 1968 - **Chief of Neurosurgery Service, Emerson Hospital, Concord, MA**  
 1970 - 1995 **Neurosurgical Consultant, Cutler Army Hospital, Fort Devens, MA**  
 1970 - 1975 **Neurosurgical Consultant, Nashoba Community Hospital, Ayer, MA**  
 1976 - 1978 **Chief of Neurosurgery Service, Nashoba Community Hospital, Ayer, MA**  
 1979 - 1980 **Chairman, Department of Surgery, Emerson Hospital, Concord, MA**  
 1980 - **Director, Service of Sports Medicine, Emerson Hospital, Concord, MA**  
 1989 - 1991 **Chairman, Department of Surgery, Emerson Hospital, Concord, MA**  
 1989 - **Medical Director, National Center for Catastrophic Sports Injury Research**  
 1991 - 1993 **Board of Trustees, Emerson Hospital, Concord, MA**  
 1991 - 1993 **Director, Emerson Health System, Inc.**  
 1992 - 1993 **President, American College of Sports Medicine**  
 1994 - **Clinical Instructor in Pediatrics, Boston University School of Medicine**

1994 - **Board of Trustees**, National Operating Committee on Standards For Athletic Equipment (NOCSAE)

1996 - **Vice-President**, National Operating Committee on Standards for Athletic Equipment (NOCSAE)

1994 - **Board of Advisors**, National Youth Sports Foundation for the Prevention of Athletic Injuries, Inc.

1998 - 2000 **Scientific Advisory Panel on Sports Medicine**, Knoll Pharmaceutical Company

1998 - 2000 **Advisory Committee for Injury Prevention**, Centers For Disease Control, Atlanta, GA

2000 - **Executive Committee Joint Section on Neurotrauma**,  
Congress Neurological Surgeons/American Association Neurological Surgeons

2002 - 2005 **Editorial Board**, Journal of Athletic Training

2001 - **Co-Chairman**, NASCAR Safety Task Force, American College Sports Medicine, Indianapolis, IN

2002 - **Editorial Board**, Current Sports Medicine Reports

2002 - **Editorial Board**, American Journal of Medicine & Sports

2002 - **Neurosurgical Consultant**, Boston College Eagles football team

2003-2010 **Neurosurgical Consultant**, Boston Cannons professional Lacrosse team

2003 - **Editorial Board Principal Sports**, *Neurosurgery*

2003- **Adjunct Appointment**, Brigham and Women’s Hospital, Boston, MA

2004-2010 **Chairman, Department of Surgery**, Emerson Hospital Concord, MA

2005- **Board of Directors**, Massachusetts Brain Injury Association, Westborough, MA

2007- **Medical Advisory Board of the State Boxing Commission**, Boston, MA

2007 - **Founding Member and Medical Director Sports Legacy Institute (SLI)**, Waltham, MA

2007 - **Clinical Professor Neurology and Neurosurgery, Boston University School of Medicine**, Boston, MA

2009 -2013 **Co-Director Center for The Study of Traumatic Encephalopathy (CSTE), Boston University Medical Center**, Boston, MA

2010 - **Senior Advisor to NFL’s Head, Neck and Spine Committee**

2010- **Fellow of the American Association of Neurological Surgeons (FAANS)**

2010 - **Member/Co-Chair Equipment and Rules Committee, NFLPA Mackey/White TBI Committee**

2010- **Fellow American Association Neurological Surgeons**

2012 - **Adjunct Staff Department Neurosurgery, Senior Advisor Brain Injury Center Children’s Hospital Boston**, Boston, MA

2013 - **International Rugby Board Concussion Advisory Group – United Kingdom**

2014- **Clinical Diagnostics and Therapeutics Leader CTEC, member BUADC Executive Committee**

2015- **Medical Director and Director of Clinical Research, Dr. Robert C. Cantu Concussion Center**, Emerson Hospital, Concord, MA

2015- **USA Rugby Medical & Risk Committee sub-committee for Sports Concussion**

2015- **Institute of Sports Law and Ethics Board –Santa Clara University**

## SERVICE TO PROFESSIONAL SOCIETIES

### NATIONAL SOCIETIES:

<b>American College of Sports Medicine</b>		1978 -
Board of Trustees		1984 - 1994
		1996 - 1999
Ambassador		1988 –
President-elect:	<b>American College of Sports Medicine,</b>	1991 - 1992
<b>President:</b>	<b>American College of Sports Medicine,</b>	1992 - 1993
Treasurer:	<b>American College of Sports Medicine,</b>	1996 – 1999
Associate Editor:	<u>Medicine and Science in Sports and Exercise,</u>	1986 - 1998
Associate Editor:	<u>Exercise and Sports Science Reviews,</u>	1986 - 2000
Editorial Board:	<u>The Physician and Sportsmedicine,</u>	1989 -
Editorial Board:	<u>Clinical Journal of Sports Medicine,</u>	1991 -

Editorial Board: Journal Athletic Training 2000 – 2005  
 Editorial Board: Neurosurgery: Sports Section 2003 –

**American Association of Neurological Surgeons**  
**Chairman**, Sports Medicine Section, 1985 – 1988

**American Medical Tennis Association**  
**Board of Directors**, 1984 – 1987

**REGIONAL SOCIETIES:**

New England Chapter, American College of Sports Medicine

**Executive Committee:** 1980 - 1982  
**President:** 1981 - 1982  
**Board of Trustees:** 1982 - (**Chairman**, 1983)

**PROFESSIONAL CONSULTANT:**

1983 - 1985 Advisory editor in sports medicine to The Collamore Press, Lexington, MA  
 1984 - Technical advisor, Milner-Fenwick Company, Baltimore, MD  
 1985 - Consultant, United States of America Amateur Boxing Federation, Inc.  
 1986 - Consultant, Exercycle Corporation, Woonsocket, RI  
 1986 - 1988 Consultant, Reebok Corporation, Avon, MA  
 1988 - 1990 Consultant, Nautilus Company, Independence, VA  
 1994 - Athletic Advisory Board, Hartwell Medical  
 1994 - 2000 Consultant, NordicTrack, Chaska, MN  
 1998 - 2000 Scientific Advisory Panel on Sports Medicine. Knoll Pharmaceutical Co.  
 2000- Executive Committee Joint Section on Neurotrauma, Congress Neurological Surgeons/American Association Neurological Surgeons  
 2002-2005 Editorial Board, Journal of Athletic Training  
 2002- Neurosurgical Consultant to Boston College Eagles football team  
 2003-2010 Neurosurgical Consultant to Boston Cannons professional Lacrosse team  
 2003 Principal – Sports Section, *Neurosurgery*  
 2003- NOCSAE Consultant to the NFL Concussion Committee  
 2004- Board of Directors, Massachusetts Brain Injury Association, Westborough, MA  
 2007- Medical Advisory Board of the State Boxing Commission, Massachusetts  
 2007 - Founding Member and Chairman Medical Advisory Board Sports Legacy Institute, Waltham, MA  
 2014 - International Rugby Board Advisory Board – United Kingdom

**FELLOWSHIPS:**

1975 **Fellow**, American College of Surgeons  
 1981 **Fellow**, International College of Surgeons  
 1981 **Fellow**, American College of Sports Medicine  
 2010 **Fellow**, American Association Neurological Surgeons (FAANS)

**HONORS AND AWARDS:**

California Scholastic Federation Award  
 Kraft Award (top twenty freshmen), University of California, Berkeley, 1956-57  
 Borden Research Award, 1963  
 Microcirculatory Travel Award, 1963  
 Candidate Group Prize, Massachusetts Chapter, American College of Surgeons, 1969  
 Honor Award in Medicine, New England Chapter, American College of Sports Medicine, 1987  
 Distinguished Service Award, American Association for the Improvement of Boxing, 1991



Rocky Marciano Medical Award, American Association for the Improvement of Boxing, 1995  
Citation Award, American College of Sports Medicine, 1996  
Special Citation Award, New England Chapter, American College Sports Medicine, 2002  
Educator of the Year Award from the American Association of Professional Ringside Physicians 2004  
Dr. Ernst Jokl Sports Medicine Award 2010 from The United States Sports Academy 2010  
Community Clinician of the Year 2013 from The Middlesex Central District Medical Society and The Massachusetts Medical Society  
ETHOS Award, Institute for Sports Law and Ethics, University of Santa Clara 2014  
Wise Up! Pioneer “Grandfather of the Concussion Movement” Award 2014

**LICENSES TO PRACTICE MEDICINE:**

By written examination in California, 1963 #: 21223  
By written examination in Massachusetts, 1964 #: 28386

**SPECIALTY BOARD CERTIFICATION:**

American Board of Neurological Surgery, 1970

**MEMBERSHIPS:**

Social Fraternities: Phi Kappa Psi  
Nu Sigma Nu (President, Phi Chapter, 1962-1963)  
Scholastic Fraternities California Scholastic Federation  
Tower and Flame  
Phi Eta Sigma  
Phi Beta Kappa (junior year)  
Alpha Omega Alpha

**PROFESSIONAL SOCIETIES:**

American Academy of Sports Physicians  
American Association for the Advancement of Science  
American Association for the Improvement of Boxing  
American Association of Neurological Surgeons  
American Association of Professional Ringside Physicians  
American Association for the History of Medicine  
American College of Angiography  
American College of Sports Medicine  
American College of Surgeons  
American Federation of Clinical Research  
American Heart Association  
American Medical Association  
American Physiology Society  
American Society for Pharmacology and Experimental Biology  
California (Medical) Alumni Society  
Congress of Neurological Surgeons  
International College of Surgeons  
International Society for Pediatric Neurosurgery  
Massachusetts Medical Benevolent Society  
Massachusetts Medical Society  
Microcirculatory Society  
New England Neurosurgical Society  
North American Spine Society  
Presbyterian Hospital Alumni Society  
Society of Military Surgeons

Society of Neuroscience

## BACKGROUND SUMMARY

Currently Dr. Cantu's professional responsibilities include those of Medical Director and Director of Clinical Research, Dr. Robert C. Cantu Concussion Center at [Emerson Hospital](#) in Concord, Massachusetts, Clinical Professor of Neurology and Neurosurgery, Clinical and Therapeutics Leader AD and [Center for the Study of Traumatic Encephalopathy, Boston University School of Medicine](#), Boston, MA; Founding member and Medical Director [Concussion Legacy Foundation](#) (formally SLI), Waltham, MA; Adjunct Professor Exercise and Sport Science and Medical Director [National Center for Catastrophic Sports Injury Research, University of North Carolina](#), Chapel Hill, NC; Co-Director, [Neurologic Sports Injury Center, Brigham and Women's Hospital](#), Adjunct Staff Department Neurosurgery and Senior Advisor Brain Injury Center [Children's Hospital Boston](#), Boston, MA; Boston, Chief of Neurosurgery Service, Associate Chairman Department of Surgery, and Director of Sports Medicine at [Emerson Hospital](#) in Concord, Massachusetts, Neurosurgical Consultant Boston Eagles football team. He has authored over 415 scientific publications, including 32 books on neurology and sports medicine, in addition to numerous book chapters, peer-reviewed papers, abstracts and free communications, and educational videos. He has served as associate editor of [Medicine and Science in Sports and Exercise](#) and [Exercise and Sports Science Review](#), and on the editorial board of [The Physician and Sports Medicine](#), [Clinical Journal of Sports Medicine](#), and [Journal of Athletic Training](#). In 2003 Dr. Cantu became the section head for the Sports Medicine Section of *Neurosurgery*.

He grew up in the northern California community of Santa Rosa. In 1960, he received his B.A. degree from the University of California Berkley where he pitched on the varsity baseball team. Jointly, in medical school and graduate school, he received his M.A. degree in endocrinology in 1962, and in 1963, his M.D. from the University of California Medical School in San Francisco. Following a surgical internship at Columbia-Presbyterian Hospital in New York City in 1963-1964, he began a neurosurgery residency at Massachusetts General Hospital in Boston, and simultaneous position of research fellow in physiology at Harvard Medical School. Upon completion of his residency in 1968, he joined the neurosurgery staff at MGH, where his practice and laboratory were located, while assuming the position of acting assistant director of neurosurgery and director of pediatric neurosurgery at Boston City Hospital. After five years of academic neurosurgery with Harvard Hospitals, Dr. Cantu entered private neurosurgery practice at the suburban Emerson Hospital in Concord, Massachusetts where he currently serves as Chairman Department of Surgery, Chief Neurosurgical Service and Director Service of Sports Medicine.

In addition to his professional responsibilities, Dr. Cantu is medical director of the [National Center for Catastrophic Sports Injury Research, located in Chapel Hill, North Carolina](#), an ongoing registry instituted in 1982 for data collection and analysis of spine and head injuries. From this data important contributions have been made in sport safety and accident reduction; most notably football rule changes concerning tackling and blocking with the head, the establishment of football helmet standards, improved on-the-field medical care, and coaching techniques. He also serves on the Board of Trustees as Vice President and chairman of scientific committee of [NOCSAE](#) (National Operating Committee on Standards for Athletic Equipment).

Dr. Cantu also is Co-Director of the Neurological Sports Injury Center at Brigham and Women's Hospital in Boston, MA.

For many years, Dr. Cantu has been actively involved with the American College of Sports Medicine (ACSM), the oldest and largest sports medicine and exercise science organization in the world, and served as President of this organization from 1992 to 1993 and served as treasurer from 1996 to 1999. Dr. Cantu has received recognition from the college being named as the recipient of their Citation Award in 1996. This year Dr. Cantu gave the organizations most prestigious J.B. Dill Lecture on the History of Concussions at ACSM's annual meeting in New Orleans.

As spokesperson for ACSM, he has participated in nationally televised sports programs speaking on diverse sports issues and has appeared on "Larry King Live" discussing the Chris Benoit case in conjunction with Chris' father Michael Benoit, "ESPN Outside the Lines" discussing the Chris Benoit case, Canadian Television also discussing the Chris Benoit case as well as other media avenues, "NFL Today" with Bryant Gumbel and Terry Bradshaw, discussing the effect of artificial turf on cervical spine injuries, and football injuries on CNBC's "The Real Story". He has been interviewed for World News Tonight with Peter Jennings, CBS Evening News with Katie Couric, Dan Rather, and NBC Evening News with Brian Williams regarding gender and concussion incidence. He has been a spokesperson for ACSM on NASCAR deaths and safety issues surrounding NASCAR and has been interviewed for "World News Tonight" with Peter Jennings regarding NASCAR deaths and specifically Dale Earnhardt's death as well as safety issues in auto racing. Dr. Cantu also appeared on "ABC World News Tonight" with Bob Jamison regarding the Korey Stringer death from heat stroke as well as WGBH Channel 2 in Boston, NPR radio interview, WEEI Boston radio interview and ESPN's "Outside the Lines", all discussing the issue of heat stroke. He has discussed the health issues of football players with Mary Carillo on HBO's Inside the NFL and has done an interview regarding sports related injuries in cheerleading on Inside the NFL. Dr. Cantu has also been interviewed by Bob Costas on HBO's Inside the NFL regarding Concussion in Professional Sports and was the key speaker on Designer Steroids

for Comcast Cable Network. Dr. Cantu is currently serving as the Consultant for NOCSAE to the NFL Concussion Committee and Co-Chairman for the NASCAR Safety Task Force with ACSM. Dr. Cantu has done safety presentations for drivers and teams of CART as well as NASCAR. Dr. Cantu has been interviewed by ESPN Outside the Lines Tom Friend regarding Baby Joe Mesi and his return to boxing after a controversial subdural hematoma. Dr. Cantu continues to be an outspoken advocate for the sport of boxing and continues to advocate for the safety of that sport and its participants. Recently Dr. Cantu has done several interviews on Concussion in the NFL with ESPN, HBO and the Boston area news channels. Dr. Cantu has recently been involved with the NFL meeting in NYC regarding concussions and guidelines for concussions with Roger Goodell. Most recently Dr. Cantu has appeared on Brian Williams Rock Center with Kate Snow discussing concussion issues.

As an author of numerous books as well as articles on sports medicine topics, he is frequently invited to participate in symposiums addressing a wide range of sports medicine topics including anabolic steroid use; eating disorders in female athletes; acute and chronic brain injury in boxing; and on-the-field evaluation and medical management and return to play guidelines following head and spine sports injuries. *Dr. Cantu's most recent book "Concussion and Our Kids" was released September 19, 2012 from Houghton Mifflin Harcourt.*

He has served as a consultant to many scholastic and professional athletes on the return to collision sports after a head injury or spine injury, and is active speaking on a variety of health-related interests including the overall benefits of moderate regular exercise; the special health and exercise concerns of senior citizens; and sports safety issues with high school athletic trainers, coaches, students and parents. He currently serves as the Neurosurgical consultant to the Boston College Eagles Football team and served as the Neurosurgical consultant to the Boston Cannons professional Lacrosse team from 2003 to 2010. He recently was asked by the NFL Commissioner Roger Goodell to give two presentations at the NFL's concussion meeting in Chicago.

Practicing what he preaches, Dr. Cantu has enjoyed long-distance running since 1967. An official entrant in many Boston Marathons, he has also enjoyed the "long runs" at Newport and New York City,. Besides running, Dr. Cantu is a serious tennis player, for many years ranked in the men's senior singles in New England (NELTA) region. Dr. Cantu has two children, Rob and Elizabeth and a grandchild Jeremy and lives with his wife Tina in Lincoln, Massachusetts.

**PUBLICATIONS: 415**

<b>BOOK CHAPTERS</b>	<b>93</b>
<b>REFEREED ARTICLES</b>	<b>194</b>
<b>BOOKS</b>	<b>32</b>
<b>NON-REFEREED ARTICLES</b>	<b>49</b>
<b>ABSTRACTS AND FREE COMMUNICATIONS</b>	<b>29</b>
<b>SPORTS MEDICINE EDUCATIONAL VIDEOS</b>	<b>15</b>
<b>IN PRESS</b>	<b>3</b>

## BOOK CHAPTERS

1. **Cantu RC**: The treatment and prevention of athletic low back injuries, in Vinger FP, Hoerner EF (ed): Sports Injuries: the Unthwarted Epidemic, Littleton, PSG Publishing, Inc, 1980.
2. **Cantu RC**: Nutrition and endurance exercise: Facts, myths, speculations, in **Cantu RC** (ed): Health Maintenance Through Physical Conditioning, Littleton, Wright-PSG Publishing, Inc, 1981.
3. **Cantu RC**: The prevention of athletic head and spine injuries, in **Cantu RC** (ed): Health Maintenance Through Physical Conditioning, Littleton, Wright-PSG Publishing, Inc, 1981.
4. **Cantu RC**, Day RG: Corporate fitness centers, in **Cantu RC** (ed): The Exercising Adult, Lexington, The Collamore Press, D.C. Heath & Co, 1981.
5. **Cantu RC**: Head and cervical spine injuries, in **Cantu RC** (ed): The Exercising Adult, Lexington, The Collamore Press, D.C. Heath & Co, 1981.
6. **Cantu RC**: Lumbar spine injuries, in **Cantu RC** (ed): The Exercising Adult, Lexington, The Collamore Press, D.C. Heath & Co, 1981.
7. **Cantu RC**: Conditioning the cardiovascular system, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
8. **Cantu RC**: Nutrition for sports, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
9. **Cantu RC**: Exercise and life-style modifications in primary care practice, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
10. **Cantu RC**: Writing a precise aerobic exercise prescription, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
11. **Cantu RC**: Sports injuries in young athletes, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
12. **Cantu RC**: The sports medicine bag of the primary care team physician, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
13. **Cantu RC**: Head and neck injuries, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
14. **Cantu RC**: Lumbar spine injuries, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
15. **Cantu RC**: Torso and genitourinary tract injuries, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
16. **Cantu RC**: Upper extremity injuries, in **Cantu RC** (ed): Sports Medicine in Primary Care, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
17. **Cantu RC**: Sports and the handicapped child, in Micheli LJ (ed): Sports Injuries in the Child and Adolescent, Boston, Little Brown & Co, 1982.
18. **Cantu RC**: Techniques of spinal fusion, in Schmidek HH, Sweet W (ed): Current Techniques in Operative Neurosurgery, Orlando, Grune & Stratton, Inc, 1982.

19. **Cantu RC**: Epidemiology, biomechanics, and diagnoses of head and cervical spine injuries, in **Cantu RC** (ed): Sports Medicine-Sports Science: Bridging the Gap, Lexington, The Collamore Press, D.C. Heath & Co, 1982.
20. **Cantu RC**: Intracranial injuries, in Butler RB, Moore MJ, **Cantu RC** (ed): Neurology in Primary Care, New York, MacMillan Publishing Co, 1985.
21. **Cantu RC**: Cervical, thoracic and lumbar spine injuries, in Butler RB, Moore MJ, **Cantu RC** (ed): Neurology in Primary Care, New York, MacMillan Publishing Co, 1985.
22. **Cantu RC**: Intervertebral disc disease: Acute rupture, spondylosis and spinal stenosis, in Bulter RB, Moore MJ, **Cantu RC** (ed): Neurology in Primary Care, New York, MacMillan Publishing Co, 1985.
23. **Cantu RC**: Head and spine injuries in the young athlete, in Micheli LJ (ed): Clinics in Sports Medicine: Injuries in the Young Athlete, Philadelphia, W.B. Saunders Co, 1988.
24. **Cantu RC**: Techniques of fusion in the cervical, thoracic, and lumbar spine, in Schmidek HH, Sweet WH (ed): Operative Neurosurgical Techniques: Indications, Methods and Results, ed 2. Orlando, Grune & Stratton, Inc, 1988.
25. **Cantu RC**: Head injury in sports, in Grana WA, Lombardo JA (ed): Advances in Sports Medicine and Fitness, vol 2. Chicago, Year Book Medical Publishers, 1989.
26. **Cantu RC**: Head and neck injuries, in Mueller FO, Ryan A (ed): The Sports Medicine Team and Athletic Injury Prevention, Philadelphia, F.A. Davis Co, 1990.
27. **Cantu RC**: Osseous fusion of the cervical, thoracic, and lumbar spine with primary and metastatic spine tumors, in Schmidek HH, Schiller AL, Rosenthal DI, Sundaresan N (ed): Tumors of the Spine: Diagnosis and Clinical Management, Philadelphia, W.B. Saunders Company, 1990.
28. **Cantu RC**: Criteria for return to competition following a closed head injury, in Torg JS (ed): Athletic Injuries to the Head, Neck, and Face, ed 2. Chicago, Year Book Medical Publishers, 1991.
29. **Cantu RC**: Position statement of the American Medical Association on boxing: Analysis and perspective, in Torg JS (ed): Athletic Injuries to the Head, Neck, and Face, ed 2. Chicago, Year Book Medical Publishers, 1991.
30. **Cantu RC**: The nervous system, in Strauss RH (ed): Sports Medicine, ed 2. Philadelphia, W.B. Saunders Co, 1991.
31. **Cantu RC**: Minor head injuries in sports, in Dymont PG (ed): Adolescent Medicine: State of the Art Reviews, 2(1). Philadelphia, Hanley & Belfus, Inc, 1991.
32. Mueller FO, **Cantu RC**: The annual survey of catastrophic football injuries: 1977-1988, in Holloszy JO (ed): Exercise and Sport Sciences Reviews, vol 19. Baltimore, Williams & Wilkins, 1991.
33. **Cantu RC**: Transportation/immobilization: Criteria for return to competition after head or cervical spine injury, in **Cantu RC**, Micheli LJ (ed): American College of Sports Medicine: Guidelines for the Team Physician, Philadelphia, Lea & Febiger, 1991.
34. Young JE, **Cantu RC**: Life-threatening emergencies, in **Cantu RC**, Micheli LJ (ed): American College of Sports Medicine: Guidelines for the Team Physician, Philadelphia, Lea & Febiger, 1991.
35. **Cantu RC**: Criteria for return to competition after head or cervical spine injury, in **Cantu RC**, Micheli LJ (ed): American College of Sports Medicine: Guidelines for the Team Physician, Philadelphia, Lea & Febiger, 1991.
36. Mueller FO, **Cantu RC**: Annual survey of catastrophic football injuries: 1977-1992, in Hoerner EF (ed): Head and Neck Injuries in Sports, Philadelphia, ASTM, 1994.



37. **Cantu RC**: How to make professional boxing safer: the American Medical Association controversy, in Hoerner EF (ed): Head and Neck Injuries in Sports. Philadelphia, ASTM, 1994.
38. **Cantu RC**: Medicine's stand on boxing in the 20<sup>th</sup> century, in **Cantu RC** (ed): Boxing and Medicine. Champaign, Human Kinetics, 1995.
39. **Cantu RC**: Brain injuries, in **Cantu RC** (ed): Boxing and Medicine. Champaign, Human Kinetics, 1995.
40. **Cantu RC**: How to make professional boxing safer, in **Cantu RC** (ed): Boxing and Medicine. Champaign, Human Kinetics, 1995.
41. **Cantu RC**: Sports medicine aspects of cervical spinal stenosis, in Exercise and Sports Science Reviews, vol 23. Baltimore, Williams & Wilkins, 1995.
42. **Cantu RC**: Head and spine injuries in youth sports, in Micheli LJ (ed): Clinics in Sports Medicine, vol 14(3). Philadelphia, W.B. Saunders Company, 1995.
43. **Cantu RC**: Head and neck injuries, in Kibler WB (ed): American College of Sports Medicine: Handbook for the Team Physician. Baltimore, Williams & Wilkins, 1996.
44. **Cantu RC**: Diagnosis and management of concussion, in Sallis RE, Massimino F (ed): American College of Sports Medicine: Essentials of Sports Medicine. St. Louis, Mosby Year-Book, 1996.
45. **Cantu RC**: Diagnosis and management of concussion, in Sallis RE, Allen ME, Massimino F (ed): American College of Sports Medicine: Sports Medicine Review. St. Louis, Mosby Year-Book, 1996.
46. Cantu RV, **Cantu RC**, Wilberger JE: Sports-related spinal cord injury, in Narayan RK, Wilberger JE, Povlishnock JT (ed): Neurotrauma. New York, McGraw-Hill, 1996.
47. **Cantu RC**: Guidelines for return to contact sports in Hoerner EF (ed): Safety in American Football. West Conshohocken, ASTM, 1996.
48. **Cantu RC**: Catastrophic head and spine injuries, in Mueller FO, **Cantu RC**, Van Camp SP (ed): Catastrophic Injuries in High School and College Sports. Champaign, Human Kinetics, 1996.
49. **Cantu RC**: Second Impact Syndrome, in **Cantu RC** (ed): Clinics In Sports Medicine: Neurologic Athletic Head and Neck Injuries. Philadelphia, W.B. Saunders Company, 1998.
50. **Cantu RC**: Return to Play Guidelines After a Head Injury, in **Cantu RC** (ed): Clinics In Sports Medicine: Neurologic Athletic Head and Neck Injuries. Philadelphia, W.B. Saunders Company, 1998.
51. **Cantu RC**: The Cervical Spinal Stenosis Controversy, in **Cantu RC** (ed): Clinics in Sports Medicine: Neurologic Athletic Head and Neck Injuries. Philadelphia, W.B. Saunders Company, 1998.
52. **Cantu RC**, Bailes JE, Wilberger JE: Guidelines for Return to Contact or Collision Sport After a Cervical Spine Injury, in **Cantu RC** (ed): Clinics In Sports Medicine: Neurologic Athletic Head and Neck Injuries. Philadelphia, W.B. Saunders Company, 1998.
53. **Cantu RC**: Head Injuries, in Safran M (ed): Spiral Manual of Sports Medicine. New York, Lippencott-Raven Publishers, 1998.
54. Proctor MR, **Cantu RC**: Head and Neck Injuries in Young Athletes, In Clinics and Sports Medicine. WB Saunders Company, 2000.
55. **Cantu RC**: Classifications and Clinical Management of Concussion, In Sports Medicine and Neurosurgery, 2000, The American Association of Neurological Surgeons.

56. **Cantu RC:** Cervical Spine Injuries in the Athlete, In Seminars in Neurology on Sports Neurology. Michael Cherington, editor 2000.
57. **Cantu RC:** Injuries to the Head and Cervical Spine, In Textbook Paediatric Exercise Science and Medicine. Willem van Mechelen and Neil Armstrong, editors, Oxford Press, 2000.
58. **Cantu RC:** Overview of Concussion, Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
59. **Cantu RC:** Life Threatening Head Injuries: Malignant Brain Edema and Second Impact Syndrome. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
60. **Cantu RC:** Guidelines for Safe Return to Play After Athletic Head and Neck Injuries. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
61. **Cantu RC:** Cervical Spinal Stenosis: Diagnosis and Return to Play Issues. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
62. **Cantu RC:** Guidelines for Return to Contact or Collision Sport After a Cervical Spine Injury. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
63. **Cantu RC:** Biomechanics of Head Injury. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
64. **Cantu RC:** Return to Play Guidelines After Concussion. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
65. **Cantu RC:** Life Threatening Head Injuries: Intracranial Hematoma. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
66. **Cantu RC:** Return to Competition After Life Threatening Head Injury. Neurologic Athletic Head and Spine Injuries. WB Saunders Company, Philadelphia, PA, 2000.
67. **Cantu RC:** Classification and Management of Concussion, In Neurological Sports Medicine, A Guide for Physicians and Trainers. American Association of Neurologic Surgeons, Rolling Meadows, IL 2001.
68. **Cantu RC:** Head Injuries in Adults, In Orthopaedic Sport Medicine. Edited by Jesse C. DeLee, M.D. and David Drez, Jr., M.D. Elsevier Science, Philadelphia, PA 2002.
69. **Cantu RC:** Recurrent Athletic Head Injury: Risks and When to Retire, In Clinics in Sports Medicine. Edited by D. Greg Anderson, M.D. and Gregory A. Helm, M.D., Ph.D. W. B. Saunders Company. Philadelphia, PA 2003.
70. Bailes J, Maroon J, **Cantu R:** Athlete with Spine Injury. In Spine Surgery Techniques, Complication Avoidance, and Management Second Edition. Elsevier Science, Philadelphia, PA 2005.
71. Neurotrauma: Evidence-based Answers to Common Questions: How Important are Stingers. Thieme Medical Publishers, New York, N.Y. 2001
72. Cantu RV, **Cantu RC:** Athletic Head Injuries. Clinical Sports Medicine. Eited by Walter R. Frontera, MD; Lyle Micheli MD; Stanley A. Herring, MD and Julie K. Silver, MD. W.B. Saunders Company. Philadelphia, PA 2005.
73. Proctor MR, **Cantu RC:** Specific Injuries by Anatomic Location – NECK. Clinical Sports Medicine. Eited by Walter R. Frontera, MD; Lyle Micheli MD; Stanley A. Herring, MD and Julie K. Silver, MD. W.B. Saunders Company. Philadelphia, PA 2005.

74. **Cantu RC**, Cantu RV: Head Injuries. Sports Medicine. Edited by Anthony A. Schepsis; Brian D. Busconi. Lippincott, Williams & Wilkins. Philadelphia, PA 2006;88-95.
75. **Cantu RC**: Transient Quadripareisis. In Sports Neurology. Edited by Barry D. Jordan, Peter Tsairis, Russell F. Warren. Lippincott-Raven. Philadelphia, PA 1998.
76. **Cantu RC**: Recurrent Athletic Head Injury: Risks and When to Retire. In Clinics in Sports Medicine. Edited by D. Gregg Anderson and Gregory A. Helm. WB Saunders Company. Philadelphia, PA 2003.
77. Echemendia RL, **Cantu RC**: Return to play following brain injury, in Traumatic Brain Injury in Sports: An international neuropsychological perspective. Lisse, The Netherlands: Swets & Zeitlinger., Lovell M, Echemendia R, Barth J, Collins M, Editor. 2004, Psychology Press: Lisse p. 479-498.
78. **Cantu RC**: Concussion Classification: Ongoing Controversy. In Foundations of Sport-Related Brain Injuries. Edited by Semyon M. Slobounov and Wayne J. Sebastianelli. Springer Science and Business Media, Inc. New York, New York 2006.
79. **Cantu RC**: Injuries to the Head and Cervical Spine, In Textbook Paediatric Exercise Science and Medicine. Willem van Mechelen and Neil Armstrong, editors 2<sup>nd</sup> Edition, Oxford Press, 2008.
80. Guskiewicz KM, Echemendia RJ, **Cantu RC**: Assessment and Return to Play Following Sports-Related Concussion, In Orthopaedic Knowledge Update Sports Medicine. W. Ben Kibler, MD Editor 4<sup>th</sup> Edition, American Academy of Orthopaedic Surgeons, 2009.
81. **Cantu RC**, Cantu RV: Head Injuries. In Orthopedic Sports Medicine Principles and Practice 3<sup>rd</sup> Edition DeLee, Drez and Miller, Saunders Elsevier 2009 p 657-663.
82. Jayaro M, Chin LS, **Cantu RC**: Punch Drunk Syndrome. In Encyclopedia Of Sports Medicine. Micheli L, Editor. Sage Publications, Inc. 2011 pp1185-1187.
83. Jayro M, Chin LS, **Cantu RC**: Catastrophic Sports Injuries. In Encyclopedia of Sports Medicine, Micheli L, Editor. Sage Publications, Inc. 2011. pp243.255
84. **Cantu RC**: Diabetes Mellitus in Sports. In Encyclopedia of Sports Medicine. Micheli L, Editor. Sage Publications, Inc. 2011. pp 363-365.
85. Cantu RV, **Cantu RC**: Skull Fractures. In Encyclopedia of Sports Medicine. Micheli L, Editor. Sage Publications, Inc. 2011 pp1340-1343.
86. Jayarao M, Chin LS, **Cantu RC**: Prevention of Sports-Related Concussion and Brain Injury. In Manual of Traumatic Brain Injury Management. Demos Medical Publishing. 2011 pp 30-34.
87. Toshkezi G, Chin LS, **Cantu RC**: Cumulative Effects of Repeated Mild Traumatic Brain Injury. In Manual of Traumatic Brain Injury Management. Demos Medical Publishing. 2011 pp 72-76.
88. Daneshvar DH, Riley DO, Nowinski CJ, McKee AC, Stern RA, **Cantu RC**: Long-Term Consequences; Effects on Normal Development Profile After Concussion. In Youth Sport Concussions. Bell KR and Herring, SA Editors. Physical Medicine and Rehabilitation Clinics of North America. Nov 2011, volume 22 pp 683-700.
89. Micheli I, Stein C, O'Brien M, d'Hemecourt P, **Cantu RC**, Cantu RV: Acute Cervical Spine Injuries. Spinal Injuries and Conditions in Young Athletes. Springer 2013, pp 37-45.
90. Slobounov SM, Sebastianelli WJ, **Cantu RC**: Consequences of Ignorance and Arrogance for Mismanagement of Sports-Related Concussions: Short- and Long-Term Complications. Concussions in Athletics, Springer 2014, pp 23-33.
91. Montenegro PH, Sisniega DC, **Cantu RC**: Prevention of Sports-Related Concussion and Brain Injury:

*Manual of Traumatic Brain Injury: Assessment and Management, Second Edition (In Press)*

92. **Cantu RC:** Concussion. Head Trauma and Brain Injury For Lawyers, edited by Hubbard JE, Hodge Jr SD, ABA Medical Legal Guides, 2016, pp 155-167.
93. Montenigro PH, Sisniega DC, **Cantu RC:** Cumulative Effects of Repeated Concussion and Chronic Traumatic Encephalopathy: *Manual of Traumatic Brain Injury: Assessment and Management, Second Edition (In Press)*

**REFERRED ARTICLES**

1. **Cantu RC**, Wise BL, Goldfien A, Gullixson KS, Pischer N, Ganong WF: Neural pathways mediating the increase in adrenal medullary secretion produced by hypoglycemia. *Proc Soc Exper Biol Med* 1964; 114:10-13.
2. **Cantu RC**, LeMay M: A large middle cerebral aneurysm presenting as a bizarre vascular malformation. *Brit J Radiol* 1966; 39:317-319.
3. **Cantu RC**, Schwab RS: Ceruloplasmin rise and protein-bound iodine fall in human serum during diphenylhydantoin (Dilantin) administration. *Trans Amer Neurol Assn* 1966; 91:201-203.
4. **Cantu RC**, Drew JH: Pathological laughing and crying associated with a tumor ventral to the pons. *J Neurosurg* 1966; 24:1024-1026.
5. **Cantu RC**, Nahas GG, Manger WM: Effect of hypercapnic acidosis and hypoxia on adrenal catecholamine output of the spinal dog. *Proc Soc Exper Biol Med* 1966; 122:434-437.
6. Hepler RS, **Cantu RC**: Internal carotid aneurysms and third nerve palsies: Ocular status of survivors. *Surg Forum* 1966; 17:436-437.
7. **Cantu RC**, LeMay M, Wilkinson HA: The importance of repeated angiography in the treatment of mycotic-embolic intracranial aneurysms. *J Neurosurg* 1966; 25:189-193.
8. **Cantu RC**, Schwab RS: Ceruloplasmin rise and protein-bound iodine fall in serum due to diphenylhydantoin. *Arch Neurol* 1966; 15:393-396.
9. **Cantu RC**, Moses JM, Kjellberg RN, Connelly JP: An unusual cause of aseptic postoperative fever in a neurosurgical patient. *Clin Med* 1966; 5:747-754.
10. **Cantu RC**, Michelsen JJ, New PFJ: Demonstration of a venticulo-mastoid fistula (paradoxical cerebrospinal fluid rhinorrhea) by pantopaque ventriculography. *Neurochirurgia* 1967; 10:35-44.
11. **Cantu RC**, Goodman HM: Effects of denervation and fasting on white adipose tissue. *Amer J Physiol* 1967; 212:207-212.
12. **Cantu RC**, Roach AM, Hegsted DM: Atherosclerosis in denervated and intact carotid arteries in rabbits. *Proc Soc Exper Boil Med* 1967; 124:451-454.
13. **Cantu RC**, LeMay M: Porencephaly caused by intracerebral hemorrhage. *Radiology* 1967;; 38:526-530.
14. **Cantu RC**: Importance of pathological laughing and/or crying as a sign of occurrence or recurrence of a tumor lying beneath the brainstem. *J Nerv Ment Dis* 1967; 143:508-512.
15. Cantu JQ, **Cantu RC**: The psychiatric efforts of William Herberden Jr. *Bull Hist Med* 1967; 41:132-139.
16. Hepler RH, **Cantu RC**: Aneurysms and third nerve palsies: Ocular status of survivors. *Arch Ophth* 1967; 77:604-608.
17. Prieto A, **Cantu RC**: Spinal subarachnoid hemorrhage associated with neurofibroma of the cauda equina. *J Neurosurg* 1967; 27:63-69.
18. **Cantu RC**, Mark VH, Austen WG: Accurate placement of the distal end of a ventriculo-atrial shunt catheter using vascular pressure changes. *J Neurosurg* 1967; 27:584-586.
19. **Cantu RC**, Michelsen JJ: Long-term follow-up of nine cases of ventriculocisternostomy for non-neoplastic aqueductal occlusion. *J Neurol Neurosurg Psychiat* 1967; 30:556-558.

20. **Cantu RC**, Ojemann RG: Glucosteroid treatment of keratin meningitis following removal of a fourth ventricle epidermoid tumor. *J Neurol Neurosurg Psychiat* 1967; 31:73-75.
21. **Cantu RC**, Kjellberg RN, Moses JM, Ganz RN: Aseptic meningitis due to dermoid tumor: case report and confirming test. *Neurochirurgia* 1968; 11:94-98.
22. **Cantu RC**, Ferris EJ, Baker EP Jr: Collateral circulation to a parietal arteriovenous malformation following bilateral external carotid artery ligation. *J Neurosurg* 1968; 28:369-372.
23. **Cantu RC**, Ojemann RG: Corticosteroids in aseptic meningitis. *Lancet*; 2:1360-1361.
24. **Cantu RC**, Schwab RS, Timberlake WS: Comparison of blood levels with oral and intramuscular diphenylhydantoin. *Neurology* 1968; 18:782-784.
25. **Cantu RC**, Wright RL: Aseptic meningitis syndrome with cauda equina epidermoid tumor. *J Ped* 1968; 73:114-116.
26. **Cantu RC**, Roth DA, Ferris EJ: Angiography in penetrating cervical injuries. *Inter Surg* 1968; 50:562-565.
27. **Cantu RC**, Correll JW, Manger WM: Reassessment of central neural pathways necessary for adrenal catecholamine output in response to hypoglycemia. *Proc Soc Exper Biol Med* 1968; 129:155-170.
28. **Cantu RC**, Prieto A, Ahmadi A: Evaluation of the increased risk of gastrointestinal bleeding following intracranial surgery in patients receiving high steroid dosages in the immediate postoperative period. *Inter Surg* 1968; 50:325-335.
29. **Cantu RC**: Corticosteroids for spinal metastases. *Lancet* 1968; 2:912.
30. **Cantu RC**, Adams RD, McNamara J, Connelly JP: Spinal cord tumors in children: Current status of early diagnosis in this potentially curable neoplasm. *Clin Ped* 1968; 7:726-732.
31. **Cantu RC**: Improvement of cerebrovascular perfusion following complete ischemia. *Bibl Anat* 1969; 10:324-327.
32. **Cantu RC**: Factors influencing post-ischemic cerebral vascular obstruction. *Surg Forum* 1969; 20:426.
33. **Cantu RC**: Oculomotor palsy with posterior communicating artery aneurysm: Outcome with carotid ligation versus medical therapy. *Inter Surg* 1969; 52:144-150.
34. **Cantu RC**: Transient traumatic cerebellar dysfunction: Report of a syndrome. *Inter Surg* 1969; 52:392-394.
35. **Cantu RC**, Ames A III: Distribution of vascular lesions caused by cerebral ischemia; relation to survival. *Neurology* 1969; 19:128-132.
36. **Cantu RC**, Ames A III: Experimental prevention of cerebral vascular obstruction produced by ischemia. *J Neurosurg* 1969; 30:50-54.
37. **Cantu RC**, Ames A III, DiGiacinto G, Dixon J: Hypotension: A major factor limiting recovery from cerebral ischemia. *J Surg Res* 1969; 9:525-529.
38. **Cantu RC**, Ames A III, Dixon J, DiGiacinto G: Reversibility of experimental cerebrovascular obstruction induced by complete ischemia. *J Neurosurg* 1969; 31:429-431.
39. **Cantu RC**, Dixon J, Ames A III: Reversible ischemia model. *J Surg Res* 1969; 9: 521-524.

40. **Cantu RC**, Souders T, Hepler RS: Effects of carotid ligation on aneurysm-induced oculomotor palsy. *J Neurosurg* 1969; 31:528-532.
41. Kornblith PL, **Cantu RC**, Wilkinson HA, Santamarina BA: Syndrome of temporal lobe herniation in pre-eclampsia. *Amer J Obstet Gynec* 1969; 104:923-924.
42. **Cantu RC**, Hegsted DM: Comparison of cerebrovascular perfusion after ischemia in normal and atherosclerotic rabbits. *J Surg Res* 1970; 10:129.
43. DiGiacinto G, **Cantu RC**: Influence of hypertension on post-ischemic cerebrovascular obstruction. *J Sur Res* 1970; 10:229-232.
44. Price DL, Harris JL, New PFJ, **Cantu RC**: Cardiac myxoma; a clinicopathologic and angiographic study. *Arch Neurol* 1970; 23:558-567.
45. **Cantu RC**: Successful excision of giant scalp hemangioendothelioma. *Inter Surg* 1970; 53:293-295.
46. **Cantu RC**: Unusual complication of long hair. *Lancet* 1971; 1(694):350.
47. Wilkinson HA, Ferris EJ, Muggia AL, **Cantu RC**: Central nervous system tuberculosis; a persistent disease. *J Neurosurg* 1971; 34:15-22.
48. **Cantu RC**: Value of myelography in thoracic spinal cord injuries. *Inter Surg* 1971; 56:23-26.
49. **Cantu RC**, Snyder M: Effects of anticoagulants, vasodilators, and dipyridamole on post-ischemic cerebral vascular obstruction. *J Surg Res* 1971; 2:70-71.
50. **Cantu RC**: Use and abuse of carotid angiography in assessing brain ischemia in cases of increased intracranial pressure. *Inter Surg* 1972; 57: 668-670.
51. **Cantu RC**: Brain death as determined by cerebral arteriography. *Lancet* 1973; 1:1391-1392.
52. **Cantu RC**: A simplified technique of anterior spinal fusion using Methyl Methacrylate (Acrylic). *Inter Surg* 1974; 59:110-111.
53. **Cantu RC**: Joint fitness program benefits business and hospital employees. *Hospitals* 1982; 56:46.
54. **Cantu RC**: It happened in 1974. *Surgical Rounds* 1985; 8:117-118.
55. **Cantu RC**: Guidelines to return to contact sports after cerebral concussion. *The Physician and Sportsmedicine* 1986; 14:75-83.
56. **Cantu RC**: Catastrophic injuries in high school and collegiate athletes. *Surgical Rounds for Orthopaedics* 1988; November:62-66.
57. Mueller FO, Blyth CS, **Cantu RC**: Catastrophic spine injuries in football. *The Physician and Sportsmedicine* 1989; 17(10).
58. Cunningham LN, **Cantu RC**: Acute and chronic effects of exercise using an Exercycle in healthy, untrained adults. *Phys Ther* 1990; 70:494-502.
59. McKeag DB, **Cantu RC**: Neck pain in a football player. *The Physician and Sportsmedicine* 1990; 18(3):115-120.
60. **Cantu RC**, Mueller FO: Catastrophic spine injuries in football (1977-1989). *J Spinal Disord* 1990; 3(3):227-231.

61. Mueller FO, **Cantu RC**: Catastrophic injuries and fatalities in high school and college sports: fall 1982-spring 1988. *MSSE* 1990; 22(6):737-741.
62. Weinstein SM, **Cantu RC**: Cerebral stroke in a semi-pro football player: a case report. *MSSE* 1991; 23:1119-1121.
63. **Cantu RC**: Congenital cardiovascular disease – the major cause of athletic death in high school and college. *MSSE* 1992; 24(3):279-280.
64. **Cantu RC**: When to allow athletes to return to play after injury. *J Neurol Orthop Med Surg* 1992; 13:30-34.
65. **Cantu RC**, Mueller FO: Catastrophic football injuries in the USA: 1977-1990. *Clinical Journal of Sports Medicine* 1992; 2 (3):180-185.
66. **Cantu RC**: Cerebral concussion in sports. *Sports Medicine* 1992; 14(1):64-74.
67. **Cantu RC**: Second impact syndrome: Immediate management. *The Physician and Sportsmedicine* 1992; 20(9):55-66.
68. **Cantu RC**: Cervical spinal stenosis: Challenging an established detection method. *The Physician and Sportsmedicine* 1993; 21(9):57-63.
69. **Cantu RC**: Functional spinal stenosis: A contraindication to participation in contact sports. *MSSE* 1993; 25(3):316-317.
70. Cantu RV, **Cantu RC**: Guidelines for return to contact sports after transient quadriplegia. *J Neurosurg* 1994; 80(3):592-594.
71. **Cantu RC**, Mueller FO: Cheerleading. *Clinical Journal of Sports Medicine* 1994; 4(2):75-76.
72. Cantrill SV, **Cantu RC**, Ivatury RR, Viccellio P: Neck Trauma – no margin for error. *Patient Care* 1994; 28:44-46.
73. **Cantu RC**: Transient quadriplegia: to play or not to play. *Sports Medicine Digest* 1994; 16:1-4.
74. **Cantu RC**, Voy RO: Second Impact Syndrome: a risk in any contact sport. *The Physician and Sportsmedicine*. 1995; 23(6):27-34.
75. Van Camp SP, Bloor CM, Mueller FO, **Cantu RC**, Olson HG: Nontraumatic sports death in high school and college athletes. *Medicine and Science in Sports and Exercise* 1995; 27(5):641-647.
76. **Cantu RC**: Catastrophic injury of the brain and spinal cord. *Virginia Medical Quarterly* 1996; 123:98-102.
77. **Cantu RC**: Head injuries in sport. *Br J Sports Med* 1996; 30:289-296.
78. **Cantu RC**: Guidelines for Return to Contact Sport After Transient Quadriplegia. *ASTM* 1996; 1305:53-59.
79. **Cantu RC**: Stingers, Transient Quadriplegia and Cervical Spinal Stenosis: Return to Play Criteria. *MSSE* 1997; 29:233-235.
80. **Cantu RC**: Reflection on Head Injuries in Sport and the Concussion Controversy. *Clinical Journal of Sports Medicine* 1997; 7:83-84.
81. **Cantu RC**, Mueller FO: Fatalities and Catastrophic Injuries in High School and College Sports, 1982 -1997, *The Physician in Sports Medicine* 1999; 27:35-48.



82. **Cantu RC**: Cervical Spinal Stenosis: Diagnosis and Return to Play Issues, *Sports Medicine Consultant* 2000, McGraw-Hill, 2000; 1:2-6.
83. **Cantu RC**: Curve Counter Spinal Stenosis, *NASS News*, 2000.
84. **Cantu RC**, Mueller FO: Catastrophic Football Injuries *Neurosurgery* 2000; 47:673-677.
85. **Cantu RC**: Cervical Spine Injuries in the Athlete, *Seminars in Neurology*, 2000;20(2):173-178.
86. **Cantu R**: Post Traumatic Retrograde and Anterograde Amnesia: Pathophysiology and Implications in Grading and Safe Return to Play. *Journal Athletic Training on Sports Related Concussion*\_ 2001;36:244-248.
87. **Cantu R**: Forward: *Journal of Athletic Training on Sports Related Concussion*\_2001;36:227.
88. Marchiacci Barth, Littlefield Jane, **Cantu Robert**: Multiple Concussions and Neuropsychological Functioning in College Football Player. *Journal of Athletic Training on Sports Related Concussion* 2001;36:303-306.
89. Aubry M, **Cantu R**, Devorak J, et al: Summary and Agreement Statement of the First International Conference on Concussion in Sport, Vienna 2001: *The Physician and Sportsmedicine* 2002;30(2):57-63.
90. Aubry M, **Cantu R**, Devorak J et al: Summary and Agreement Statement of the First International Conference on Concussion in Sport, Vienna 2001: Published Concurrently In: *Br J Sports Med*\_2002; 36(1):6-10 and *Clin J Sports Med* 2002;12(1):6-11.
91. Guskiewicz KM, Marshall SW, Broglio SP, **Cantu RC**, Kirkendall DT: No evidence of impaired neurocognitive performance in collegiate soccer athletes. *American Journal of Sports Medicine* 2002; 30(2):157-162.
92. **Cantu RC**: Work-up of the Athlete With Concussion. The American Journal of Medicine & Sports 2002; IV(II):152-154.
93. Collins MW, Lovell MR, Iverson G, **Cantu RC**, Maroon J, Field M, Fu FH: Cumulative Effects of Concussion in High School Athletes. *Neurosurgery* 2002.
94. Bailes JE, **Cantu RC**, Day AL: The Neurosurgeon in Sport: Awareness of the Risks of Heatstroke and Dietary Supplements. *Neurosurgery* 2002; 51:283-288.
95. Guskiewicz KM, **Cantu RC**: The Concussion Puzzle: Evaluation of Sport-Related Concussion. *The American Journal of Medicine and Sport* 2003
96. Quarrie KL, **Cantu RC**, Chalmers DJ: Rugby Union injuries to the cervical spine and spinal cord. *Sports Medicine* 2002;32(10):633-653.
97. **Cantu, RC**: Invited Commentary: Athletic Head Injury. *Current Sports Medicine Reports* 2003; 2(3):117-119.
98. **Cantu RC**, Echemendia RJ: Return to Play Following Sports-Related Mild Traumatic Brain Injury; The Role for Neuropsychology. *Applied Psychology* 2003; 10(1):48-55.
99. Guskiewicz K, McCrea M, Marshall S, **Cantu R**, Barr W, Onate J, Kelly J: Cumulative Effects Associated With Recurrent Concussion in Collegiate Football Players, The NCAA Concussion Study. *JAMA* 2003; 290(19):2549-2555.
100. McCrea M, Guskiewicz KM, Marshall SW, Barr W, Randolph C, **Cantu RC**, Onate JA, Yang J, Kelley JP: Acute Effects and Recovery Time Following Concussion in Collegiate Football Players. *JAMA* 2003; 290(19):2556-2563.
101. Lovell M, Collins M, Iverson G, Field M, Maroon J, **Cantu R**, Rodell K, Powell J, Belza M, Fu F: Recovery from mild concussion in high school athletes. *Journal of Neurosurgery*\_ 2003; 98:295-301.

102. Collins M, Lovell M, Iverson G, **Cantu R**, Maroon J, Field M: Cumulative effects of concussion in high school athletes. *Neurosurgery* 2003; 51:1175-1181.
103. McCrea M, Guskiewicz K, Marshall S, Barr W, Randolph C, **Cantu R**, Onate J, Yang J, Kelly J: Acute Effects and Recovery Time Following Concussion in Collegiate Football Players: The NCAA Concussion Study. *JAMA* 2003; 290(19):2556-2563.
104. Erlanger D, Kushik T, **Cantu R**, Barth J, Brishek D, Freeman J, Kroger D: Symptom-Based Assessment of Concussion Severity. *J Neurosurg* 2003; Mar93(3):477-484.
105. Echemendia RJ, **Cantu RC**: Return to play following Sports-Related Mild Traumatic Brain Injury: The Role for Neuropsychology. *Applied Neuropsychology* 2003;10(1):48-55.
106. Echemendia RC, **Cantu RC**: Neuropsychology's role in return to play following sports-related cerebral concussion. *Applied Neuropsychology*, 2003;10(1):48-55.
107. **Cantu RC**: Concussion severity should not be determined until all post concussion symptoms have abated. *The Lancet* 2004;3:437-438.
108. Guskiewicz K, Bruce S, **Cantu R**, Ferrara M, Kelly J, McCrea M, Putukian M, McLeod T: National Athletic Trainer's Association Position Statement: Management of Sport-Related Concussion. *Journal Athletic Training* 2004;39(3):280-295.
109. Guskiewicz K, Bruce S, **Cantu R**, Ferrara M, Kelly J, McCrea M, Putukian M, Valovich T: Recommendations on Management of Sport-related Concussion: Summary of the National Athletic Trainers' Association Position Statement. *Neurosurgery* 2004;55(4):891-896.
110. McCrory P, Johnston K, et al: Summary and Agreement Statement of the Second International Conference on Concussion in Sport, Prague 2004. *Phy and Sports Med* 2005;33(4):29-44
111. McCrea M, Barr W, Guskiewicz K, Randolph C, Marshall S, **Cantu R**, Onate J, Kelly J: Standard regression-based methods for measuring recovery after sport-related concussion. *Applied Neuropsychology* 2005;58-69.
112. McCrory P, Johnston K, et al: Summary and Agreement Statement of the Second International Conference on Concussion in Sport, Prague 2004. *Br J Sports Med* 2005;39(4):196-205.
113. McCrory P, Johnston K, et al: Summary and Agreement Statement of the Second International Conference on Concussion in Sport, Prague 2004. *Clin Sports Med* 2005;15(2):48-56.
114. Guskiewicz KM, Marshall SW, Bailes J, McCrea M, **Cantu RC**, Randolph C, Jordan BD: Association between recurrent concussion, mild cognitive impairment, and Alzheimer's disease in retired professional football players. *Neurosurgery* 2005;57(4):719-724.
115. Herring, S, **Cantu R**, et al: ACSM Team Physician Concussion Consensus Statement. *Med Sci Sports Exerc.* 2006; 38(2):395-399.
116. Boden B, Tacchetti R, **Cantu R**, Knowles S, Mueller F: Catastrophic Cervical Injuries in High School and College Football Players *AJSM* 2006;34(8):1223-1232.
117. **Cantu RC**: An Overview of Concussion Consensus Statements Since 2000. *Neurosurgical Focus* 2006;21:1-5.
118. Miele VJ, Bailes JE, **Cantu RC**, Rabb CH: Subdural hematomas in boxing: the spectrum of consequences. *Neurosurgical Focus* 2006;21(4):1-8.

119. Boden B, Tacchetti R, **Cantu R**, Knowles S, Mueller F: Catastrophic Head Injuries in High School and College Football Players. *AJSM* 2007;35:1-7.
120. **Cantu RC**: Athletic Concussions: Current Understanding as of 2007. *Neurosurgery* 2007;60(6):963-964.
121. **Cantu RC**: Chronic Traumatic Encephalopathy in the National Football League. *Neurosurgery* 2007;61(2):223-225.
122. Guskiewicz KM, Marshall SW, Bailes J, McCrea M, Harding HP JR, Matthews A, Mihalik JR, **Cantu RC**: Recurrent concussion and risk of depression in retired professional football players. *Medicine and Science in Sports and Exercise* 2007;39(6):903-909.
123. **Cantu RC**, Herring SA, Putukian M: Concussion: Letter to the Editor. *NEJM* 2007;356(17):1787.
124. Standaert CJ, Herring SA, **Cantu RC**: Expert Opinion and Controversies in Sports and Musculoskeletal Medicine: Concussion in the Young Athlete. *Arch Phys Med Rehabil*; 2007;88:1077-1079.
125. **Cantu RC**, Detection of postconcussion abnormalities after injury in young athletes. *Clin J Sport Med* 2007;17(5):435-436.
126. Davis G, Ugokwe K, Roger EP, Benzel EC, **Cantu RC**, Rogers M, Dvorak J, McCrory P: *Br J Sports Med* June 2008
127. Terrell, T, Bostick, R, Abramson, Xie, D, R, Barfield, W, **Cantu, R**, Stanek, M, Ewing, T. APOE, APOE Promoter, and Tau Genotypes and Risk for Concussion in College Athletes. *Clinical Journal of Sport Medicine* 2008;18:10-17.
128. **Cantu, R**: Consensus Statement on Concussion in Sport – The 3<sup>rd</sup> International Conference on Concussion, Zurich, November 2008. *Neurosurgery* 2009;64(5):786-787.
129. **Cantu RC**: Commentary When to Disqualify an Athlete After a Concussion, *Current Sports Medicine Reports* 2009;8:6-7.
130. McCrory JP, Meeuwisse W, Johnston K, Dvorak J, Aubry M, Mallow M, **Cantu R**. Consensus statement on concussion in sports – the Third International Conference on Concussion in Sport held in Zurich, November 2008, *Phy Sportsmed*. 2009;37:141-159.
131. McKee AC, **Cantu RC**, Nowinski CJ: Chronic Traumatic Encephalopathy in Athletes: Progressive Tauopathy After Repetitive Head Injury. *J Neuropath Exp Neurol* 2009;68:709-735.
132. **Cantu RC**, Mueller FO. The prevention of catastrophic head and spine injuries in high school and college sports. *Br J Sports Med*. 2009;43:981-986.
133. Mihalik JP, Greenwalk RM, Blackburn JT, **Cantu RC**, Marshall SW, Guskiewicz KM. The effect of infraction type on head impact severity in youth ice hockey. *Med Sci Sports Exer*. 2010;42:1431-1438.
134. Gavett BE, Stern RA, **Cantu RC**, Nowinski CJ, McKee AC. Mild traumatic brain injury: a risk factor for Neurodegeneration. *Alzheimer's Research & Therapy* 2010;2:18-21.
135. **Cantu RC**, Gean A. Second Impact Syndrome and a Thin Subdural Hematoma: An Uncommon Catastrophic Result of Repetitive Head Injury With a Characteristic Imaging Appearance. *J Neurotrauma* 2010;27:1-8.
136. Echlin PS, Tator CH, Cusimaon MD, **Cantu RC**, Taunton JE, Upshur RE, Hall CR, Johnson AM, Forwell LA, Skopelja EN. A prospective study of physician-observed concussions during junior ice hockey: implications for incidence rates. *Neurosurg Focus* 2010;29(5):E4.

137. Echlin PS, Johnson AM, Riverin S, Tator CH, **Cantu RC**, Cusimano MD, Taunton JE, Upshur RE, Hall CR, Forwell LA, Skopelja EN. A prospective study of concussion education in 2 junior ice hockey teams: implications for sports concussion education. *Neurosurg Focus* 2010;29(5):E6.
138. Echlin PS, Tator CH, Cusimano MD, **Cantu RC**, Taunton JE, Upshur RE, Czarnota M, Hall CR, Johnson AM, Forwell LA, Driediger M, Skopelja EN. Return to play after an initial or recurrence concussion in a prospective study of physician-observed junior ice hockey concussions: implications for return to play after a concussion. *Neurosurg Focus* 2010;29(5):E5.
139. Jayarao M, Chin L, **Cantu R**. Boxing-Related Head Injuries. *The Physician and Sportsmedicine*. October 2010;3:0091-3847.
140. McKee AC, Gavett BE, Stern RA, Nowinski CJ, **Cantu RC**, Kowall NW, Perl DP, Hedley-Whyte ET, Price B, Sullivan C, Morin P, Kubilus CA, Daneshvar DH, Wulff M, Budson AE. TDP-43 proteinopathy and motor neuron disease in chronic traumatic encephalopathy. *J Neuropathol Exp Neurol*. September 2010;60(9):918-29.
141. Mihalik JP, Blackburn JT, Greenwald RM, **Cantu RC**, Marshall SW, Guskiewicz KM. Collision type and player anticipation affect head impact severity among youth ice hockey players. *Pediatrics*. June 2010;125(6):e1394-401.
142. **Cantu RC**, Guskiewicz K, Register-Mhialik JK. A Retrospective Clinical Analysis of Moderate to Severe Athletic Concussions. *PM&R*. December 2010;(2)12:1088-1093.
143. **Cantu RC**: World Cup Soccer; A Major League Soccer Superstar's Career-Ending Injury, Concussion; and World Neurosurgery: A Common Thread. *World Neurosurgery* August/September 2010;74(2/3):224-225.
144. **Cantu RC**: Is Helmet Design the Answer to Concussion in Sports. *Active Voice Bulletin ACSM*, September 2010.
145. Thomas M, Haas, TS, Doerer, JJ, Hodges JS, Aicher BO, Garberich RF, Mueller FO, **Cantu RC**, Maron BJ: Epidemiology of Sudden Death in Young, Competitive Athletes Due to Blunt Trauma. *Pediatrics* July 2011;
146. Chin LS, Jayarao M, **Cantu RC**: Inside Sports-Related Head Injury: Tau Inclusion Bodies and Proteins in a Tangle. *Neurosurgeon*, 2011;20(1):4-7.
147. Daneshvar DH, Baugh CM, Nowinski CJ, McKee AC, Stern RA, **Cantu RC**: Helmets and Mouth Guards: The role of personal equipment in preventing sport-related concussions. *Clinics in Sports Medicine*. 2011;30:145-163
148. Chin LS, Toshkezi G, **Cantu RC**, Traumatic Encephalopathy Related to Sports Injury, *US Neurology*, 2011;7(1):33-6.
149. Broglio S, Schartz E, Crisco T, **Cantu RC**, In Vivo Biomechanical Measurements of a Football Player's C6 Spine Fracture, *N Engl J Med* 365;3 *nejm.org* 2011
150. Mihalik JP, Guskiewicz KM, Marshall SW, Greenwald RM, Blackburn JT, **Cantu RC**, Does Cervical Muscle Strength in Youth Ice Hockey Players Affect Head Impact Biomechanics, *Clin J Sport Med*, 2011;21:416-421
151. **Cantu RC**. Register-Mihalik JK: Return-to-Play and Retirement Decisions After Concussion. *PM&R*, 2011;3:S440-444.
152. Daneshavar DH, Riley DO, Nowinski CJ, McKee AC, Stern RA, **Cantu RC**: Long-Term Consequences: Effects on Normal Development Profile After Concussion. *PM&R*, 2011;22(4):682-700.
153. Herring SA, **Cantu RC**, Guskiewicz KM, Putukian M, Kibler WB: Concussion (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement – 2011 Update. *Medicine & Science in Sports & Exercise*, 2011 Special Communications 2412-2422. <http://www.acsm-msse.org>
154. Stern RA, Riley DO, Daneshvar DH, Nowinski CJ, **Cantu RC**, Mckee AC: Long Term Consequences of Repetitive Brain Trauma: Chronic Traumatic Encephalopathy. *PM*, 2011;3: S460-S467.

155. Gavett, BE, **Cantu RC**, Shenton M, Lin A, Nowinski CJ, McKee AC, Stern RA: Clinical Appraisal of Chronic Traumatic Encephalopathy: Current Perspectives and Future Directions. *Current Opinion in neurology* 2011 Dec; 24(6):525-531.
156. Daneshvar D, Nowinski C, McKee A, Cantu R. The epidemiology of Sports-Related Concussion. *Clinics in Sports Medicine*. 2011 Jan;30(1):1-17, vii.
157. L. E. Goldstein, A. M. Fisher, C. A. Tagge, X.-L. Zhang, L. Velisek, J. A. Sullivan, C. Upreti, J. M. Kracht, M. Ericsson, M. W. Wojnarowicz, C. J. Goletiani, G. M. Maglakelidze, N. Casey, J. A. Moncaster, O. Minaeva, R. D. Moir, C. J. Nowinski, R. A. Stern, **R. C. Cantu**, J. Geiling, J. K. Blusztajn, B. L. Wolozin, T. Ikezu, T. D. Stein, A. E. Budson, N. W. Kowall, D. Chargin, A. Sharon, S. Saman, G. F. Hall, W. C. Moss, R. O. Cleveland, R. E. Tanzi, P. K. Stanton, A. C. McKee, Chronic traumatic encephalopathy in blast-exposed military veterans and a blast neurotrauma mouse model. *Sci. Transl. Med.* 4, 134ra60 (2012).
158. Mihalik JP, Guskiewicz KM, Marshall, SW, Blackburn JT, **Cantu RC**, Greenwald RM (2011). Head Impact Biomechanics in Youth Hockey: Comparisons across playing position, event types, and impact locations. *Annals of Biomedical Engineering*;40(1):141-149.
159. Saffary R, Chin LA, **Cantu RC**. From Concussion to Chronic Traumatic Encephalopathy: A review. *J Lifestyle Magazine* (2012)
160. Baugh, CM, Stamm, JM, Riley DO, Gavett, BE, Shenton M, Lin A, Nowinski, CJ, **Cantu RC**, McKee AC, Stern RA: Chronic Traumatic Encephalopathy: Neurodegeneration Following Repetitive Concussive and Subconcussive Brain Trauma. *Brain Imaging and Behavior*, June 2012;6(2):244-54.
161. McKee A, Stern R, Nowinski C, Stein T, Alvarez V, Daneshvar D, Lee H, Hall G, Wojtowica S, Baugh C, Riley D, Kubilis C, Cormier K, Jacobs M, Martin B, Abraham C, Ikesu T, Reichard R, Wolozin B, Budson A, Goldstein L, Kowall N, **Cantu R**: The Spectrum of Disease in Chronic Traumatic Encephalopathy, *doi:10.1093/Brain/aws307* (22 pages) 2013.
162. Yi J, Padalino D, Chin L, Montenegro P, **Cantu RC**: Chronic Traumatic Encephalopathy, *Current Sports Medicine Reports*, Jan/Feb 2013;12 (1): 28-32
163. Saffary R, Chin L, **Cantu RC**: From Concussion to Chronic Traumatic Encephalopathy: A Review, *Journal of Clinical Sport Psychology* 2012;6:351-362.
164. **Cantu, RC**, Li Y, Abdulhamid M, Chin L, Return to Play After Cervical Spine Injury in Sports, *Current Sports Medicine Reports*, Jan/Feb 2013;12 (1): 14-17.
165. Seichepine, DR, Stamm, JM, Daneshvar, DH, Riley, DO, Baugh, CM, Gavett, BE, Tripodis, Y, Martin, B, Chaisson, C, McKee, AC, **Cantu, RC**, Nowinski, CJ, & Stern, RA (in press). Profile of Self-reported Problems with Executive Functioning in College and Professional Football Players. *Journal of Neurotrauma*, 2013; 30: 1299-1304.
166. McCrory P, Meeuwisse WH, Aubry M, **Cantu B**, et al, Dvorak J, Echemendia RJ, Engebretsen L, Johnston K, Kutcher JS, Raftery M, Sills A, Benson BW, Davis GA, Ellenbogen RG, Guskiewicz K, Herring SA, Iverson GL, Jordan BD, Kissick J, McCrea M, McIntosh AS, Maddocks D, Makdissi M, Purcell L, Putukian M, Schneider K, Tator CH, Turner M: Consensus Statement on Concussion in Sport: the 4<sup>th</sup> International Conference on Concussion in Sport held in Zurich, November 2012: *Br J Sports Med* 2013;47:250-258 doi:10.1136/bjsports-2013-092313.
167. Putukian M, Raftery M, Guskiewicz K, Herring S, Aubry M, **Cantu RC**, Molloy M: Onfield Assessment of Concussion in the adult athlete: *Br J Sports Med* 2013;47:285-288 doi:10.1136/bjsports-2013-092158.
168. Makdissi M, **Cantu RC**, Johnston KM, McCrory P, Meeuwisse WH: The difficult Concussion Patient: What is the Best Approach to Investigation and Management of Persistent (>10 days) Postconcussive Symptoms?: *Br J Sports Med* 2013;47:308-313 doi:10.1136/bjsports-2013-092255.

169. Stern RA, Baugh CM, Seichepine DR, Montenegro PH, Riley DO, Fritts NG, Stamm JM, Robbins CA, McHale L, Simkin I, Stein TD, Alvarez VE, Goldstein LE, Budson AE, Kowall NW, Nowinski CJ, **Cantu RC**, McKee AC: Clinical Presentation of Chronic Traumatic Encephalopathy: *American Academy of Neurology*; 2013;81:1122-1129.
170. **Cantu RC**, Role of Diffusion Tensor Imaging MRI in Detecting Brain Injury in Asymptomatic Contact Athletes: *World Neurosurgery*; December 2013;5:792-793.
171. **Cantu RC**, The Role of the Neurologist in Concussions When to Tell Your Patient to Stop: *Jama Neurology*; October 2013;*Jamaneurology.com*;E1-E2.
172. Kroshus E, Daneshvar DH, Baugh, CM, Nowinski CJ, **Cantu RC**, NCAA Concussion Education In Ice Hockey: An Ineffective Mandate: *BJSM Online*; 2013 10.1136
173. Broglio SP, **Cantu RC**, Gioia GA, Guskiewicz KM, Kutcher J, Palm M, Valovich McLeod TC, National Athletic Trainers' Association Position Statement: Management of Sport Concussion: *Journal of Athletic Training*; 2014;49(2):245-265.
174. Slobounov S, Bazarian J, Bigler E, **Cantu R**, Hallett M, Harbaugh R, Hovda D, Mayer AR, Nuwer MR, Kou Z, Lazzarino G, Papa L, Vagnozzi R, Sport-Related concussion: Ongoing Debate: *BR J Sports Med*; January 2014: 48:2:75-76.
175. Robbins CA, Daneshvar DH, Picano JD, Gavett BE, Baugh CM, Riley DO, Nowinski CJ, McKee AC, **Cantu RC**, Stern RA, Self-Reported Concussion History: Impact of Providing a Definition of Concussion: *Open Access Journal of Sport Medicine*; 2014;5:99-103.
176. Collins CL, Fletcher EN, Fields, SK, Kluchurosky L, Rohrkemper MK, Comstock RD, **Cantu RC**, Neck Strength: A Protective Factor Reducing Risk for Concussion in High School Sports: *J Primary Prevent*; June 2014: 35(5):309-19(ISSN: 1573-6547).
177. Montenegro PH, Baugh CM, Daneshvar DH, Mez J, Budson AE, Au R, Katz D, **Cantu RC**, Stern RA, Clinical Subtypes of Chronic Traumatic Encephalopathy: Literature Review and Proposed Research Diagnostic Criteria for Traumatic encephalopathy Syndrome: *Alzheimer's Research and Therapy*; 2014;6:68
178. Terrell TR, Abramson R, Bostick R, Barth J, Sloane R, **Cantu RC**, Bennett E, Galloway L, Erlanger D, McKeag D, Valentine V, Nichols G: Multi Center Cohort Study on Association of Genotypes with Prospective Sports Concussion: Methods, Lessons Learned, and Recommendations: *Journal of Sports Medicine and Physical Fitness*; 2014; ePub (ePub): ePub
179. Riley DO, Robbins CA, **Cantu RC**, Stern RA: Chronic Traumatic Encephalopathy: Contributions from the Boston University Center for the Study of Traumatic Encephalopathy: *Brain Injury* 2015: Vol 29, No.2 154-163.
180. Montenegro PH, Corp DT, Stein TD, **Cantu RC**, Stern RA: Chronic Traumatic Encephalopathy: Historical Origins and Current Perspective: *Annual Review of Clinical Psychology*: 11:309-360; 2015.
181. Carman AJ, Ferguson R, **Cantu RC**, Comstock D, Dacks PA, DeKosky ST, Gandy S, Gilbert J, Gilliland C, Gioia G, Giza C, Greicius M, Hainline B, Hayes RL, Hendrix J, Jordan B, Kovach J, Lane RF, Mannix R, Murray T, Seifert T, Shineman DW, Warren E, Wilde E, Willard H, Fillit HM: Mind the Gaps-Advancing Research into Short-term and Long-term Neuropsychological Outcomes of Youth Sports-related Concussions: *Nature Review Neurology*: 11:230-244;2015.
182. Montenegro PH, Bernick C, **Cantu RC**: Clinical Features of Repetitive Traumatic Brain Injury and Chronic Traumatic Encephalopathy: *Brain Pathology*: 25:304-317;2015.
183. Stein TD, Montenegro PH, Alvarez VE, Xia W, Crary JF, Tripodis Y, Daneshvar DH, Mez J, Solomon T, Meng G, Kubilus CA, Cormier KA, Meng S, Babcock K, Kiernan P, Murphy L, Nowinski CJ, Martin B, Dixon D, Stern RA,

**Cantu RC**, Kowall NW, McKee AC: Beta-amyloid Deposition in Chronic Traumatic Encephalopathy: *Acta Neuropathol*: 130:21–34:2015.

184. Marshall SW, Guskiewicz KM, Shankar V, McCrea M, **Cantu RC**: Epidemiology of Sports-Related Concussion in Seven US High School and Collegiate Sports: *Injury Epidemiology*;2:13:2015. DOI 10.1186/s40621-015-0045-4
185. Stamm JM, Koerte IK, Muehlmann M, Pasternak O, Bourlas AP, Baugh CM, Giwerc MY, Zhu A, Coleman MJ, Bouix S, Fritts NG, Martin BM, Chaisson C, McClean MD, Lin AP, **Cantu RC**, Tripodis Y, Stern RA, Shenton ME: Age at First Exposure to Football is Associated with Altered Corpus Callosum White Matter Microstructure in Former Professional Football Players: *Journal of Neurotrauma*;2015; 32:1–9
186. Seifert T, Bernick C, Jordan B, Alessi A, Davidson J, **Cantu R**, Giza C, Goodman M, Benjamin J: Determining Brain Fitness to Fight: Has the Time Come?; *The Physician and Sportsmedicine*: 2015;43:4, 395-402.
187. Jha NK, Cantu RC, Tator CH, Bailes JE: The Future of Concussion Management; *Curr Res Concussion*: 2015;2:1
188. Mez J, Solomon TM, Daneshvar DH, Murphy L, Kiernan PT, Montenegro PH, Kriegel J, Abdolmohammadi B, Fry B, Babcock KJ, Adams JW, Bourlas AP, Papadopoulos Z, McHale L, Ardaugh BM, Martin BR, Dixon D, Nowinski CJ, Chaisson C, Alvarez VE, Tripodis Y, Stein TD, Goldstein LE, Katz DI, Kowall NW, **Cantu RC**, Stern RA, McKee AC: Assessing clinicopathological correlation in chronic traumatic encephalopathy: rationale and methods for the UNITE study: *Mez et al. Alzheimer's Research & Therapy*;7:62; 2015
189. Stern RA, Tripodis, Y, Baugh CM, Fritts NG, Martin BM, Chaisson C, **Cantu RC**, Joyce JA, Shah S, Ikezu T, Zhang J, Gercel-Taylor C, Taylor DD. Plasma Exosomal Tau as a Potential Biomarker for Chronic Traumatic Encephalopathy. *Journal of Alzheimer's Disease*: 2016 February 10; 51(4): 1099-1109.
190. Montenegro PH, Alosco ML, Martin B, Daneshvar D, Chaison C, Nowinski CJ, AU R, McKee AC, **Cantu RC**, McClean MD, Stern RA, Tripodis Y. Cumulative Head Impact Exposure Predicts Later-Life Depression, Apathy, Executive Dysfunction, and Cognitive Impairment in Former High School and College Football Players. *Journal of Neurotrauma*:DOI: 10.1089/neu.2016.
191. Wright MJ, Woo E, Birath JB, Siders CA, Kelly DF, Want C, Swerdloff R, Romero E, Kernan C, **Cantu RC**, Guskiewicz K. An index predictive of cognitive outcome in retired professional American Football players with a history of sports concussion. *Journal of Clinical and Experimental Neuropsychology*; 2016, 38 (5): 561-571.
192. Stern RA, Seichepine D, Tschoe C, Fritts NG, Alosco ML, Berkowitz O, Burke P, Howland J, Olshaker J, **Cantu RC**, Baugh CM, Holsapple JW: Concussion Care Practices and Utilization of Evidence-Based Guidelines in the Evaluation and Management of Concussion: A Survey of New England Emergency Departments. *Journal of Neurotrauma*: DOI: 10.1089/neu.2016.4
193. Currie DW, Comstock D, Fields SK, **Cantu RC**: A Paired Comparison of Initial and Recurrent Concussions Sustained by US High School Athletes Within a Single Athletic Season: *Head Trauma Rehabil*: DOI: 10.1097/HRO.0000000000000240.
194. Alosco ML, Jarnagin J, Tripodis Y, Platt M, Martin B, Chaisson CE, Fritts NG, **Cantu RC**, Stern RA: Olfactory Function and Associated Clinical Correlates in Former NFL Players. *Journal of Neurotrauma*. (in press).

## BOOKS

1. **Cantu RC**, Michelsen JJ, White JC: Ventriculocisternostomy: Long-term Experiences Springfield, Charles C Thomas, 1970.
2. **Cantu RC**: Toward Fitness New York, Human Sciences Press, 1980.

3. **Cantu RC:** Health Maintenance Through Physical Conditioning  
Littleton, Wright-PSG Publishing, Inc, 1981.
4. **Cantu RC:** The Exercising Adult  
Lexington, The Collamore Press, D.C. Heath & Co, 1981.
5. **Cantu RC:** Sports Medicine in Primary Care  
Lexington, The Collamore Press, D.C. Heath & Co, 1982.
6. **Cantu RC:** Diabetes and Exercise  
New York, E.P. Dutton, Inc, 1982.
7. **Cantu RC:** Sports Medicine-Sports Science: Bridging the Gap  
Lexington, The Collamore Press, D.C. Heath & Co, 1982.
8. **Cantu RC:** Regaining Health and Fitness  
Brattleboro, The Stephen Greene Press, 1982.
9. **Cantu RC:** Exercise Injuries: Prevention and Treatment  
Washington, D.C., The Stonewall Press, 1983.
10. **Cantu RC:** Clinical Sports Medicine  
Lexington, The Collamore Press, D.C. Heath & Co, 1983.
11. **Cantu RC,** Butler RB, Moore MJ:  
Neurology in Primary Care  
New York, MacMillan Publishing Co, 1987.
12. **Cantu RC:** The Exercising Adult, 2<sup>nd</sup> Edition  
New York, MacMillan Publishing Co, 1987.
13. **Cantu RC,** Micheli LJ:  
American College of Sports Medicine: Guidelines for the Team Physician  
Philadelphia, Lea & Febiger, 1991.
14. **Cantu RC,** et al, in Cantu RC (ed): Boxing and Medicine  
Champaign, IL, Human Kinetics, 1995.
15. Mueller FO, **Cantu RC,** Van Camp SP:  
Catastrophic Injuries in High School and College Sports  
Champaign, IL, Human Kinetics, 1996.
16. **Cantu RC:** Clinics in Sports Medicine: Neurologic Athletic Head and Neck Injuries  
17. Philadelphia, W.B. Saunders Company, 1998.
18. **Cantu RC:** Neurologic Athletic Head and Spine Injuries Philadelphia, W.B. Saunders Company, 2000.
19. **Cantu R,** Shephard R, Alexander M, Kohrt W, Nieman D, Shrier I: Yearbook of Sports Medicine Philadelphia, PA Mosby, Inc. 2002
20. **Cantu R,** Shephard R, Alexander M, Kohrt W, Nieman D, Shrier I: Yearbook of Sports Medicine Philadelphia, PA Mosby, Inc. 2003
21. **Cantu R,** Shephard, R, Alexander M, Nieman D, Sanborn C, Shrier I, Sallis R: Yearbook of Sports Medicine Philadelphia, PA, Mosby, Inc. 2004.
22. **Cantu R,** Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2005.



23. **Cantu R**, Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2006.
24. **Cantu R**, Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2007.
25. **Cantu R**, Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2008.
26. **Cantu R**, Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2009.
27. **Cantu R**, Shepard R, Alexander M, Feldman D, McCrory P, Nieman D, Rowland T, Sanborn C, Shrier I: Yearbook of Sports Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2010.
28. Mueller FO, **Cantu RC**: Football Fatalities and Catastrophic Injuries, 1931-2008 Carolina Academic Press Durham, NC 2011.
29. Shephard RJ, **Cantu RC**, Feldman DH, Jankowski CM, Khan KM, Lebrun C, Nieman DC, Pierrynowski MR, Rowland T: Yearbook of Sport Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2011.
30. Shephard RJ, **Cantu RC**, Feldman DH, Jankowski CM, Khan KM, Lebrun C, Nieman DC, Pierrynowski MR, Rowland T: Yearbook of Sport Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2012.
31. **Cantu RC**, Hyman M: Concussion and Our Kids Houghton Mifflin Harcourt 2012
32. Shephard RJ, **Cantu RC**, Feldman DH, Jankowski CM, Khan KM, Lebrun C, Nieman DC, Pierrynowski MR, Rowland T: Yearbook of Sport Medicine Philadelphia, PA, Elsevier/Mosby, Inc. 2013.

**NON-REFEREED ARTICLES**

1. **Cantu RC:** Unwilling laughter traced to tumor. Med World News 1965; 184-185.
2. **Cantu RC, Drew JH:** Pathological laughing and crying associated with a tumor ventral to the pons. JAMA 1966; 197:184.
3. **Cantu RC, Drew JH:** Pathological laughing and crying associated with a tumor ventral to the pons. Psychiat Digest 1966; 27:46-47.
4. **Cantu RC:** Factors improving post-ischemic cerebral vascular obstruction. Cerebral Circulation and Metabolism 1975; 216-219.
5. **Cantu RC:** Nutrition for the long distance runner. Runner's Release 1979; 1(2):8-9.
6. **Cantu RC:** The psychological benefits of running. Runner's Release 1979; 1(3):13.
7. **Cantu RC:** Risk of chronic brain injury. ACSM Bulletin 1986; November.
8. **Cantu RC:** When to return to contact sports after a cerebral concussion. Sports Medicine Digest 1988; 10(11):1-2.
9. Mueller FO., **Cantu RC:** National Center for Catastrophic Sports Injury Research 6th Annual Report. Fall 1982-Spring 1988. Chapel Hill, NC.
10. Mueller FO, **Cantu RC:** National Center for Catastrophic Sports Injury Research 7th Annual Report. Fall 1982-Spring 1989. Chapel Hill, NC.
11. Tobin WE, **Cantu RC:** Subarachnoid hemorrhage associated with aerobic exercise. The Physician and Sportsmedicine 1989; 17(5):145-148.
12. Mueller FO, **Cantu RC:** National Center for Catastrophic Sports Injury Research 8th Annual Report. Fall 1982-Spring 1990. Chapel Hill, NC.
13. **Cantu RC:** On-the-field evaluation of head and neck injuries. Orthopedic & Sports Medicine News 1991; 2:15-16.
14. **Cantu RC:** Diagnosis of acute low back pain in the athlete. Sports Medicine Digest 1991; 13(3):1-2.
15. Mueller FO, **Cantu RC:** National Center for Catastrophic Sports Injury Research 9th Annual Report. Fall 1982-Spring 1991. Chapel Hill, NC.
16. Mueller FO, **Cantu RC:** National Center for Catastrophic Sports Injury Research 10th Annual Report. Fall 1982-Spring 1992. Chapel Hill, NC.
17. Hodgson VR, **Cantu RC:** Rule change in 1970s highlights efforts to reduce football injuries. National Federation News 1992; 28-29.
18. **Cantu RC:** Research: Our roots. Sports Medicine Bulletin 1992; 27(3):3.
19. **Cantu RC:** A night to be proud. Sports Medicine Bulletin 1993; 28(1):3.
20. **Cantu RC:** Membership: The foundation and strength of ACSM. Sports Medicine Bulletin 1993; 28(2):3.
21. **Cantu RC:** Functional spinal stenosis: A contraindication to participation in contact sports. (letter to editor) MSSE 1993; 25(9):1082-1083.
22. **Cantu RC:** Assessing athletic head injuries. Rehab Management 1993; 6(5):59-60.

23. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 11th Annual Report. Fall 1982-Spring 1993. Chapel Hill, NC.
24. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 12th Annual Report. Fall 1982-Spring 1994. Chapel Hill, NC.
25. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 13th Annual Report. Fall 1982-Spring 1995. Chapel Hill, NC.
26. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 14th Annual Report. Fall 1982-Spring 1996. Chapel Hill, NC.
27. **Cantu RC**: Football’s rate of concussions demands more helmet research and a halt to “spearing tactics.” National Collegiate Athletic Association Education Newsletter: Sports Sciences Spring 1995.
28. **Cantu RC**: The prevention of athletic head and spine injuries. Sidelines Fall 1996; National Youth Sports Safety Foundation, Needham, MA.
29. Kleiner DM, **Cantu RC**: Football helmet removal. American College of Sports Medicine: Current Comments September, 1996.
30. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 15<sup>th</sup> Annual Report. Fall 1982 to Spring 1997. Chapel Hill, NC.
31. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 16<sup>th</sup> Annual Report. Fall 1982 to Spring 1998. Chapel Hill, NC.
32. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 17<sup>th</sup> Annual Report. Fall 1982 to Spring 1999. Chapel Hill, NC.
33. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 18<sup>th</sup> Annual Report. Fall 1982 to Spring 2000. Chapel Hill, NC.
34. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 19<sup>th</sup> Annual Report. Fall 1982 to Spring 2001. Chapel Hill, NC.
35. **Cantu RC**: A New Tool for the Evaluation of Concussion in Boxers. 2002
36. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 20<sup>th</sup> Annual Report. Fall 1982 to Spring 2002. Chapel Hill, NC.
37. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 21<sup>st</sup> Annual Report. Fall 1982 to Spring 2003. Chapel Hill, NC.
38. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 22<sup>nd</sup> Annual Report. Fall 1982 to Spring 2004. Chapel Hill, NC.
39. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 23<sup>rd</sup> Annual Report. Fall 1982 to Spring 2005. Chapel Hill, NC.
40. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 24<sup>th</sup> Annual Report. Fall 1982 to Spring 2006. Chapel Hill, NC.
41. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 25<sup>th</sup> Annual Report. Fall 1982 to Spring 2007. Chapel Hill, NC.

42. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 26<sup>th</sup> Annual Report. Fall 1982 to Spring 2008. Chapel Hill, NC.
43. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 27<sup>th</sup> Annual Report. Fall 1982 to Spring 2009. Chapel Hill, NC
44. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 28<sup>th</sup> Annual Report. Fall 1982 to Spring 2010. Chapel Hill, NC
45. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 29<sup>th</sup> Annual Report. Fall 1982 to Spring 2011. Chapel Hill, NC
46. Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 30<sup>th</sup> Annual Report. Fall 1982 to Spring 2012. Chapel Hill, NC
47. Kucera KL, Cox LM, Mueller FO, **Cantu RC**: National Center for Catastrophic Sports Injury Research 31<sup>st</sup> Annual Report. Fall 1982 to Spring 2013. Chapel Hill, NC
48. Kucera KL, Klossner D, Colgate B, Cantu RC: National Center for Catastrophic Sport Injury Research Annual Survey of Football Injury Research Report. 1931-2014. Chapel Hill, NC
49. **Cantu, RC**: Opportunities for Prevention of Athletic Concussion on the Playing Field. The Bridge. 46.1 Spring 2016, 31-33.

**ABSTRACTS AND FREE COMMUNICATIONS**

1. Correll JW, **Cantu RC**: Effect of hypophysectomy and adrenalectomy on mobilization of free fatty acids (FFA) from isolated rat adipose tissue by nerve stimulation, in vitro. Fed Proc 1964; part 1, 23:541.
2. **Cantu RC**, Nahas GG, Correll JW, Manger WM: Effect of hypoxia and acidosis on medullary secretion from the denervated adrenal gland. Physiologist 1964; 7:99.
3. Correll JW, **Cantu RC**, Manger WM: Neural pathways mediating effects of intravascular norepinephrine administration. Physiologist 1964; 7:107.
4. Nahas GG, **Cantu RC**, Manger WM, Correll JW: Mediation of adrenal medullary secretion in response to hypotension after spinal cord section. Physiologist 1964; 7:210.
5. **Cantu RC**, Correll JW, Manger WM: Neural pathways mediating the increase in adrenal medullary secretion produced by hypoglycemia and hypotension. Pharmacologist 1964; 6:195.
6. Correll JW, **Cantu RC**, Manger WM: Mechanism for mobilization of free fatty acids by insulin-induced hypoglycemia. Fed Proc 1965; part 1, 24:298.
7. **Cantu RC**, Schwab RS: Protein-bound iodine (PBI) fall and serum ceruloplasmin (SC) rise following diphenylhydantoin administration (DA) in man. Pharmacologist 1965; 7:145.
8. **Cantu RC**, Goodman HM: Effects of denervation and fasting on lumbar fat in the rat. Fed Proc 1966; part 3, 25:271.
9. **Cantu RC**, Ames A III: Improvement of cerebral perfusion following complete ischemia. Fed Proc 1968; 27:329.
10. **Cantu RC**: Heart failure: A limiting factor in recovery from cerebral ischemia. Circulation 1968; 38, suppl VI:51.
11. **Cantu RC**, Ames A III: Distribution of cerebral vascular obstruction following ischemia. Circulation 1968; 38, suppl VI:51.
12. DiGiacinto G, **Cantu RC**, Ames A III, Dixon J: Hypotension: A limiting factor in recovery from cerebral ischemia. Clin Res 1968; 16:512.
13. Dixon J., **Cantu RC**, Ames A III, DiGiacinto G: Effect of heparin on vascular lesions caused by cerebral ischemia. Clin Res 1968; 16:513.
14. **Cantu RC**, DiGiacinto G, Dixon J, Ames A III: Reversibility of post-ischemic cerebrovascular obstruction. Clin Res 1969; 17:233.
15. DiGiacinto G, **Cantu RC**, Ames A III: Effects of hypertension on post-ischemic cerebrovascular obstruction. Clin Res 1969; 17:237.
16. **Cantu RC**, Snyder M: Effect of pharmacological agents on post-ischemic cerebrovascular obstruction. Fed Proc 1970; 29:520.
17. **Cantu RC**: Factors improving post-ischemic cerebrovascular obstruction. Stroke 1973; 4:345.
18. **Cantu RC**: Acute and chronic brain injury and contact sports. 1987; ACSM Clinical Conference, Keystone, CO.
19. **Cantu RC**: Concussion - what is it? Guidelines for returning to sports. 1987; ACSM Clinical Conference, Keystone, CO.

20. **Cantu RC**: Discogenic disease: surgical and non-surgical approaches. 1987; ACSM Clinical Conference, Keystone, CO.
21. **Cantu RC**: Medical aspects of boxing. 1987; ACSM Clinical Conference, Keystone, Co.
22. **Cantu RC**: Catastrophic Football Spine Injuries: 1977-1988. Joint Section on Disorders of the Spine and Peripheral Nerves 1990; AANS/CNS Annual Meeting, Captiva Island, FL.
23. Cunningham LM, **Cantu RC**: Is exercise intensity generalizable? Comparison of exercise test modes. MSSE 1990; 22:13.
24. Van Camp SP, Mueller FO, **Cantu RC**, Nattiv A, Eichner ER: Catastrophic sports injuries in high school and college athletes. MSSE 1994; 26:S86.
25. Mueller FO, **Cantu RC**: High school and college catastrophic pole vaulting injuries. MSSE 1995; 27:598.
26. Ross SE, Guskiewicz KW, **Cantu RC**: Balance recovery following cerebral concussion in collegiate athletes. ACSM Clinical Conference, Baltimore, MD MSSE 2001; 33:S145.
27. Guskiewicz KM, **Cantu RC**, Mueller FO, Barth, JT: Management of sports related concussion: New insights into an old problem. ACSM Clinical Conference, Baltimore, MD MSSE 2001; 33:S144.
28. Guskiewicz KM, Marshall SW, Broglio SP, **Cantu RC**, Kirkendall DT: No evidence of impaired neurocognitive performance in collegiate soccer players. ACSM Clinical Conference, Baltimore, MD MSSE 2001; 33:S186.
29. Mihalik JP, Guskiewicz KM, Marshall SW, **Cantu RC**, Blackburn JT, Greenwald RM. Effect of General On-Ice Aerobic Fitness on Head Impact Biomechanics in Youth Hockey Players. MSSE 2010

## SPORTS MEDICINE EDUCATIONAL VIDEOS

- Diabetes and Exercise  
**Cantu, RC.**  
Milner-Fenwick Company; 1984
- Sports Medicine and the Primary Care Physician  
**Cantu RC, Siegel AJ, Childs HD.**  
Network for Continuing Medical Education; 1990  
  
The preschool-sports physical, life-style modification in the well patient; special emphasis given to assisting physicians to help patients make life-style changes necessary to reap the benefits of regular physical activity.
- ACSM's Guidelines for the Team Physician  
**Cantu RC, Herring SA, Kibler WB, Micheli LJ, Puffer JC.**  
Williams & Wilkins Electronic Media; 1992  
  
**Cantu RC:** "Athletic Head and Neck Injury"
- ACSM: 39th Annual Meeting  
**Cantu RC, Jordan BD, Sennett BJ, Micheli LJ, Hainline B.**  
CME Conference Video, Inc.; 1992  
  
**Cantu RC, Jordan BD:** "Sports Neurology"
- ACSM Sports Medicine CAQ Review  
**Cantu RC, Stoller D, Saal J, Smith AD, Shoor S.**  
CME Conference Video, Inc.; 1993  
  
**Cantu RC:** "Functional Anatomy & Biomechanics: Exam of the Patient with Low-Back Pain"  
**Cantu RC:** "Lumbar spinal stenosis: Dx and Management"  
**Cantu RC** "Indications for Surgery and Return to Competition After Lumbar Spine Injury"  
**Cantu RC:** "Legal Aspects of Sports Medicine and Role of the Team Physician"  
**Cantu RC:** "Epidemiology, Recognition, and Acute Management of Closed Head Injury/Concussion"  
**Cantu RC:** "Return to Competition After Head Injury"  
**Cantu RC:** "Fractures and Dislocations of Cervical Spine"  
**Cantu RC:** "Epidemiology, Evaluation, and Treatment of Traumatic Spinal Cord Injury: Return to Competition"  
**Cantu RC:** "Case Presentations: Transient Quadriplegia"
- ACSM/Wyeth Ayerst Laboratories  
Spellbound Productions; 1994  
  
**Cantu RC:** "Cervical Spine Injuries"  
  
**Cantu R, Torg J et al:** "Catastrophic Head and Spine Injuries in Football"  
NATA

**IN PRESS**

1. Picano J, **Cantu RC** et al. Defining Concussion: An Emperical Analysis of Concussion Reporting Using a Specific Definition of Concussion. *Clin J Sports Med* (submitted)
2. Cantu RV, **Cantu RC**. Cervical Spine chapter for Lyle Micheli due October
3. Chapter on “Concussion” *Head Trauma and Brain Injury*.



## RECENT LECTURE PRESENTATIONS

- 11.3.16 2016 Chronic Traumatic Encephalopathy Conference  
 “History of Concussion & CTE”  
 Metcalf Trustee Center Boston University  
 Boston, MA
  
- 10.27.16 5<sup>th</sup> International Consensus Conference on Concussion in Sport  
 Berlin, Germany
  
- 10.22.16 The Ultimate Concussion Conference  
 “Why Children are at Greater Risk of Concussion:”  
 Hollywood Beach Marriott  
 Hollywood, FL
  
- 10.20.16 DRI Annual Meeting  
 “Concussion Diagnosis and Management - The Past, Present and Future”  
 Sheraton Boston Hotel and Hynes Convention Center  
 Boston, MA
  
- 8.16.16 Virginia Tech Helmet Ratings Symposium  
 Dulles Airport Marriott  
 Dulles, VA
  
- 7.30.16 The Association of Ringside Physicians 2016 Annual Medical Seminar  
 “Second Impact Syndrome”  
 Monte Carlos Resort & Casino  
 Las Vegas, NV
  
- 6.19.16 NOCSAE Summer Board Meeting  
 SAC presentation  
 “Definition of Concussion”  
 Sheraton Kansas City Hotel  
 Kansas City
  
- 5.20.16 The 13<sup>th</sup> Annual Sports Concussion, Traumatic Brain and Spine Injury Conference  
 “History of Medical Management of Sport-Related Concussion”  
 The Joseph B. Martin Conference Center at Harvard Medical School  
 Boston, MA
  
- 4.29.16 Sports Neuropsychology Society’s 4<sup>th</sup> Annual Sport Concussion Symposium  
 “A Debate on the Relationship between Head Trauma and CTE”  
 The Westin Houston, Memorial City Hotel  
 Houston, TX
  
- 4.20.16 Carlisle for the Friends of the Carlisle COA  
 “What You Should Know About Concussions Especially In Our Youth”  
 Gleason Public Library  
 Carlisle, MA
  
- 4.14.16 Hackley School  
 “What You Should Know About Concussions Especially in Our Kids”

- Tarrytown, NY
- 4.13.16 Hackley School  
“Concussions, Athletics and Kids”  
Tarrytown, NY
- 3.26.16 Oklahoma State University for Health Sciences  
“How to Best Manage a Concussion”  
Tulsa, OK
- 3.25.16 Oklahoma State University for Health Sciences  
“Current Research in Concussion”  
Tulsa, OK
- 3.3.16 USA Rugby Sports Medicine Symposium  
“World Rugby Video Program-Team Approach to TX Concussions”  
Aria Resort & Casino  
Las Vegas, NV
- 1.28.16 NOCSAE Winter Board Meeting  
SAC Presentation  
Royal Palms  
Phoenix, AZ
- 1.12.16 2016 NASCAR Summit  
“How to Best Manage Concussion”  
Daytona Beach, FL
- 1.8.16 Emerson Hospital Clinical Conference  
“Why Children are at Greater Risk of Head Injury and How to Prevent Concussions”  
Emerson Hospital  
Concord, MA
- 12.10.15 National Center for Catastrophic Sport Injury Research (NCCSIR) Meeting  
“History of National Center for Catastrophic Sport Injury Research”  
Rizzo Conference Center  
Chapel Hill, NC
- 11.3.15 International State-of-the-Science (SoS) Meeting  
“Clinicopathologic Phenotypes of Chronic Traumatic Encephalopathy: Distinct Traumatic Risk-Factors”  
Booz Allen Hamilton headquarters  
McLean, VA
- 10.30.15 The Twentieth Boston Sports Medicine Symposium  
“Concussion Update”  
Boston Marriott Hotel  
Newton, MA
- \*10.28.15 Brok National Education Seminar  
Keynote Speaker: “Concussion: More Than Just a Word. What G-Max Really Looks Like in the Brain”  
St. Julien Hotel  
Boulder, CO
- 10.14.15 Targeted Evaluation & Active Management (TEAM) Approach to Treating Concussion  
Beyond a “One Size Fits All” Approach

UPMC Center for Sports Medicine  
Pittsburgh, PA

- 10.9-12.15 International Rugby Union Meeting  
“What is Concussion? The Science of the Injury and How to Recognize it”  
London, England
- \*10.7.15 Texas Lutheran University  
Concussion Summit  
Keynote Speaker: “Concussions and TBI”  
Sequin, TX
- 10.6.15 Oak Foundation  
Chapel Hill  
N Carolina
- 10.4.15 Dr. Robert C. Cantu Concussion Center  
“Importance of New Advances in Concussion Research, Early DX and TX”  
310 Baker Ave  
Concord, MA
- \*9.25.15 Concussion Retreat  
Keynote Speaker: “Current Research: Concussion”  
Ontario, Canada
- \*7.30.15 Concussion Forum  
Keynote Speaker: “Prevention of Concussions”  
Smyth County Hospital  
Marion, VA
- \*7.30.15 Concussion Forum  
Keynote Speaker: “Concussion: Past, Present and Future”  
Smyth County Hospital  
Marion, VA
- \*6.23.15 Concussion A National Challenge  
Keynote Speaker: “Reducing the Incidence of Concussive and Sub-Concussive Head Trauma in  
Football/Collision Sports”  
Global Center for Health Innovation  
Cleveland, OH
- 6.13.15 NOCSAE Summer Board Meeting  
SAC presentation  
Park Hyatt Chicago  
Chicago, IL
- 6.12.15 NOCSAE Summer Board Meeting  
SAC presentation  
Park Hyatt Chicago  
Chicago, IL
- 6.2.15 Concussion Prevention Meeting  
“Why Youth Are At Greater Risk of Head Injury”  
U Mass Lowell
- 6.2.15 Concussion Prevention Meeting

- “Concussions in Professional Sports”  
U Mass Lowell
- 5.26.15 SLI  
“Historical Perspectives”  
Waltham, MA
- 5.15.15 Children’s Hospital Sports Medicine Meeting  
“Practice Like the Pros”  
Martin Conference Room, Harvard Medical School  
Boston, MA
- \*3.26.15 NEASM Annual Meeting  
Keynote Speaker: “From Concussion to CTE, Myth, Fiction and Fact”  
Central Connecticut State University  
New Britain, CT
- 3.6.15 BIA of CT  
“Management of Concussion: Yesterday, Today and Tomorrow”  
“Workshop: Biomarkers currently being trialed for concussion, sub-concussive, post concussion  
syndrome and chronic traumatic encephalopathy”  
Hartford, CT
- 2.27.15 Wise Up Initiative Conference  
“Concussive and Sub-Concussive Trauma- How It Can Be Prevented/Minimized?”  
Birmingham, AL
- \*2.26.15 Grand Rounds  
University of Alabama Hospital  
“Update on Concussion and Sub-Concussive Trauma – Why The Pediatric Population Is At Greater Risk?”  
Birmingham, AL
- 2.25.15 Project Play Summit Aspen Institute  
Newseum  
Panel Participant  
Washington, DC
- 2.19-20.15 NFL/NFLPA Engineering Meeting  
“Report on King Devick Test”  
Indianapolis, IN
- 2.12-13.15 USA Rugby Meeting  
“Short and Long Term Results of Repetitive Sub-Concussive and Concussive Head Injury”  
Las Vegas, NV
- 1.23.15 USA Lacrosse Meeting  
Baltimore, MD
- 1.20.15 NCAA Meeting  
NYC
- 1.15-18.15 NOCSAE Meeting  
SAC presentation  
Phoenix, Arizona
- 1.11-12.15 Meeting with NASCAR

Charlotte, NC

- 11.24.14 Safe Sports Think Tank 2014  
How do we advance the science of prevention?  
“How do we develop Evidence t Inform Safe Play”  
Washington, DC
- 11.21.14 NOCSAE Grant Reviews  
Chapel Hill, NC
- 11.17.14 IRB World Rugby Conference and Exhibition’  
“Concussion – Driving Cultural Change”  
London, England
- 11.7.14 SAC Meeting  
Atlanta, GA
- 11.4.14 International State-of-the-Science Meeting  
“What NOCSAE and I have learned from 40 years of concussion research and helmet testing”  
Booz Allen Hamilton headquarters  
McLean, VA 22102
- 11.1.14 2014 ARP Annual Convention “Ringside Medicine: Back to the Basics”  
“Post Fight Neurological Evaluation”  
Vdara Hotel & Spa  
Las Vegas, Nevada
- 10.30.14 SLI Awards Banquet  
Introducing People
- \*10.24.14 French Rugby Federation  
“Return to Play After Cervical Spine Injury”  
Biarritz, France
- 10.23.14 French Rugby Federations  
“Second Impact Syndrome Update”  
Biarritz, France
- \*10.16.14 31<sup>st</sup> Annual BIA Colorado Conference  
“Concussion Management: Yesterday, Today Tomorrow”  
Colorado Convention Center  
Denver, CO
- 10.14.14 NHL Presentation  
“Concussion/Post Concussion Syndrome and CTE”  
Boston, MA
- 10.8.14 Oakmeadow School  
“ImPACT Testing and Concussion Management”  
Littleton, MA
- 8.13.14 Western University  
“Sport Safety and Accident Reduction, Including The Establishment of Helmet Standards”  
“Treatment Outcomes, Signs and Symptoms and Contemporary Treatment Strategies”  
London, ON, Canada

- 7.31.14 #C4CT Concussion Awareness Summit  
“Current State of Sport Concussion”  
United Nations Headquarters  
NYC, NY
  
- 7.18.14 Third Annual Western Slope Sports Medicine Clinical Symposium  
“Concussion Management – Yesterday, Today, Tomorrow”  
Grand Junction, CO
  
- 7.15.14 Hit Count Meeting
  
- 6.20.14 NOCSAE Summer Meeting  
SAC presentation  
Boston, MA
  
- 6.5.14 Concord Rotary Club  
“Why Youth Are At Increased Risk of Concussion”  
Concord, MA
  
- 5.29.14 White House Concussion Summit  
Washington, DC
  
- 5.23.14 11<sup>th</sup> Annual Sports Conference  
“Practice Like Pros”  
Martin Conference Center  
Harvard Medical School  
Boston, MA
  
- 5.16.14 9<sup>th</sup> Annual Brain Injury Rehabilitation Conference  
“Update on Chronic Traumatic Encephalopathy”  
“Management of Concussion in Student Athletes”  
Liberty Station conference Center  
San Diego, CA
  
- 5.8.14 New England Youth Concussion forum  
“Concussion Past, Present, Future”  
Gillette  
Foxboro, MA
  
- 4.26.14 2014 Sports Sciences Symposium  
“Concussions: The Current Concussion Lessons We Have Learned”  
Hilton Orlando at Lake Buena Vista Hotel  
Orlando, FL
  
- 4.6.14 AMSSM  
“Neurological Assessment and Concussion Management”  
“Breaking Backbones: Diagnosis and Management of Spinal Fractures in Athletes”  
Hyatt Regency New Orleans  
New Orleans, LA
  
- 3.29.14 ARP Mid Term Board Meeting  
Miami, FL
  
- 3.21.14 Mackey White TBI Committee Meeting  
Waldorf Astoria, Orlando

Orlando, FL

- 3.17.14 Brain Injury Association of South Carolina  
“Short Term and Long Term Results of Repetitive Sub-Concussive and Concussive Head Injury”  
Columbia, SC
- 2.27.14 Press Conference  
“House Bill 5113, An Act Concerning Youth Athletics and Concussion”  
Hartford, CT
- 1.29.14 C4CT Concussion Awareness Summit  
“Long Term Consequences of Repetitive Brain Trauma: CTE and Neurodegeneration”  
United Nations  
NYC, NY
- 1.23.14-1.24.14 5<sup>th</sup> Annual USA Rugby sports Medicine Symposium  
“Short Term and Long Term Results of Repetitive Sub-Concussive and Concussive Head Injury”  
Las Vegas, NV
- 1.17.14 NOCSAE Winter Board Meeting 2014  
SAC Presentation  
Royal Palms  
Phoenix, AZ
- 1.9.14 NASCAR Meeting  
John Bobo, Steve O’Donnell, Jim Cassidy, Thomas Gideon, P.E., John Patalak, P.E.  
Daytona, FL
- 12.14.13 Beth Israel Deaconess Hospital  
“Risks for and Management of Patients with Concussions”  
Dedham Holiday Inn  
Dedham, MA
- 12.13.13 NCCSIR  
Chapel Hill, NC
- 11.25.13 Safe Sports Think Tank: Exploring the relationship between childhood sports-related concussions and long-term cognitive outcomes  
“What Should Parents Know About Short and Long-Term effect of Concussions, and Should Parents Limit Sports Activities For Children Who Have Suffered Multiple Concussions”  
Washington, DC
- 11.14.13 Press Conference  
Legislative Office Building  
Albany, NY
- 10.25.13 Boston Sports Medicine Symposium 2013  
“How to Reduce the Risk of Concussions and CTE in Collision Sports”  
Waltham Woods conference Center  
Waltham, MA
- 10.24.13 ARP Annual conference  
“Relationships Between CTE and Concussive Exposure in Contact Sports”  
Symposium: Concussion and Action Points

- VDARA Hotel & Spa  
Las Vegas, NV
- 10.16.13 Annual Emerson Hospital Auxiliary  
“The Concussion Crisis: Where Are We Today?”  
Nashawtuc Country Club  
Concord, MA
- 10.4.13 Reading Hospital  
Grand Rounds  
“Concussion Crisis in Youth Sports”  
Thun/Janseen Auditorium  
West Reading, PA
- 9.26.13 Belmont Hill School  
“Concussion Update”  
Belmont, MA
- 9.17.13 Emerson Hospital Cooperator Dinner  
“The Concussion Crisis in 2013”  
Emerson Hospital  
Concord, MA
- 9.12.13 Fourth Annual Sports Law & Ethics Symposium  
“Concussion Update”  
Santa Clara, CA
- \*8.18.13 LA84 Foundation  
“The Concussion Crisis in Youth Sports”  
Los Angeles, CA
- 8.10.13 Massachusetts Coaches’ Association  
“Practice Like Pro’s”  
Worcester, MA
- 7.13.13 AOSSM 2013 Annual Meeting  
“Concussion in Sports”  
Sheraton Chicago Hotel & Towers  
Chicago, IL
- 6.28.13 NOCSAE Summer Board Meeting  
SAC report  
Fairmont Olympic Hotel  
Seattle, WA
- 5.17.13 10<sup>th</sup> Annual Sports-Related Conference on Concussion and Spine Injury  
“Cervicogenic Headache, Upper Cervical Spine”  
Martin conference Center at Harvard Medical School  
Boston, MA
- 4.24.13 Mackey-White TBI Committee Meeting  
Westin Grand Central  
New York, NY
- 4.11.13 New England Patriots Alumni Club, Inc.  
“Concussion Update”



- CBS Scene, Patriots Place  
Foxboro, MA
- 4.10.13 SLI Reception  
Boston Harbor Hotel  
Boston, MA
- 4.8.13 NOCSAE SAC Meeting  
Westin Atlanta Airport Hotel  
Atlanta, GA
- 3.22.13 8<sup>th</sup> Annual Brain Injury Rehabilitation Conference  
“The Concussion Crisis-Later Life Consequences”  
“Why We Need to Re-Think How Youth Sports Are Played”  
Sheraton Carlsbad Resort  
Carlsbad, CA
- 3.9.13 Second Matthew Gfeller Neurotrauma Symposium  
“Are Professional Sports Athletes Different From the Rest?”  
Chapel Hill, NC
- 1.27.13 NOCSAE Board Meeting  
SAC Presentation  
Fairmont Olympic Hotel  
Seattle, WA
- 12.1.12 APR Winter Board Meeting  
Atlantic City, NJ
- 11.16.12 NOCSAE Grant Meeting  
Chapel Hill, NC
- 11.14.12 “Concussion and Our Kids”  
Park School of Baltimore  
Baltimore, MD
- 11.4.12 4<sup>th</sup> International Consensus Conference on Concussion in Sport  
Writing Group  
FIFA House  
Zurich Switzerland
- 10.31.12 - 4<sup>th</sup> International Consensus Conference on Concussion in Sport  
“The NFL and Brain Safety First Since Zurich 2008”  
11.4.12 FIFA House  
Zurich Switzerland
- 10.27.12 Boston Sports Symposium  
“Protecting the Athlete’s Brain”  
Waltham Woods Conference Center  
Waltham, MA
- 10.26.12 2012 Brain Trauma and the Athlete Conference  
“Case Presentations and Discussion of Concussion, Post-Concussion Syndrome  
And CTE”  
The Conference Center at Bentley College

Waltham, MA

- 10.26.12 2012 Brain Trauma and the Athlete Conference  
 “Graduated Return to Play and Academics”  
 The Conference Center at Bentley College  
 Waltham, MA
- 10.26.12 2012 Brain Trauma and the Athlete Conference  
 “Pathophysiology and Biomechanics of Concussion, Head Injury, and  
 Second Impact Syndrome”  
 The Conference Center at Bentley College  
 Waltham, MA
- 10.25.12 2012 Hit Count Symposium  
 “Evidence of Dose-Related Brain Damage and Disease-Is there a Threshold?”  
 Waltham, MA
- 10.13.12 Eighteenth Annual Brain Injury Symposium  
 Keynote Speaker  
 “Short and Long-term Consequences of Repetitive Head Trauma, Post Concussion  
 Syndrome – CTE Chronic Traumatic Encephalopathy”  
 JW Marriott Hotel  
 Miami, FL
- 10.12.12 2<sup>nd</sup> Annual Conference Concussion in Athletics: From Brain to Behavior”  
 “Consequences of “Ignorance & Arrogance” in accurate assessment of sport-related  
 Concussions”  
 Penn State University, PA
- 9.30.12 Cleveland Clinic Lou Ruvo Center for Brain Health  
 “Chronic Traumatic Encephalopathy (CTE) Conference 2012”  
 “CTE in the NFL: What Changes Have Been Made and What More Needs to be Done?”  
 Frank Gehry – designed Keep Memory Alive Center  
 Las Vegas, NV
- 8.15.12 St. Mary’s Healthcare  
 Gloversville High School  
 “Short and Long-term Consequences of Repetitive Head Trauma, Post Concussion  
 Syndrome – CTE Chronic Traumatic Encephalopathy”  
 Gloversville, NY
- 8.15.12 St. Mary’s Healthcare  
 Amsterdam High School\|  
 “Short and Long-term Consequences of Repetitive Head Trauma, Post Concussion  
 Syndrome – CTE Chronic Traumatic Encephalopathy”  
 Amsterdam, NY
- 7.19.12 Center for the Study of Traumatic Encephalopathy  
 Presentation to President BU
- 6.14.12 NOCSAE Board Meeting  
 NOCSAE Scientific Advisory committee Report to the Board  
 Intercontinental Hotel  
 Kansas City, MO

- 6.1.12 ARP Annual Meeting  
 “Concussion and Head Trauma in Martial Arts”  
 San Francisco Marriott Marquis  
 San Francisco, CA
  
- 5.26.12 Congress AQMS 2012  
 “Concussion Update 2012”  
 Grenville-sur-la-Rouge  
 Montreal Canada
  
- 5.18.12 Children’ Hospital Annual Sports Medicine Meeting  
 Sports-Related Conference on Concussion and Spine Injury  
 “Prevention of Concussion: What Works, What Doesn’t”  
 Joseph B. Martin Conference Center  
 Boston, MA
  
- 5.11.12 Injuries in Football 2012  
 “Head and Spine Injuries in Football: Concussion: Where are We Now”  
 Andrews Institute  
 Destin, FL
  
- 4.24.12 FC Stars of MA  
 “Concussion Prevention”  
 Nashawtuc Country Club  
 Concord, MA
  
- 4.23.12 National School Board Association Meeting  
 “Head Injuries”  
 Boston Convention Center  
 Boston, MA
  
- 4.18.12 NOCSAE Retreat  
 Westin Atlanta Airport  
 Atlanta, GA
  
- 4.13.12 Emerson Hospital Grand Rounds  
 “Current Concepts and Future Trends in Concussion Evaluation, Management and Treatment”  
 Assembly Room A/B  
 Emerson Hospital  
 Concord, MA
  
- 4.11.12 FC Stars of MA  
 “Concussion Prevention”  
 Nashawtuc Country Club  
 Concord, MA
  
- 3.26.12 NFLPA Annual Meeting  
 Mackey-White Traumatic Brain Injury Committee  
 Marco Island Marriott  
 Marco Island, FL
  
- 3.23.12 2012 Harvard Law Sports Symposium  
 “Concussion Crisis in Professional Sports”  
 Panelist  
 Harvard Law School

Cambridge, MA

- 3.23.12 Parker Memorial DBP CME Program BU/BMC  
 “Youth Concussions: Diagnosis, Management Including Return to Play and Prevention”  
 Boston University School of Medicine  
 Boston, MA
- 3.21.12 FC Stars of MA  
 “Concussion Prevention”  
 Nashawtuc Country Club  
 Concord, MA
- 3.18.12 NHL Meeting  
 New York, NY
- 3.11.12 APR Meeting  
 JW Marriott  
 Indianapolis, IN
- 2.25.12 Professional Football Chiropractic Meeting  
 “Concussion Management: Short and Long-term Consequences of Mismanaging a Concussion”  
 Indianapolis, IN
- 2.25.12 Professional Football Chiropractic Meeting  
 “Catastrophic and Long-Term Outcomes After Traumatic Brain Injury”  
 Indianapolis, IN
- 1.28.12 LifeBridge Health Concussion Symposium  
 “Chronic Effects of Concussive Injury”  
 Sinai Hospital of Baltimore Zamoiski Auditorium  
 Baltimore, MD
- 1.25.12 Syracuse Neuroscience Grand Rounds  
 “Short and Long Term Consequences of Mismanaging a Concussion”  
 Upstate Medical University  
 Syracuse, NY
- 1.21.12 NOCSAE Board Meeting  
 SAC Report to Board of Trustees  
 Royal Palms  
 Phoenix, AZ
- 1.7.12 Eastern Athletic Trainers Association  
 “Concussion Update”  
 Copley Plaza  
 Boston, MA
- 12.10.11 Beth Israel Deaconess Hospital Core Curriculum Series  
 “Traumatic Brain Injury: From Concussions to More Severe Injuries”  
 Dedham Holiday Inn  
 Dedham, MA
- 12.9.11 Retired Men’s Association  
 “Concussion Update”  
 First Baptist Church  
 Sudbury, MA

- 12.5.11 Congressional Hearings Testimony  
NOCSAE  
Congress  
Washington, DC
  
- 11.17.11 Hyannis Rotary Club Luncheon  
“Concussion Crisis”  
Hyannis Country Club  
Hyannis, MA
  
- 11.14.11 NOCSAE Youth Football Helmet Meeting  
Westin Atlanta Airport  
Atlanta, GA
  
- 11.4.11 Boston Shoulder and Sports Symposium 2011  
“Concussion Update”  
Conference Center at Waltham Woods  
Waltham, MA
  
- 10.28.11 2011 Brain Trauma and Athletic Conference  
Boston University Center for the Study of Traumatic Encephalopathy  
“Return to Play Guidelines and Step-by-step Clinical Recommendations”  
Framingham Sheraton  
Framingham, MA
  
- 10.27.11 APR Annual Meeting  
“Chronic Traumatic Encephalopathy”  
Omni Orlando Resorts Championship Gate  
Orlando, FL
  
- 10.24.11 Harvard University Lunch Time Learning Talk  
“The neurophysiological cascade of concussion and brain damage – what is going on in the gray/white matter? Brain stem trauma – shearing/tearing – CNS damage from whiplash direct blows  
Murr Center, Harvard University  
Boston, MA
  
- 9.26.11 2011 Boston Public Schools Advanced Concussion Training  
“Concussion Management for Coaches”  
Northeastern University  
Boston, MA
  
- 9.22.11 Athletics Committee Williams College  
“New Trends in Concussion Management”  
Williams College  
Williamstown, MA
  
- 9.22.11 Athletics Committee Williams College  
“Concussion for Coaches and Trainers”  
Williams College  
Williamstown, MA
  
- 9.21.11 Grand Rounds Haywood Hospital

- “Current Evaluation and Management of Concussion”  
Henry Haywood Hospital  
Gardner, MA
- 7.23.11 1<sup>st</sup> Annual USOC Sports Medicine Symposium  
“Keynote Presentation: Current Concepts and Future Trends in Concussion Evaluation,  
Management, and Treatment  
Olympic Training Center  
Colorado Springs, CO
- 7.17.11 ATSNJ 2<sup>nd</sup> Annual Sports Concussion Summit  
“Keynote Presentation: Long-Term Effects of Concussion  
Wyndham Princeton Forrestal Village  
Plainsboro, NJ
- 6.17.11 NOCSAE Board Meeting  
“Report of the Scientific Advisory Committee Meeting of 4.22.11  
Carolina Inn  
UNC Chapel Hill
- 6.4.11 2011 Jacksonville Concussion Summit  
“Concussion Management in your Community”  
Brooks Rehabilitation Hospital  
Jacksonville, FL
- 6.4.11 2011 Jacksonville Concussion Summit  
“Concussion 101”  
Brooks Rehabilitation Hospital  
Jacksonville, FL
- 5.28.11 Canadian Athletic Trainers Association Annual Meeting  
“Chronic Traumatic Encephalopathy”  
Banff, Alberta Canada
- 5.27.11 Sports-Related Conference on Concussion & Spine Injury  
“How the NFL Has Become a Leading Concussion Advocate”  
Fenway Park  
Boston, MA
- 5.7.11 Sports Related Concussion and Cervical Spine Injury Symposium  
“Everything You Wanted to Know About Sports Related Concussion:  
Epidemiology/Incidence/Research”  
Rust Auditorium – North Shore University Hospital  
Manhasset, NY
- 5.6.11 Andrews Institute “Injuries in Football” Conference  
“Concussion: More Than Just a Headache”  
Destin, FL
- 4.30.11 Inaugural UNC Matthew Gfeller Center Sport-Related Neurotrauma Symposium  
“Catastrophic and Long-Term Outcomes of TBI”  
UNC Chapel Hill
- 4.30.11 Inaugural UNC Matthew Gfeller Center Sport-Related Neurotrauma Symposium

“Pharmacological Interventions and Return-To-Play After Spinal Injury”  
 UNC Chapel Hill

- 4.29.11 Head Injury Symposium: Stunts & Tumbling, Cheerleading and other female sports  
 “Keynote Message, The Latest on the Concussion Crisis”  
 Omni Parker House Hotel  
 Boston, MA
- 4.22.11 NOCSAE Scientific Advisory Committee Meeting  
 Westin Atlanta  
 Atlanta, GA
- 4.1.11 MMS and DPS Sports Concussion Symposium and State Laws  
 “Concussion Management and Prevention”  
 Mass Medical Society Conference Room  
 Waltham, MA
- 3.23.11 RI Primary Care Physicians Corporation  
 “Concussion Management – New Strategies”  
 Crowne Plaza  
 Warwick, RI
- 3.19.11 Massachusetts Neurology Society  
 “Traumatic Brain Injury – Pathophysiologic Mechanisms”  
 Newton Marriott  
 Newton, MA
- 2.26.11 Joint Commission on Sports Medicine and Science  
 “Boxing Policy/Legislation: How it Can Be Improved”  
 Philadelphia Convention Center  
 Philadelphia, PA
- 2.26.11 Joint Commission on Sports Medicine and Science  
 “Concussion Landscape”  
 Philadelphia Convention Center  
 Philadelphia, PA
- 2.25.11 NFL Players Association Mackie/White TBI Committee  
 “Concussion and the Role of the Helmet”  
 Conrad Hotel  
 Indianapolis, Indiana
- 02.02.11 39<sup>th</sup> Annual INS Meeting  
 “Chronic Traumatic Encephalopathy: Long-term Consequences of Repetitive Brain Trauma”  
 Boston, MA
- 1.14.11 Washington DC Children’s Hospital  
 National Forum on Youth Sport Concussion Taking Action State by State  
 “The Concussion Landscape”  
 Children’s National Medical Center  
 Washington, DC
- 1.11.11 Brigham Young University College of Life Sciences  
 Sports Concussion and Brain Injury Seminar  
 “Brain Injuries and Concussions”  
 Brigham Young University, Provo, UT

- 12.13.10 NFL Players Association Meeting  
Mackey-White TBI Committee Members  
Washington, DC
- 12.8.10 NFL Meeting  
“NOCSAE: Current and future helmet standards  
NYC, NY
- 11.18.10 Retired Athletes Meeting  
Chapel Hill, NC
- 11.10.10 Get aHead Workshop: Emerging Knowledge and Significance of Sports-Related Concussions  
“International Perspective On Concussions”  
Dartmouth-Hitchcock Medical Center  
Hanover, NH
- 11.04.10 AAPRP Annual Meeting The Brain and Neck In Boxing and Related Sports  
“Concussion Definitions and Clinical Manifestations  
Omni Orlando Resort at ChampionsGate  
Orlando, FL
- 11.01.10 Hockey Concussion in Canada  
Hockey Concussion Education Project (HCEP) – an Independent Physicians’ Study –  
Presentation of findings – Press Conference  
InterContinental Toronto Centre – Ontario Room  
Toronto, Canada
- 10.29.10 Boston Shoulder and Sports Symposium 15<sup>th</sup> Annual  
“Update Athletic Head and Neck Injuries”  
Mass Medical Society Conference Center  
Waltham, MA
- 10.20.10 Ice Hockey Summit: Action on Concussions  
“Incorporating Hockey and Medical Knowledge with Action Items for Prevention”  
Mayo Clinic  
Rochester, MN
- 10.13.10 Lincoln Sudbury Regional High School Sports Conference  
“Concussion in Sports Update”  
LSRHS Auditorium  
Sudbury, MA
- 10.5.10 “Gender and Age Effects On Concussion”  
22<sup>nd</sup> Annual Ironman Sports Medicine Conference in Conjunction with the 2010  
Ford Ironman World Championships  
Royal Kona Resort  
Kailua-Kona, HI
- 10.5.10 “Overview of Sports Related Concussion”  
22<sup>nd</sup> Annual Ironman Sports Medicine Conference in Conjunction with the 2010  
Ford Ironman World Championships  
Royal Kona Resort  
Kailua-Kona, HI



- 10.1.10 BU Second Annual Head Trauma in the Athlete Conference  
Massachusetts Medical Society Auditorium  
Waltham, MA
- 9.23.10 Emerson Hospital Youth Sports Injury Symposium  
Concussions in Sports  
Concord Carlisle High School Auditorium  
Concord, MA
- 9.22.10 New Hampshire Pediatric Society  
“Concussion Recognition, Management and Long term Sequellae”  
SERESC Conference Center  
Bedford, NH
- 9.15.10 Brigham and Women’s Hospital CORE Meeting  
“Head Injuries and Athletes and Return to Play”  
Brigham and Women’s offsite at Chestnut Hill  
Chestnut Hill, MA
- 8.21.10 Athletic Trainers Association of New Jersey Concussion Summit  
“Management of Concussion 2010”  
Philadelphia, PA
- 6.28.10 “Coaches and Concussion”  
Hooksett, NH
- 6.17.10 “Physical Fitness and Sports Medicine – Post Concussion”  
“Short and Long Term Consequences of Mismanaging Concussion”  
8<sup>th</sup> Annual Symposium on Men’s Health  
Mass Medical Society Headquarters  
Waltham, MA
- 6.12.10 United States Sports Academy  
2009 United States Sports Academy Ernst Jokl Sports Medicine Award Presentation  
To Dr. Robert Cantu  
Harvard University  
Cambridge, MA
- 5.18.10 Association of Chief Executives of Sport  
“Short and Long Term Consequences of Mismanaging Concussion”  
Antlers Hilton Hotel  
Colorado Springs, CO
- 5.14.10 “What is a Concussion? Current Consensus Guidelines”  
The Seventh Annual Sports-Related Conference on Concussion & Spine Injury  
Presented by Brigham and Women’s Hospital  
Fenway Park  
Boston, MA
- 5.7.10 Keynote Speaker  
“Chronic Traumatic Encephalopathy”  
Neurology in the News  
The University of Toledo, Department of Neurology and Center for Continuing Medical

Education  
 Eleanor N. Dana Conference Center – University of Toledo  
 Toledo, Ohio

- 4.29.10 “Concussion in Sports Presentation at the CDC”  
 National Center for Injury Prevention and Control  
 Centers for Disease Control and Prevention  
 Atlanta, GA
- 4.26.10 “2010 Sports and Society Colloquium”  
 Brown University, Salomon Hall  
 Providence, RI
- 4.22.10 “Short and Long Term Consequences of Mismanaging an Athletic Concussion”  
 2010 Injuries in Football Course  
 Andrews Institute  
 Pensacola, FL
- 4.8.10 “Short and Long Term Consequences of Mismanaging Concussion”  
 Massachusetts General Hospital Neurosurgery Grand Rounds  
 Ether Dome, MGH  
 Boston, MA
- 4.7.10 “Short and Long Term Consequences of Mismanaging a Concussion”  
 Boston University Grand Rounds  
 Boston University School of Medicine Continuing Medical Education  
 Boston, MA
- 3.12.10 “The Triad of Symptomatic Concussion, Second Impact Syndrome and Thin Subdural  
 Hematoma”  
 Is Football Bad for the Brain?  
 Forensic Scientific, Medical-Legal and Societal Aspects of Concussion Debate  
 The Cyril H. Wecht Institute of Forensic Science and Law
- 3.12.10 “Update on NFL Concussion Committee Experiences”  
 Is Football Bad for the Brain?  
 Forensic Scientific, Medical-Legal and Societal Aspects of Concussion Debate  
 The Cyril H. Wecht Institute of Forensic Science and Law
- 3.7.10 “Interactive Case Studies  
 Youth Sports Concussions: Education to Legislation  
 Kane Hall Rm 130  
 University of Washington Campus  
 Seattle, Washington
- 3.6.10 Keynote Speaker  
 “Chronic Traumatic Encephalopathy”  
 Youth Sports Concussions: Education to Legislation  
 Kane Hall Rm 130  
 University of Washington Campus  
 Seattle, Washington
- 2.18.10 “The Short and Long Term Consequences of Mismanaging Concussion”

Concussion and Mild Traumatic Brain Injury: Update 2010  
 CSM Annual Meeting  
 Omni San Diego Hotel  
 San Diego, CA

- 1.26.10 NFL Players Association Concussion Committee  
 Medical Committee  
 Breakers  
 Palm Beach, FL
  
- 1.9.10 “Concussions”  
 Eastern Athletic Trainers Association Annual Meeting  
 Marriott Copley  
 Boston, MA
  
- 11.10.09 “Managing Concussion”  
 Pediatric Brain Injury Conference – BIA-MA  
 Best Western Royal Plaza  
 Marlborough, MA
  
- 11.6.09 “Panel Discussion on TBI”  
 Partnership for Military Medicine Symposium  
 Omni Shoreham Hotel  
 Washington, DC
  
- 10.30.09 “Concussions”  
 Fourteenth Annual Boston Shoulder and Sports Symposium 2009  
 Conference Center  
 Waltham Woods, Waltham, MA
  
- 10.29.09 CNN - Lou Dobbs  
 “Testimony before U.S. House Judiciary Committee”  
 Time Warner Building – CNN Headquarters, NYC  
 New York, NY
  
- 10.29.09 “Testimony Before U.S. House Judiciary Committee – Hearing on Legal Issues Relating  
 To Football Head Injuries”  
 Rayburn Building  
 Washington, DC
  
- 10.16.09 “Study of Traumatic Encephalopathy”  
 The American Association of Professional Ringside Physicians, Inc.  
 2009 Annual Medical Seminar  
 Mohegan Sun  
 Uncasville, CT
  
- 10.2.09 Welcoming Remarks  
 “Overview of Current Concussion Consensus Statements Including Zurich Conference”  
 Concussion and the Athlete  
 Boston University Medical Center School of Medicine Continuing Education  
 Gillette Stadium, Foxboro, MA
  
- 10.2.09 “Panel Discussion”

Concussion and the Athlete  
 Boston University Medical Center School of Medicine Continuing Education  
 Gillette Stadium, Foxboro, MA

- 10.2.09 “Chronic Traumatic Encephalopathy and the Athlete – Update from the Center for the Study Of Traumatic Encephalopathy”  
 Concussion and the Athlete  
 Boston University Medical Center School of Medicine Continuing Education  
 Gillette Stadium, Foxboro, MA
- 9.3.09 “Traumatic Brain Injury in Sports: When Can the Athlete Return to Play?”  
 XIV World Congress of Neurological Surgery of the WFNS  
 Boston, MA
- 6.18.09 “The Concussion Dilemma: Are We Headed in the Right Direction”  
 60<sup>th</sup> NATA Annual Meeting and Clinical Symposia  
 Henry B. Gonzalez Convention Center  
 San Antonio, TX
- 5.27.09 “Managing Sports Related Concussion in the Youth and Adolescent Athlete”  
 American College of Sports Medicine Annual Meeting  
 Seattle, WA
- 5.20.09 “Overview of Sports Concussion Consensus Statements and Chronic Traumatic Encephalopathy”  
 Brain Injury Association of New Hampshire 26<sup>th</sup> Annual Brain Injury and Stroke Conference  
 Radisson, Manchester, NH
- 5.15.09 “Playing with Post Concussion Symptoms: Alarming Rates and Prevalence”  
 3<sup>rd</sup> Annual National Summit on Concussion and Other Sports Medicine Injuries  
 Westin Hotel LAX  
 Los Angeles, CA
- 5.15.09 “What Should a Concussion Evaluation Consist Of”  
 3<sup>rd</sup> Annual National Summit on Concussion and Other Sports Medicine Injuries”  
 Concurrent Afternoon Session  
 Westin LAX  
 Los Angeles, CA
- 5.14.09 Keynote Address:  
 College Athletic Trainers’ Society  
 2009 Spring Symposium for Athletic Trainers and Team Physicians  
 The Orleans Hotel and Casino  
 Las Vegas, Nevada
- 5.9.09 “Concussion Management: Yesterday, Today and Tomorrow”  
 Sanford Sports Medicine Symposium  
 Sanford University South Dakota Medical Center  
 Sioux Falls, South Dakota
- 5.9.09 “Return to Play Issues Following Cervical Spine Injury”  
 Sanford Sports Medicine Symposium  
 Sanford University South Dakota Medical Center  
 Sioux Falls, South Dakota
- 5.9.09 “Catastrophic and Long Term Effects of Concussion”

Sanford Sports Medicine Symposium  
 Sanford University South Dakota Medical Center  
 Sioux Falls, South Dakota

- 5.9.09 “On-the-Field Management of the Concussed Athlete”  
 Sanford Sports Medicine Symposium  
 Sanford University South Dakota Medical Center  
 Sioux Falls, South Dakota
  
- 5.1.09 “Overview: Current Concussion Guidelines from the International Study Group”  
 6<sup>th</sup> Annual Sports Conference  
 BWH Hospital Conference  
 Fenway Park  
 Boston, MA
  
- 4.27.09 “Coaches Education Initiative”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.27.09 “Celebrity Athletes – Is Management the Same?”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.27.09 “Legal Case Discussion Sport and the Law”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.21.09 “Traumatic Brain Injury & Physiological Disorders Facing Athletes Post Performance”  
 Summit on Health of the Former Professional Athlete  
 LaQuinta Spa and Resort  
 Palm Springs, CA
  
- 4.13.09 “Pharmacological Interventions in Management of Spine Injuries”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.13.09 “Return to Play After Spinal Injury”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.13.09 “Spine Injuries and Contraindications to Participation in Collision Sports”  
 Neurologic Head and Spine Injuries Semester Course Lecture  
 University of North Carolina – Doctorate Program Presentation  
 Chapel Hill, NC
  
- 4.5.09 “Current Concussion Classification and Return to Play Criteria”  
 First Annual Spring Current Concepts in Sports Related Concussions Symposium  
 Athletic Trainer Solutions  
 St. Paul Catholic High School

Bristol, CT

- 3.16.09 “Overview of Injury Types and Associated Complications”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 3.16.09 “Anatomy and Biomechanics of Spine Injuries in Sport”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 3.16.09 “Spine Injuries – Which Sports are at Greatest Risk and Why?”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 2.16.09 “Case Studies”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 2.16.09 “Parkinson’s Disease”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 2.16.09 “Chronic Traumatic Encephalopathy”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 2.16.09 “Post Concussion Syndrome”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.27.09 Press Conference  
Chronic Traumatic Encephalopathy  
In Association with the Super Bowl  
Tampa, Florida
- 1.26.09 “Anatomical Dissection of the Brain”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.26.09 “Headaches in the Athlete”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.26.09 “Epilepsy and Athletics”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC

- 1.26.09 “Stroke in Athletes”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.26.09 “Malignant Brain Edema and Second Impact Syndrome”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.26.09 “Intercerebral Hematoma”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.17.09 “Current Testing and Return to Play Issues/Guidelines – Zurich Update”  
London Hockey Concussion Summit  
London Hilton Hotel  
London, Ontario, Canada
- 1.12.09 “Ionic and Metabolic Consequences of Concussion”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.12.09 “Athletic Head Injuries – Which Sports are at Greatest Risk and Why?”  
Neurologic Head and Spine Injuries Semester Course Lecture  
University of North Carolina – Doctorate Program Presentation  
Chapel Hill, NC
- 1.9.09 “Post Concussion Syndrome and Traumatic Encephalopathy”  
Emerson Hospital Medical Staff Clinical Conference  
Emerson Hospital, Concord, MA
- 1.6.09 “Post Concussion Syndrome and Traumatic Encephalopathy”  
Boston University Grand Rounds Presentation  
Boston, MA
- 10.30-31.08 “Is Immediate Return to Play in the Same Game Ever Justified?”  
3<sup>rd</sup> International Conference on Concussion in Sport  
Hotel Zurichberg  
Zurich Switzerland
- 10.18.08 “Pituitary Dysfunction in Professional Boxing and the National Football League”  
2008 Annual Medical Seminar, AAPRP  
Paris/Bally’s Resort & Casino  
Las Vegas, Nevada
- 10.3.08 “Return to Boxing After Subdural Hematoma – When?”  
World Boxing Association Medical Seminar, 87<sup>th</sup> Annual Convention  
Hotel Barcelo Bavaro Palace  
Punta Cana, Dominican Republic

- 9.18.08 “Traumatic Brain Injury and Shaken Baby Syndrome”  
14<sup>th</sup> International Conference Child Abuse Allegations: Separating Scientific Fact from Fiction  
Riviera Hotel and Casino  
Last Vegas, NV
- 7.24.08 “Preventive Aspects of Sports Concussion”  
New Developments in Sports-Related Concussion Conference  
Sheraton Station Square  
Pittsburgh, PA
- 6.21.08 “Concussion in Sports”  
New York State Public High School Athletic Association (NYSPHSAA)  
Saratoga, NY
- 6.11.08 “Neurotrauma in Sports”  
Symposium on the Prevention of Spinal Cord Injuries and Concussions in Hockey  
Hockey Hall of Fame  
Toronto, Canada
- 5.28.08 “Neuropsychological Assessment of the Concussed Athlete: Only One Piece of the Concussion  
Puzzle”  
ACSM 55<sup>th</sup> Annual Meeting  
Indianapolis, IN
- 5.9.08 “Concussion in Women Athletes”  
2008 Sports Related Conference on Concussion and Spine Injury  
Brigham and Women’s Hospital  
Fenway Park  
Boston, MA
- 5.3.08 “Concussion in Sports”  
The Hill School  
Pottstown, PA
- 5.1.08 “Concussion and High School Sports, Risks and Management”  
Arlington High School  
Arlington, MA
- 4.19.08 “Concussion in Sports: Does Gender Matter?”  
The National Concussion Summit  
Concussion in Sports: Advancing Health and Safety  
Marriott Hotel  
Marina del Rey, CA
- 4.18.08 “Concussion in Sports: Does Gender Matter?”  
The National Concussion Summit  
Concussion in Sports: Advancing Health and Safety  
Marriott Hotel  
Marina del Rey, CA
- 4.3.08 “Concussions and Sports”  
Winchester High School  
Winchester, MA



- 3.13.08 “Clinical Models for Concussion Management and Return to Play”  
Fourth International Meeting on Minor Traumatic Brain Injury in Sports  
Hotel Crystal, St. Moritz, Switzerland
- 3.8.08 “Concussions and the Sports Legacy Institute”  
Joint Commission on Sports Medicine and Science 2008  
New Orleans Hilton Riverside  
New Orleans, LA
- 12.13.07 “Current Advances in Concussion Management/Traumatic Encephalopathy”  
Grand Rounds  
Brigham and Women’s Hospital  
Boston, MA
- 11.29.07 “Concussion in Sports”  
Two presentations to student assemblies  
Concord Carlisle High School  
Concord, MA
- 11.28.07 “Concussion and Sports”  
Presentation for parents, coaches, trainers, nurses and physicians  
Concord Carlisle High School  
Concord, MA
- 11.26.07 “Chronic Traumatic Encephalopathy/Concussion”  
Boston Medical Center Grand Rounds  
Boston Medical Center  
Boston, MA
- 11.29.07 “Update Baby Joe Mesi”  
Medical Advisory Board Meeting  
Massachusetts Boxing Commission  
McCarthy Building  
Boston, MA
- 11.29.07 “More Than Just a Bump on the Head”  
Concord Carlisle High School Students Presentation  
Two Presentations One hour each to student body  
Concord, MA
- 11.28.07 “More Than Just a Bump on the Head”  
Concord Carlisle High School Parents Presentation  
Concord, MA
- 11.26.07 “Concussion and Sports Related Head Injury”  
Neurosurgery/Surgery Grand Rounds  
Boston University Medical Center  
Boston , MA
- 11.15.07 “Joe Mesi Update”  
AAPRP Annual Meeting  
Intercontinental Hotel and Resort  
San Juan, Puerto Rico

- 10/29/07 “Concussion in High School”  
Woburn High School  
Woburn, MA
- 10/26/07 “Concussion and Sudden Death: Coping With Two Crises”  
Independent School Health Association Annual Meeting  
New Canaan Country School  
New Canaan, CT
- 9/27/07 “Concussions in High School”  
Austin Prep School  
Reading, MA
- 9/24/07 “The Concussion Crisis in Football”  
U Mass Lowell Athletic Department Meeting  
McGauvran Hall  
Lowell, MA
- 9/17/07 “History of Concussion and Second Impact Syndrome”  
New Hampshire Interscholastic Athletic Association  
Annual Meeting  
Courtyard by Marriott  
Concord, NH
- 7/13/07 “Concussion/Brain”  
The American Orthopedic Society for Sports Medicine Annual Meeting  
TELUS Convention Center  
Calgary, Canada
- 7/12/07 “Spine Instructional Course”  
The American Orthopedic Society for Sports Medicine Annual Meeting  
TELUS Convention Center  
Calgary, Canada
- 6/1/07 The D.B. Historical Lecture  
“The Evolution of Sports-related Concussion Recognition, Management and Prevention: The  
Science, the Art and the Politics.”  
Annual Meeting ACSM  
New Orleans, Louisiana
- 5.5.07 “Concussion: How to make the diagnosis and Overview of Current Concussion Consensus  
Statements”  
Sports Specific Rehabilitation Program  
High Performance Sports, Inc.  
Peabody, MA
- 4/30/07 “Concussion Management and Diagnosis”  
New England University Medical Department Seminar  
New England University  
Biddeford, ME
- 4/27/07 “Overview of Current Concussion Consensus Statement”

2007 Sports Related Conference on Concussion and Spine Injury  
 Fenway Park  
 Boston, MA

- 4.20.07 “Traumatic Encephalopathy Among NFL Players”  
 The National Concussion Summit. Concussion in Sports: The Under-Recognized Public Epidemic  
 The Marriott Hotel  
 Los Angeles, CA
- 4/20/07 “Concussion in Sports: State of the Science - Discussant  
 The National Concussion Summit: Concussion in Sports: The Under-Recognized Public Epidemic  
 The Marriott Hotel  
 Los Angeles, CAS
- 4/18/07 “Argument to Ban Boxing – Analysis of Neurological Injury”  
 75<sup>th</sup> Annual Meeting of the American Association of Neurological Surgeons  
 Washington, DC
- 3/15/07 “Can the Recognition and Treatment of Hypopituitarism After mTBI Influence Post Concussion Syndrome”  
 Third International Meeting on Minor Traumatic Brain Injuries in Sports  
 St. Moritz, Switzerland
- 3/14/07 “How Many Concussion Are Too Many”  
 Third International Meeting on Minor Traumatic Brain Injuries in Sports  
 St. Moritz, Switzerland
- 12/8/06 “Cervical Spine Return to Play Issues”  
 ACSM - Advanced Team Physician Course  
 Omni Orlando Resort at Championsgate  
 Orlando, FL
- 12/8/06 “MBTI Return to Play Issues”  
 ACSM Advanced Team Physician Course  
 Omni Orlando Resort at Championsgate  
 Orlando, FL
- 11/9/06 “Concussion Management”  
 Acute Management of Mild Traumatic Brain Injury in Military Operational Settings  
 Department of Defense Meeting  
 Washington, DC
- 10/24/06 “A Case of Concussion in Pop Warner Football”  
 Playing It Safe  
 Brain Injury Association of Massachusetts Sports Injury Conference  
 Best Western Royal Plaza Hotel  
 Marlborough, MA
- 9/15/06 “Intracranial Bleeding in Boxing/The Joe Mesi Story Round 3”  
 American Association of Professional Ringside Physicians  
 2006 Annual Medical Seminar  
 Luxor Hotel and Casino

Las Vegas, NV

- 9/9/06 “Neurosurgery Head and Neck Injury Update”  
Emerson Hospital Fall Sports Primer  
Harvey Wheeler Community Center  
Concord, MA
- 05/19/06 Case Presentations  
Sports Related Concussion and Spine Injury Conference 2006  
Brigham and Women’s Neurological Injury Center  
Fenway Park  
Boston, MA
- 05/13/06 “Management of Cervical Injuries and Related Disorders”  
Sports Medicine and Football: The 2006 Perspective  
AOSSM Meeting  
Seminole Hard Rock Hotel and Casino  
Hollywood, FL
- 05/12/06 Physical Examination Spine  
Sports Medicine and Football: The 2006 Perspective  
AOSSM Meeting  
Seminole Hard Rock Hotel and Casino  
Hollywood, FL
- 03/10/06 “Return to Boxing After Intracranial Hemorrhage”  
USA Boxing Physician Symposium 2006  
US Olympic Training Center  
Colorado Springs, CO
- 03/10/06 “Acute and Chronic Brain Injuries in Boxing”  
USA Boxing Physician Symposium 2006  
US Olympic Training Center  
Colorado Springs, CO
- 03/07/06 “Acute TBI Assessment and Secondary Prevention”  
Armed Forces Epidemiological Board Meeting  
Armed Forces Medical Intelligence Center  
Fort Detrick Frederick, MD
- 02/24/06 “Evolution of the Understanding of Concussion”  
Concussion in Youth Sports Summit  
Brain Injury Association of New Jersey  
Stadium Club at Giants Stadium  
Rutherford, NJ
- 10/28/05 “PASSOR: Sub-Acute Assessment and Management: Grading Systems: Initial Symptom  
Management: Second Impact Syndrome: When to Order Imaging”  
American Academy of Physical Medicine and Rehabilitation  
2005 Annual Assembly  
Philadelphia Marriott Downtown  
Philadelphia, PA

- 10/28/05 “PASSOR: Concussion/Mild Traumatic Brain Injury: Return to Play and Function Decision Making”  
American Academy of Physical Medicine & Rehabilitation  
2005 Annual Assembly  
Philadelphia Marriott Downtown  
Philadelphia, PA
- 10/27/05 “PASSOR: Vienna Conference Update and Future Decisions: Meet the Experts”  
American Academy of Physical Medicine & Rehabilitation  
2005 Annual Assembly  
Philadelphia Marriott Downtown  
Philadelphia, PA
- 6/25/05 “Catastrophic Spine Injury in American Football – effect of athlete education and rule change”  
1<sup>st</sup> World Congress on Sports Injury Prevention  
Holmenkollen Park Hotel  
Oslo, Norway
- 5/20/05 “What’s New in Concussion Research and Overview of Prague Concussion Consensus Statement  
Brigham and Women’s 2<sup>nd</sup> Annual Sports Medicine Symposium  
Gillette Stadium  
Foxboro, MA
- 5/20/05 “NATA/AFCA Spearing in Football Task Force Recommendations”  
Brigham and Women’s 2<sup>nd</sup> Annual Sports Medicine Symposium  
Gillette Stadium  
Foxboro, MA
- 5/13/05 “Concussion in Sports”  
Mass Academy of Family Physicians Annual Meeting  
Fort Point Sheraton  
Leominster, MA
- 4/30/05 “Interesting Sport Medicine Cases of Concussion in Athletes”  
Concussion in Sports Conference  
Penn State University  
The Penn Stater Conference Center Hotel  
University Park, PA
- 4/29/05 “Concussion Classification: Scales and Categories”  
Concussion in Sports Conference  
Penn State University  
The Penn Stater Conference Center Hotel  
University Park, PA
- 3/10/05 “Catastrophic Spinal Injuries in Football”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL

- 3/10/05            “Management of Difficult Spine Cases In Athletes”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL
- 3/12/05            “When to Retire After a Concussion”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL
- 3/12/05            “Can Second Impact Syndrome Be Eliminated?”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL
- 3/12/05            “Recommendations from 2004 NATA Position Statement”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL
- 3/12/05            “2004 Prague International Concussion Conference Consensus Statement”  
5<sup>th</sup> Annual Sports Medicine and Neurotrauma Review  
Portofino Bay Hotel  
Orlando, FL
- 3/15/05            “Concussion, Head and Neck Injuries”  
Spring Sports Primer  
Emerson Hospital/Harvey Wheeler Community Center  
West Concord, MA
- 2/9/05             “Alanto-Occipital Dislocation – A Largely Preventable Previously Fatal Injury”  
Motorsports Safety Conference  
American College of Sports Medicine Team Physician Pre Conference Course  
Hyatt Regency on the Boardwalk  
San Antonio, TX
- 11/5/04            “National Football League (NFL) and NCAA Football Study”  
IIHF Meeting  
Second International Symposium on Concussion in Sport  
Prague, Czech Republic
- 11/6/04            “How can we prevent diffuse brain swelling/SIS in children?”  
IIHF Meeting  
Second International Symposium on Concussion in Sport  
Prague, Czech Republic
- 11/6/04            “When Should an Athlete Retire Following Concussion”  
IIHF Meeting  
Second International Symposium on Concussion in Sport  
Prague, Czech Republic

- 9/23/04            “Primary Care Management of Closed Head Injuries”  
 Southboro Medical Group Meeting  
 Southboro, MA
- 7/18/04            “Concussion Guidelines - Current Status”  
 University of Pittsburgh Medical Center  
 New Developments in Sports – Related Concussion  
 The Westin Convention Center  
 Pittsburgh, PA
- 6/24/04            NFL Meeting  
 NFL Headquarters  
 New York, NY
- 6/16/04            Press Conference  
 “Position Statement on Sports – Related Concussion”  
 National Athletic Trainers Association Annual Meeting  
 Baltimore, MD
- 5/22/04            “Diffuse Brain Injuries”  
 The William W. Backus Hospital Trauma Department  
 Athletic Injuries of the Head and Neck  
 Foxwood Resort Casino  
 Uncasville, CT
- 5/4/04             “Fatal Brain Injuries in American Football (1945-1999)”  
 Sports Concussion and Spine Injury Conference  
 Brigham and Women’s Hospital  
 Fenway Park  
 Boston, MA
- 5/1/04             “Challenges In Identifying and Treating Sports Injuries”  
 2004 AANS Annual Meeting  
 Orlando Convention Center  
 Orlando, FL
- 4/6/04             “Concussions in the Active Child, Adolescent, and Young Adult: Current Concepts, New  
 Findings and Re-Education”  
 Massachusetts Medical Society Meeting  
 Waltham, MA
- 9/11/03            “Head Injury and the Risk of Alzheimer’s Disease and Depression  
 American Association of Ringside Physicians  
 Aladdin Hotel  
 Las Vegas, Nevada
- 7/4/03             “Effects of Dehydration on Race Car Drivers”  
 Daytona Pepsi 400 Race  
 Daytona International Speedway  
 Daytona Beach, Florida

- 6/21/03 “Cervical Spinal Stenosis – A Contraindication for Collision Sports”  
International Academy for Sports Dentistry 2003 Annual Meeting  
 Caribe Hilton Hotel  
 San Juan, Puerto Rico
- 6/20/03 “Cerebral Concussion Controversies in Sports”  
International Academy for Sports Dentistry 2003 Annual Meeting  
 Caribe Hilton Hotel  
 San Juan, Puerto Rico
- 5/30/03 “Emergency Care of the Spine Injured Athlete”  
American College of Sports Medicine Annual Meeting  
 San Francisco Convention Center  
 San Francisco, California
- 5/30/03 “On-the-Field Management of the Spine-Injured Athlete”  
American College of Sports Medicine Annual Meeting  
 San Francisco Convention Center  
 San Francisco, California
- 5/30/03 “Life After Football: History of Concussive Injuries, Onset of Neurologic Disorders, and  
 Mental Health Issues in former NFL Players”  
American College of Sports Medicine Annual Meeting  
 San Francisco Convention Center  
 San Francisco, California
- 5/9/03 “Athletic Head and Spine Injuries and Return To Play Decisions”  
3<sup>rd</sup> Annual Legacy Neurosurgery Symposium  
 Legacy Good Samaritan Hospital  
 Portland, Oregon
- 4/29/03 “Challenges in Identifying and Testing Sport Injuries”  
 American Association of Neurological Surgeons Annual Meeting  
 San Diego, CA
- 3/8/03 “Acute Concussion Evaluation and Post Concussion Syndrome”  
 Texas ACMS Annual Meeting  
 Omni Houston Hotel Westside  
 Houston, Texas
- 1/16/03 “ACSM Motorsports Taks Force Committee Report”  
 International Council Motorsports Sciences  
 Mirage Hotel  
 Las Vegas, Nevada
- 2/7/03 “Brain Fatalities in American Football Over the Last 55 Years”  
 3<sup>rd</sup> Annual Neurotrauma and Sports Medicine Review  
 Grand Floridian Hotel  
 Orlando, Florida
- 2/7/03 “Interesting Sports Medicine Cases: A Potpourri of Head and Spine Cases”  
 3<sup>rd</sup> Annual Neurotrauma and Sports Medicine Review



Grand Floridian Hotel  
Orlando, Florida

- 2/7/03 “Ongoing Concussion Controversy”  
3<sup>rd</sup> Annual Neurotrauma and Sports Medicine Review  
Grand Floridian Hotel  
Orlando, Florida
- 2/8/03 “On-going Cervical-Spinal Stenosis Controversy”  
3<sup>rd</sup> Annual Neurotrauma and Sports Medicine Review  
Grand Floridian Hotel  
Orlando, Florida
- 12/5/02 “Closed Head Injuries”  
Thirtieth Annual Meeting Cervical Spine Research Society  
Fontainebleu Hilton Hotel  
Miami Beach, Florida
- 12/5/02 “On-the-Field Evaluation of Head Injuries”  
Thirtieth Annual Meeting Cervical Spine Research Society  
Fontainebleu Hilton Hotel  
Miami Beach, Florida
- 9/26/02 “Concussion Guidelines and Return to Play Criteria”  
Greater New York State Orthopedic Association  
Saratoga, N.Y.
- 7/20/02 “Concussion in Sports Medicine”  
New Developments in Sports Related Concussion  
University of Pittsburgh School of Medicine  
Pittsburgh, PA
- 6/19/02 “Concussion in Sports Medicine”  
Sports Medicine Core Curriculum Series Harvard Medical School  
Massachusetts General Hospital  
Boston, MA
- 6/16/02 “Introduction to the Problem: The Grading Scale and RTP Dilemma”  
National Athletic Trainers Association: Annual Meeting  
Dallas, TX
- 6/5/02 “Concussion in Athletic Sports-Controversies Regarding Grading and Return to Play Guidelines”  
Connecticut Athletic Trainers Association Annual Meeting  
Trinity College  
Hartford, Connecticut
- 6/1/02 “On-the-Field Evaluation of Head and Neck Injured Athletes”  
American College of Sports Medicine: Annual Meeting  
St. Louis, MO
- 5/31/02 “Prehospital Care of the Spine-Injured Athlete: A Critical Look at the Task Force Document”  
American College of Sports Medicine: Annual Meeting  
St. Louis, MO

- 5/31/02 “On-the-Field Evaluation of Head and Neck Injuries”  
American College of Sports Medicine: Annual Meeting  
 St. Louis, MO
- 5/30/02 “The Pros and Cons of Neuropsychological Testing in Concussion”  
 “The Practical Use of Neuropsychological Testing: Clinically and in Research”  
American College of Sports Medicine: Annual Meeting  
 St. Louis, MO
- 4/13/02 “Grading Scale for Concussion in Sports”  
American Academy of Neurology  
 Denver, Colorado
- 2/16/02 “Overview of Concussion”  
2<sup>nd</sup> Annual Neurotrauma and Sports Medicine Review  
 Alleghany Hospital, Pittsburgh, PA  
 Caribe Royale Resort Suites and Villas  
 Orlando, Florida
- 2/16/02 “Head Injury in Recreational Sports”  
2<sup>nd</sup> Annual Neurotrauma and Sports Medicine Review  
 Alleghany Hospital, Pittsburgh, PA  
 Caribe Royale Resort Suites and Villas  
 Orlando, Florida
- 2/16/02 “Guidelines for Return to Competition after a Mild Head Injury”  
2<sup>nd</sup> Annual Neurotrauma and Sports Medicine Review”  
 Alleghany Hospital, Pittsburgh, PA  
 Caribe Royale Resort Suites and Villas  
 Orlando, Florida
- 11/3/01 “Panel Discussion: When to retire from sports”  
European Sports Medicine Conference  
 Vienna, Austria
- 11/3/01 “Assessing Concussions: Review of Grading Systems”  
European Sports Medicine Conference  
 Vienna, Austria
- 10/1/01 “Neurosurgical Management of Athletic Injuries”  
Congress of Neurological Surgeons 51<sup>st</sup> Annual Meeting  
 San Diego, California
- 10/1/01 “On-the-Field Management of Head and Neck Injuries”  
 Kerlin Jobe Clinic  
 Los Angeles, California
- 7/28/01 New Developments in Sports Related Concussion  
 “Models of Concussion Management: Current Models of Concussion  
 Management: Where Are We Headed?”  
University of Pittsburgh School of Medicine Center for Continuing

Education in the Health Sciences, Department of Orthopedic Surgery,  
UPMC Health System Center for Sports Medicine, Western Psychiatric  
Institute and Clinic  
Hilton Hotel, Pittsburgh, PA

- 6/8/01           “Second Impact Syndrome”  
Manitoba Public Insurance and the Workers Compensation Board of  
Manitoba Continuing Medical Education Guest Speakers Series  
Winnipeg, Canada
- 6/8/01           “Return to Play After Concussion”  
Manitoba Public Insurance and the Workers Compensation Board of  
Manitoba Continuing Medical Education Guest Speakers Series  
Winnipeg, Canada
- 6/8/01           “Concussion Grading Systems”  
Manitoba Public Insurance and the Workers Compensation Board of  
Manitoba Continuing Medical Education Guest Speakers Series  
Winnipeg, Canada
- 6/8/01           “Biomechanical and Pathophysiology of Head Injury”  
Manitoba Public Insurance and the Workers Compensation Board of  
Manitoba Continuing Medical Education Guest Speakers Series  
Winnipeg, Canada
- 6/8/01           “Overview of Concussion”  
Manitoba Public Insurance and the Workers Compensation Board of  
Manitoba Continuing Medical Education Guest Speakers Series  
Winnipeg, Canada
- 6/8/01           “Guidelines to the Evaluation of Mild Traumatic Brain Injury in Motor Vehicle Accidents and  
Work Injuries”  
Manitoba Public Insurance and the Workers Compensation Board of Manitoba Continuing  
Medical Education Guest Speakers Series  
Winnipeg, Canada
- 5/31/01           “On-the-Field Evaluation of Head and Neck Injuries”  
American College of Sports Medicine Annual Meeting  
Baltimore Convention Center  
Baltimore, Maryland
- 5/31/01           “Return to Play Decisions Following Concussion: Controversies and Dilemmas”  
American College of Sports Medicine Annual Meeting  
Baltimore Convention Center  
Baltimore, Maryland
- 5/30/01           “NASCAR Deaths: Were they preventable”  
American College of Sports Medicine Annual Meeting  
Baltimore Convention Center  
Baltimore, Maryland

- 5/19/01 “Concussion: It’s Effect Upon the Brain”  
Salem Sports Medicine Conference Head and Neck Injuries in Athletes  
 Colonial Sheraton  
 Lynnfield, Massachusetts
- 5/7/01 “On-the-Field Evaluation of Athletic Head and Spine Injury”  
New York State Public High School Athletic Association  
 Carrier Circle Holiday Inn  
 Syracuse, New York
- 5/7/01 “Evaluation, Treatment and Return to Play Decisions Regarding Athletic Head and Spine Injury”  
New York State Public High School Athletic Association  
 Carrier Circle Holiday Inn  
 Syracuse, New York
- 5/5/01 “Athletic Cervical Spine Injuries”  
American Academy of Neurology 53<sup>rd</sup> Annual Meeting  
 Pennsylvania Convention Center  
 Philadelphia, PA
- 3/19/01 “NASCAR Deaths: Were they preventable”  
Neurotrauma and Sports Medicine for the New Millennium  
 Department of Neurosurgery, Allegheny General Hospital  
 The Shadow Ridge Hotel and Conference Center  
 Park City, Utah
- 3/19/01 “Adult vs. Pediatric Athletic Spine Injuries: Management Issues”  
Neurotrauma and Sports Medicine for the New Millennium  
 Department of Neurosurgery, Allegheny General Hospital  
 The Shadow Ridge Hotel and Conference Center  
 Park City, Utah
- 3/19/01 “Athletic Head and Spinal Cord Injuries”  
Neurotrauma and Sports Medicine for the New Millennium  
 Department of Neurosurgery, Allegheny General Hospital  
 Park City, Utah
- 3/19/01 “On-the-Field Management of Athletic Head Injuries”  
Neurotrauma and Sports Medicine for the New Millennium  
 Department of Neurosurgery, Allegheny General Hospital  
 The Shadow Ridge Hotel and Conference Center  
 Park City, Utah
- 3/19/01 “Overview of Concussion”  
Neurotrauma and Sports Medicine for the New Millennium  
 Department of Neurosurgery, Allegheny General Hospital  
 The Shadow Ridge Hotel and Conference Center  
 Park City, Utah
- 12/2/00 “Second Impact Syndrome”  
Sports Neurology Injuries of the Head and Spine

Hospital for Special Surgery, Burke Rehabilitation Hospital and the Weill Medical College of  
Cornell University  
Uris Auditorium  
New York, New York

- 11/18/00      “Catastrophic Football Head Injuries”  
Southwest Chapter American College Sports Medicine 2000 Annual Meeting  
Bahia Hotel  
San Diego, CA
- 11/3/00        “Practical Management of Head Injuries and Concussion in Sport  
British Association of Sports and Exercise Medicine  
Hilton Puckrup Hall  
Tewkesbury, Gloucestershire England
- 9/16/00        “Diagnosis and Nonsurgical Treatment and Rehabilitation of Degenerative Cervical  
Conditions”  
7<sup>th</sup> Annual Symposium New Hampshire Musculoskeletal Institute  
Saint Anselm College, Manchester, NH
- 06/04/99        “On-The-Field Evaluation of Head and Neck Injuries”  
American College of Sports Medicine: Annual Meeting  
Washington State Convention and Trade Center  
Seattle, Washington
- 06/03/99        “Concussion Symposium”  
American College of Sports Medicine: Annual Meeting  
Washington State Convention and Trade Center  
Seattle, Washington
- 05/28/99        “Concussion: Mechanisms and Classifications”  
Sports Related Concussions and Nervous System Injury Conference  
Orlando Regional Healthcare System  
Hotel Royal Plaza  
Orlando, Florida
- 12/10/98        “Headaches”  
Middlesex Community College Community Lecture  
Bedford, Massachusetts
- 11/08/98        “Sports Related Concussion Controversies: Neuropsychological Aspects and Return to  
Play Issues:  
Traumatic Brain Injury and Stroke Conference  
Healthsouth Braintree Rehabilitation Hospital  
Royal Sonesta Hotel  
Boston, Massachusetts
- 06/06/98        “Examination of the Spine”  
American College of Sports Medicine: Annual Meeting  
Orange County Convention Center  
Orlando, Florida

- 06/05/98 “Age, Ethical, Sociological, and Safety Issues in Boxing Especially as Regards Head Injury”  
American College of Sports Medicine: Annual Meeting  
 Orange County Convention Center  
 Orlando, Florida
- 06/02/98 “Age in Boxing: Should there be an age limit”  
XXVI FIMS World Congress of Sports Medicine  
 Orange County Convention Center  
 Orlando, Florida
- 05/15/98 “Return to Sports Criteria Following Concussion”  
Innovative Symposia/Sports Related Concussion  
 Smithtown Sheraton  
 Long Island, New York
- 05/15/98 “Concussion Classification and Implementation”  
Innovative Symposia/Sports Related Concussion  
 Smithtown Sheraton  
 Long Island, New York
- 05/08/98 “Fitness Over Forty and Fifty”  
Lincoln-Sudbury Auxiliary Board Meeting  
 Pierce House, Lincoln
- 04/24/98 “The Concussion Controversy/Grading and Return to Play”  
Sports Medicine Update ‘98 and NEACSM Spring Meeting  
 Sunrise/Medplex, Concord, MA  
 Program Co-chair
- 04/07/98 “Living With Low Back Pain”  
Emerson Hospital Community Lecture Series  
 Emerson Hospital  
 Concord, Massachusetts
- 03/17/98 “Head Injury in Sports”  
Boston Medical Center  
 Department of Rehabilitation Medicine  
 Boston, Massachusetts
- 03/07/98 “Safety Issues In Boxing Regarding Head Injury”  
Sports Related Concussion and Nervous System Injuries  
 Orlando Regional Healthcare System  
 Caribe Royale Resort  
 Lake Buena Vista, Florida
- 02/06/98 “Neurologic and Vascular Causes of Upper Extremity Problems  
 (Cervical Spine Stingers, Peripheral Nerve, Brachial Plexus, Thoracic Outlet)  
American College of Sports Medicine’s Team Physician Course  
 San Diego Princess Resort  
 San Diego, California
- 02/06/98 “Cervical Spine Injury, Extra Axial Facet, Disk, Radicular Symptoms, and Transient  
 Quadriplegia”  
American College of Sports Medicine’s Team Physician Course

- San Diego Princess Resort  
San Diego, California
- 02/06/98      “Epilepsy and Sports Participation”  
American College of Sports Medicine’s Team Physician Course  
San Diego Princess Resort  
San Diego, California
- 02/06/98      “Concussion: Definition, Classification, and Return to Play”  
American College of Sports Medicine’s Team Physician Course  
San Diego Princess Resort  
San Diego, California
- 02/06/98      “Problems and Perils in On-field Management of Head and Neck Injury”  
Hands-on Exam Workshop  
American College of Sports Medicine’s Team Physician Course  
San Diego Princess Resort  
San Diego, California
- 02/06/98      “Physical Examination of the Cervical Spine”  
Hands-on Exam Workshop  
American College of Sports Medicine’s Team Physician Course  
San Diego Princess Resort  
San Diego, California
- 01/31/98      “Concussion/Closed Head Trauma/Convulsions”  
Panel Discussion  
The Jockey Club/Concussion and Head in Sport  
The Gloucester Hotel  
Harrington Gardens  
London, England
- 01/30/98      “Concussion in Sport and the Second Impact Syndrome”  
The Jockey Club/Concussion and Head in Sport  
The Gloucester Hotel  
Harrington Gardens  
London, England
- 10/18/97      “The On-Field Management of Athletic Head and Spine Injuries”  
ACC Keynote Address  
New Zealand Sports Medicine Partners In Performance Conference  
Millennium Hotel  
Christchurch, New Zealand
- 10/18/97      “Second Impact Syndrome:”  
ACC Keynote Address  
New Zealand Sports Medicine Partners in Performance Conference  
Millennium Hotel  
Christchurch, New Zealand
- 10/17/97      “When To Return to Collision Sports After Concussion”  
ACC Keynote Address: Tom Anderson Trust Lecture  
New Zealand Sports Medicine Partners in Performance Conference

Millennium Hotel  
Christchurch, New Zealand

- 10/16/97 “The Return to Sport After Cervical Spine Injury”  
Sports Physician Day  
New Zealand Sports Medicine Partners in Performance Conference  
Millennium Hotel  
Christchurch, New Zealand
- 10/14/97 “Catastrophic Sports Injuries”  
New Zealand Sports Medicine Conference  
Hawkes Bay Chapter  
Hawkes Bay, New Zealand
- 10/14/97 “Second Impact Syndrome”  
Grand Rounds Presentation  
Napier Hospital  
Napier, New Zealand
- 10/13/97 “When to Return to Competition After Head and Spine Injury”  
New Zealand Sports Medicine Conference  
Whangarei, New Zealand
- 09/25/97 “Athletic Head Injury Guidelines”  
New England American College of Sports Medicine: Fall Meeting  
Rhode Island Convention Center  
Providence, R.I.
- 05/22/97 “Head Injury In Football”  
American College of Sports Medicine: Annual Meeting  
Denver, Colorado
- 05/01/97 “Should There Be An Age Limit in Boxing”  
WBC: First Medical Conference on Boxing Safety  
Aruba
- 03/14/97 “Head Injury in Boxing”  
Ringside Physician Course  
Colorado Springs, Colorado
- 02/10/97 “Concussion Guidelines: Controversies and Implementation”  
Allegheny General Hospital Sports Medicine Meeting  
Caribe Royale Resort  
Lake Buena Vista, Florida
- 01/12/97 “Neurological Injuries and the Athlete”  
Breakfast Seminar  
AANS 65<sup>th</sup> Annual Meeting  
Colorado Convention Center  
Denver, Colorado
- 11/22/96 “Catastrophic Head Injury”  
Oklahoma Spine Institute  
Oklahoma City, Oklahoma



- 11/08/96 “Head and Face Protection for the Athlete”  
New England American College of Sports Medicine: Fall Meeting  
 Boxboro, MA
- 10/26/96 “Ask the Experts”  
 Fitness and Beauty Cruise  
 Norwegian Cruise Line
- 10/23/96 “Weekend Warrior Woes”  
 Fitness and Beauty Cruise  
 Norwegian Cruise Line
- 10/22/96 “Exercise for Health versus Fitness”  
 Fitness and Beauty Cruise  
 Norwegian Cruise Line
- 10/02/96 “Head Injury and the Athlete”  
Pediatric Day Conference  
 Waterbury, CT
- 06/01/96 “Boxing and Medicine”  
American College of Sports Medicine: Annual Meeting  
 Cincinnati, OH
- 05/31/96 “On-the-Field Evaluation of Head and Neck Injuries”  
 Clinical Workshop  
American College of Sports Medicine: Annual Meeting  
 Cincinnati, OH
- 05/31/96 “Positive and Negative Effects of Head Protection”  
 NCAA Colloquium  
American College of Sports Medicine: Annual Meeting  
 Cincinnati, OH
- 05/29/96 “Management of Head and Neck Injuries”  
American College of Sports Medicine: Annual Meeting  
 Cincinnati, OH
- 5/18/96 “Head and Neck Injuries in Sports:  
 Assessment in On-The-Field Management”  
 Sports Medicine For The Rheumatologist  
American College of Rheumatology  
 Phoenix, AZ
- 4/27/96 “Diffuse Brain Injuries”;  
 “Spinal Stenosis, Cord Neuropraxia, Transient Quadriplegia”;  
 “Athletic Injuries of the Head and Neck”  
The William W. Backus Hospital Trauma Department Program  
 Foxwoods Resort Casino, CT
- 03/14/96 “Boxing Injuries”  
Emory University School of Medicine

Summer Games: Sports Medicine Review  
Atlanta, GA

- 02/09/96 “Concussion: Definition, Classification, and Return to Play”;  
“Epilepsy and Sports Participation”;  
“Cervical Spine Injury, Extra Axial Facet, Disk, Radicular Symptoms, and Transient Quadriparesis”;  
“Neurologic and Vascular Causes of Upper Extremity Problems (Cervical Spine, Stringers, Peripheral Nerve, Brachial Plexus, Thoracic Outlet)”;  
“Hands-on Workshop - Physical Examination of the Spine”  
American College of Sports Medicine: Team Physician Course - Part I  
San Diego, CA
- 01/27/96 “Strength Aerobics - The Next Stage in Personal Fitness”  
McKenzie Speaker  
Sports Injuries Update  
Lake Placid Sports Medicine Society Conference  
Lake Placid, NY
- 01/26/96 “Epidemiology and Pathophysiology of Athletic Head Injury”  
“Acute Assessment of Athletic Head and Neck Injuries”  
“Surgical Treatment of Athletic Head and Spine Injuries: Who can Safely Return to Competition”  
Sports Injuries Update  
Lake Placid Sports Medicine Society Conference  
Lake Placid, NY
- 01/25/96 “Athletic Neck and Cervical Spine Trauma”  
Albany Medical College  
Albany, NY
- 01/07/96 “Second Impact Syndrome”  
Eastern Athletic Trainers Association Annual Meeting  
Boston, MA
- 12/14/95 “Catastrophic Head and Neck Injury in Sports”  
“Evaluation of Current Guidelines for Head Injury in Sports”  
“General Spinal Stenosis in Contact Sports”  
Rehabilitation Sports Medicine VIII: Controversies in Sports Medicine.  
The Rehabilitation Institute of Chicago  
Chicago, IL
- 11/09/95 “Strength Aerobics”  
Walden Rehabilitation & Nursing Center  
Concord, MA
- 10/23/95 “Weekend Warrior Woes: How to Avoid Exercise Injuries”  
Fitness and Beauty Cruise  
Norwegian Cruise Line
- 10/22/95 “Exercise for Health vs Fitness (How Much is Enough?)”  
Fitness and Beauty Cruise  
Norwegian Cruise Line

- 10/13/95 “Closed Head Injury”  
 “Transient Quadriplegia in Sports”  
 Together in College Health: Surviving and Thriving  
Combined Annual Meeting: New York State Health Association and New England College Health Association  
 Tarrytown, NY
- 10/11/95 “Catastrophic Sports Injuries: Functional Spinal Stenosis”  
 “Sudden Death Syndrome”  
Emerson Hospital Neurology Conference  
 Concord, MA
- 08/24/95 “Torso and Genitourinary Tract Injuries”  
Medicine in the Last Frontier/Medical World Conference  
 Alaska
- 08/24/95 “A Team Physician’s Sports Medicine Bag”  
Medicine in the Last Frontier/Medical World Conference  
 Alaska
- 08/21/95 “Sports Injuries in Young Athletes”  
Medicine in the Last Frontier/Medical World Conference  
 Alaska
- 08/21/95 “How to Write a Precise Aerobic Exercise Prescription”  
Medicine in the Last Frontier/Medical World Conference  
 Alaska
- 08/20/95 “Conditioning of Cardiovascular System: A Machiavellian Approach to Health”  
Medicine in the Last Frontier/Medical World Conference  
 Alaska
- 06/14/95 “Guidelines for Return to Competition After Mild Brain Injury in Sports”  
National Athletic Trainers’ Association  
 Indianapolis, IN
- 06/02/95 “On-The-Field Evaluation of Head and Neck Injuries”  
 Clinical Workshop  
American College of Sports Medicine: Annual Meeting  
 Minneapolis, MN
- 05/23/95 “Trauma to the Head and Spine”  
Connecticut Athletic Trainers’ Association  
 New Britain, CT
- 05/13/95 “Cervical Radiculopathy - Painless vs. Painful: A Conceptual Model and Management Approach”  
1<sup>st</sup> Annual Combined Meeting - Puget Sound & Portland Spine Interest Groups  
 Seattle, WA
- 05/07/95 “Current Treatment Recommendations for Concussions and the Burner Syndromes”  
Prevention and Management of High School Football Injuries

Salem Orthopedic Surgeons, Inc.  
Waltham, MA

- 04/28/95 “Management of Sports-Related Spine Injuries”  
Keynote Address  
Contemporary Management of Lumbar Spine Disorders  
The NeuroScience Institute at Mercy  
Oklahoma City, OK
- 04/23/95 “Assessment of Acute and Repetitive Head Injuries”;  
“Management of Cervical Injuries”  
Clinical Congress: Decision Making and Sports Injuries  
Braintree Hospital Rehabilitation Network  
Randolph, MA
- 04/21/95 “Return to Play Criteria After Cervical Spine Injury”  
“Cervical Spine Injuries Workshop: Case Studies and Discussion”  
Controversies in Decision Making: Neurological Sports Injuries  
University of Miami School of Medicine  
Lake Buena Vista, FL
- 04/01/95 “Exercise for Health vs Fitness”  
Mens Health Day  
Emerson Hospital  
Concord, MA
- 03/03/95 “Catastrophic Injury of the Brain and Spinal Cord”  
Ninth Annual Neurologically Impaired Individual Symposium  
St. Mary’s Hospital  
Richmond, VA
- 02/21/95 “Head Injuries”  
Department of Physical Medicine & Rehabilitation  
Resident Didactic Seminars  
Tufts University School of Medicine  
Newton Wellesley Hospital  
Natick, MA
- 02/15/95 “Chest and Abdominal Injuries”  
Sports Medicine: An In-Depth Review  
American Academy of Family Physicians  
Dallas, TX
- 02/14/95 “Closed Head Injuries”  
“Entrapment Neuropathies”  
“Spine: History and Exam Skills Workshop”  
Sports Medicine: An In-Depth Review  
American Academy of Family Physicians  
Dallas, TX
- 01/25/95 “Athletic Head and Spine Injuries: Recognition of  
On-The-Field Care and Return to Play Guidelines”

Sports Medicine Symposium 1995

North Broward Medical Center  
Pompano Beach, FL

- 12/07/94 “The Prevention of Sports Related Neurological Injuries in American Football: Rules, Equipment, and Surfaces”;  
“Guidelines for Return to American Football After an Episode of Transient Quadriplegia”  
American Society for Testing and Materials Symposium on Safety in American Football  
Phoenix, AZ
- 11/19/94 “Prevention, Treatment, and Return to Play Criteria for Head & Neck Injuries in Sports”  
“ACSM and the Sports Medicine Professional”  
Greater New York Regional Chapter American College-of-Sports Medicine  
New York, NY
- 11/04/94 “When to Return to Contact Collision Sports After an Episode of Transient Quadriplegia”  
New England Chapter American College of Sports Medicine  
Boxborough, MA
- 09/14/94 “Spinal Stenosis”  
Emergency Department Medical Staff Conference  
Emerson Hospital  
Concord, MA
- 06/11/94 “Assessment and Treatment of Traumatic Cervical Spine/Cord Injury”  
“Guidelines for Return to Contact Collision Sports After Traumatic Cervical Spine/Cord Injury”  
National Athletic Trainers Association Annual Meeting and Clinical Symposium  
Dallas, TX
- 06/04/94 “On-the-Field Evaluation and Management of Head and Spinal Cord Injury”  
American College of Sports Medicine: Annual Meeting  
Indianapolis, IN
- 06/03/94 “Concussion: Management and Return to Competition”  
American College of Sports Medicine: Annual Meeting  
Indianapolis, IN
- 06/02/94 “Traumatic Fatal and Non-Fatal Catastrophic Sports Injuries”  
American College of Sports Medicine: Annual Meeting  
Indianapolis, IN
- 06/02/94 “Cervical Spinal Stenosis and Contact Sports”  
American College of Sports Medicine: Annual Meeting  
Indianapolis, IN
- 05/20/94 “Return to Sport After Head Injury”  
“Head and Neck Injuries”  
“The Preparticipation Examination”  
Caribbean Sports Medicine Congress  
Bridgetown, Barbados, WI

- 04/17/94 “Cerebral Concussion in Sport: Prevention and Management”  
Mild Brain Injury Summit National Athletic Trainers Association  
Washington, D.C.
- 03/23/94 “Neck Injuries: The Great Debate: Personal Experience and Perspectives of Our Experts”  
Panelist: Neck Injuries Workshop Case Studies and Discussion  
Controversies in Decision Making: Neurological Sports Injuries  
University of Miami School of Medicine and the Miami Project to Cure Paralysis  
Lake Buena Vista, FL
- 03/22/94 “Catastrophic Sports Injuries: Which Sports Are at Greatest Risk and Why”  
“When to Return to Contact/ Collision Sports After Head and Spine Injury”  
16th Annual Family Practice Review  
Bayfront Medical Center  
St. Petersburg Beach, FL
- 03/21/94 “When is it Safe to Return to Contact Sports?”  
Panelist: Head Injury Workshop - Case Studies and Discussion  
Controversies in Decision Making: Neurological Sports Injuries  
University of Miami School of Medicine and the Miami Project to Cure Paralysis  
Lake Buena Vista, FL
- 03/20/94 “Prevention of Sports-Related Neurological Injuries: Rules, Equipment, and Surfaces,”  
Moderator: Peripheral Nerve Injuries Workshop - Case Studies and Discussion  
Controversies in Decision Making: Neurological Sports Injuries  
University of Miami School of Medicine and the Miami Project to Cure Paralysis  
Lake Buena Vista, FL
- 03/12/94 “Acute and Second Impact Syndrome Head Injury”  
First Annual Ringside Physicians Course  
United States Amateur Boxing, Inc.  
Colorado Springs, CO
- 03/08/94 “Health Benefits of Physical Fitness,”  
Second Annual New Dimensions in Research Conference  
Mabon Securities Corporation  
Beaver Creek, CO
- 03/05/94 “Managing Head and Neck Injuries”  
Sports Med Boston: “New Options for Treating the Injured Athlete”  
Back Pain Society  
Danvers, MA
- 01/21/94 “Neck Injuries”  
Sport Med 94  
Toronto, Canada
- 01/21/94 “Head Injuries in Sport”  
The Tom Pashby Sport Safety Fund Lecture  
Sport Med 94  
Toronto, Canada

- 11/19/93            “When is it Safe to Return to Contact Sports After a Head Injury”  
American Medical Tennis Association Omni Specialty Sports Medicine Update  
Palm Springs, CA
- 11/18/93            “When is it Safe to Return to Contact Sports After a Cervical Spine Injury?”  
American Medical Tennis Association Omni Specialty Sports Medicine Update  
Palm Springs, CA
- 11/09/93            “The Female Triad: Disordered Eating, Amenorrhea, and Osteoporosis”  
Community Health Education Program  
Emerson Hospital  
Concord, MA
- 09/06/93            “Head and Neck Injury”  
XV<sup>th</sup> World Congress of Neurology  
Vancouver, B.C., Canada

- 08/14/93 “Epidemiology, Recognition and Acute Management of Closed Head Injury/ Concussion”  
 “Return to Competition After Head Injury”  
 “Fractures and Dislocations of Cervical Spine”  
 “Epidemiology, Evaluation and Treatment of Traumatic Spinal Cord Injury: Return to Competition”  
 “Case Presentations: Transient Quadriplegia”  
ACSM CAQ Board Review Course for the Certification Examination in Sports Medicine  
 San Francisco, CA
- 08/13/93 “Functional Anatomy & Biomechanics: Examination of the Patient with Low Back Pain”  
 “Lumbar Spinal Stenosis: Dx and Management”  
 “Indications for Surgery and Return to Competition After Lumbar Spine Injury”  
 “Legal Aspects of Sports Medicine and Role of the Team Physician”  
 “On-field Management and Evaluation of Acute Spinal Cord Trauma”  
ACSM CAQ Board Review Course for the Certification Examination in Sports Medicine  
 San Francisco, CA
- 06/11/93 “Case Studies: Epidemiology, Assessment, and Return to Play Criteria for Head Injuries in Sports”  
National Athletic Trainers Association Annual Meeting and Clinical Symposium  
 Kansas City, MO
- 06/05/93 “Spinal Stenosis: Transient Quadriplegia and Football”  
40th Annual Meeting American College of Sports Medicine  
 Seattle, WA
- 06/03/93 “Physician Continuing Medical Education and Opportunities”  
Symposium: 40th Annual Meeting American College of Sports Medicine  
 Seattle, WA
- 05/20/93 “Where is Boxing in This Process?”  
International Symposium on Head and Neck Injuries in Sports American Society for Testing and Materials  
 Atlanta, GA
- 05/14/93 “Sports Medicine in Primary Care”  
 “Athletic Catastrophic Sports Injury Study (1931-1987): Which Sports Are at Greatest Risk and What is Being Done to Reduce Injury”  
 “Medical Coverage of Games and Events”  
 “Legal Liabilities of the Team Physician”  
 “How to Live Painlessly With Your Low Back Disorder”  
Fourth Annual Sports Medicine Conference on the Beach Halifax Medical Center Family Practice Residency Program  
 Daytona Beach, FL
- 05/07/93 “Women’s Triad”  
 Conference Chairman  
Eighth Annual Sports Medicine Update 93  
 Westford, MA



- 05/06/93 “Returning to Contact Sports After a Head Injury:  
Relative and Definite Contraindications”  
Department of Pediatrics, Emerson Hospital  
Concord, MA
- 04/15/93 “The Prevention and Treatment of Athletic Spine Injuries”  
Grand Rounds  
Nashua Memorial Hospital, NH
- 03/06/93 “Specific Problems and Pearls in Boxing”  
“Indications for Surgery and Return to Competition After Lumbar Spine Injury”  
Team Physician Course Parts II and III: American College of Sports Medicine  
Orlando, FL
- 03/05/93 “Transient Quadriplegia (Symptoms, Pathomechanics, Work-up, Return to Play,  
Controversies, Case Presentations and Discussion)  
(With Stanley A. Herring, M.D.)  
Team Physician Course Part III: American College of Sports Medicine  
Orlando, FL
- 03/04/93 “Brachial Plexus Injuries”  
“Epidemiology, Recognition, and Acute Management of Head Injuries”  
“Return to Play Criteria After Head Injury”  
“Epilepsy and the Athlete”  
Team Physician Course Part II and III: American College of Sports Medicine  
Orlando, FL
- 03/02/93 “Toward a Lifetime of Family Fitness”  
Health and Fitness in the 90’s  
The Thoreau Club of Concord  
Concord, MA
- 02/23/93 “Legal Liabilities of the Team Physician”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
Scottsdale, AZ
- 02/22/93 “Epilepsy and the Athlete”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
Scottsdale, AZ
- 01/29/93 “Catastrophic Sports Injuries: Which Sports are at Greatest Risk and Why?”  
Southeast Regional Chapter: American College of Sports Medicine  
Norfolk, VA
- 01/29/93 “Medical Risks of Boxing/Is Boxing a Sport?”  
Southeast Regional Chapter: American College of Sports Medicine  
Norfolk, VA
- 01/25/93 “Head and Spine Injuries in Athletes”  
Chelmsford High School  
Chelmsford, MA

- 01/23/93            “Head and Neck Injuries in Athletes”  
Comprehensive Review Course in Sports Medicine  
 The College of Physicians and Surgeons  
 Department of Orthopaedic Surgery  
 Columbia University, New York  
 Barbados, West Indies
- 01/12/93            “Women’s Health Issues: Ask the Doctor”  
Health and Fitness in the 90’s  
 The Thoreau Club of Concord  
 Concord, MA
- 12/23/92            “Overview of Head Injuries in the Athlete,”  
St. Vincent Hospital Grand Rounds  
 Worcester, MA
- 11/18/92            “Head and Neck Injury Reduction in Football: A Sixty-Year Effort”  
American Medical Tennis Association  
 Palm Springs, CA
- 11/13/92            “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 “Spinal Cord Injuries”  
American Academy of Family Physicians 6th Annual Family Practice Weekend & Sports  
 Medicine Conference  
 Huntington, WV
- 11/10/92            “Exercise: What’s the Right Dosage for You?”  
Health and Fitness in the 90’s  
 The Thoreau Club of Concord  
 Concord, MA
- 10/14/92            “Cervical Spine Injuries”  
Australian College of Sports Physicians: National Annual Scientific Conference in  
 Sports Medicine  
 Perth, Western Australia
- 10/13/92            “The Team Physician”  
Australian College of Sports Physicians: National Annual Scientific Conference in  
 Sports Medicine  
 Perth, Western Australia
- 10/12/92            “Catastrophic Sports Injuries”  
 Keynote Address  
Australian College of Sports Physicians: National Annual Scientific Conference in  
 Sports Medicine  
 Perth, Western Australia
- 10/06/92            “Signs and Symptoms of Anabolic Steroid Abuse”  
 Commonwealth of Massachusetts  
 Project Alliance Training Program  
 Burlington, MA

- 08/22/92            “Back Injuries in Tennis Players”  
Society of Tennis Medicine and Science  
Yale University  
New Haven, CT
- 07/23/92            “Fitness for Good Health”  
Concord Prison Outreach  
Concord, MA
- 06/05/92            “Serious Head and Neck Injury Reduction in Football - A 60-Year Effort”  
New England Neurosurgical Society,  
Waltham, MA
- 05/29/92            “Head Injury in Sports”  
39th Annual Meeting American College of Sports Medicine  
Dallas, TX
- 05/28/92            “Team Physician Certification,”  
39th Annual Meeting American College of Sports Medicine  
Dallas, TX
- 05/27/92            “Head, Neck, and Spine: Head and Neck Injury”  
Chair: Physician Case Presentations  
39th Annual Meeting American College of Sports Medicine  
Dallas, TX
- 05/13/92            “Steroid Abuse in the Athlete”  
Spring Symposium on Sports Medicine  
Milford Whitinsville Regional Hospital  
Milford, MA
- 05/01/92            “The Anabolic Steroid Epidemic”  
7th Annual Sports Medicine Update 92  
Westford, MA
- 04/14/92            “Disc Herniation in the Athlete: When to Operate?”;  
“On-field Emergencies to the Spine and Neck”  
The National Sportsmedicine Conference ‘92  
Orlando, FL
- 03/11/92            “Steroids - The Threat and Dangers,”  
Assabet Valley Regional Vocational School  
Marlborough, MA
- 02/26/92            “Lumbar Spinal Stenosis: Evaluation and Treatment”  
Leominster Hospital Grand Rounds  
Leominster, MA
- 02/24/92            “Head Trauma in Adolescents”  
Medical Student Education  
Emerson Hospital  
Concord, MA

- 02/02/92 “Sports Medicine-Sports Science: Bridging the Gap”;  
 “Head, Neck, and Extrapapinal Nerve Injury in Contact Sports”;  
 “Acute and Chronic Brain Injuries in Boxing and Other Collision Sports”;  
 “Return to Collision Sports After Athletic Cervical and Lumbar Spine Injury”  
Third National Kaiser Permanente Sports Medical Conference  
 Snowbird, UT
- 01/13/92 “Steroids - The Threat and Dangers”  
Marlborough High School Athletic Department  
 Marlborough, MA
- 12/14/91 “Epidemiology, Assessment, and Criteria for Return to Play in Cervical Spine Injuries”;  
 “Epidemiology, Assessment, and Return to Play Criteria for Head Injuries in Sports”  
Rehabilitation Sports Medicine IV: Injuries to the Head and Neck in Sports  
 Rehabilitation Institute of Chicago  
 Chicago, IL
- 12/04/91 “Steroids - The Threat and Dangers”  
Sports Injury Symposium: The Massachusetts Interscholastic Athletic Association  
 Waltham, MA
- 11/22/91 “Anabolic Steroid Abuse in Athletics”  
American Medical Tennis Association  
 Palm Springs, CA
- 11/21/91 “Catastrophic Sports Injuries in High School and College Sports”  
American Medical Tennis Association  
 Palm Springs, CA
- 10/22/91 “Catastrophic Sports Injuries: Which Sports Are at Greatest Risk and What is Being Done to  
 Reduce Injury”  
 Harvard Community Health Plan  
 Wellesley, MA
- 10/19/91 “Etiology, Biomechanics, Diagnosis, and Treatment of Athletic Low Back Pain”  
 University of Texas Health Center  
 Tyler, TX
- 10/18/91 “Etiology, Biomechanics, Diagnosis, and Treatment of Athletic Low Back Pain”  
 Tom Landry Sports Medicine Center  
 Dallas, TX
- 10/18/91 “Catastrophic Sports Injuries: Which Sports Are at Greatest Risk and What is Being Done to  
 Reduce Injury”  
 Texas College of Osteopathic Medicine  
 Fort Worth, TX
- 10/17/91 “Catastrophic Sports Injuries: Which Sports Are at Greatest Risk and What is Being Done to  
 Reduce Injury”  
 Texas A&M University  
 College Station, TX

- 10/17/91 “Etiology, Biomechanics, Diagnosis, and Treatment of Athletic Low Back Pain”  
Texas Woman’s University  
Houston Center, TX
- 10/10/91 “Head and Spine Injuries in Athletes”  
Maine Medical Center  
Portland, ME
- 09/27/91 “Catastrophic Sports Injuries: Sports at Risk?”  
Medical Staff Clinical Meeting  
Emerson Hospital  
Concord, MA
- 09/08/91 “Catastrophic Spinal Injuries in Scholastic Sports”  
American Academy of Neurological and Orthopaedic Surgeons Fifteenth Annual Scientific Convention  
Las Vegas, NV
- 09/07/91 “The Boxing Controversy: A Neurosurgeon’s Perspective”  
American Academy of Neurological and Orthopaedic Surgeons Fifteenth Annual Scientific Convention  
Las Vegas, NV
- 09/07/91 “When To Return to Collision Sports After Athletic Head and/or Cervical Spine Injury”  
American Academy of Neurological and Orthopaedic Surgeons Fifteenth Annual Scientific Convention  
Las Vegas, NV
- 09/06/91 “Catastrophic Spine Injuries in Scholastic Sports: Which Are at Greatest Risk and What is Being Done to Reduce Injury”  
1991 Presidential Guest Lecturer  
American Academy of Neurological and Orthopaedic Surgeons Fifteenth Annual Scientific Convention  
Las Vegas, NV
- 07/27/91 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
The Burdenko Water and Sports Therapy Institute  
Boston, MA
- 07/27/91 “Catastrophic Spine Injuries in All School Sports”  
American Academy of Sports Physicians  
Boston, MA
- 06/12/91 “Health Effects of Regular Exercise”  
Concord Prison Outreach  
Concord, MA
- 06/07/91 “Acute and Chronic Brain Injury in Contact Sports”;  
“Evaluation of the Athlete for Return to Sports After Concussion”  
Snake River Medical Forum  
Lewiston, ID

- 06/01/91 “Boxing - A Historical Perspective”;  
 “Professional Boxing - One Neurosurgeon’s Viewpoint”  
American College of Sports Medicine Annual Meeting  
 Orlando, FL
- 05/31/91 “Criteria For Return to Play Following Cervical Injuries”  
American College of Sports Medicine Annual Meeting  
 Orlando, FL
- 05/17/91 “Carotid Artery Stenosis”  
Medical Staff Clinical Scientific Meeting  
 Emerson Hospital  
 Concord, MA
- 05/07/91 “Sports Injuries”  
Milford Regional Hospital Grand Rounds  
 Milford, MA
- 05/03/91 “When to Return to Competition after Head and Cervical Spine Injury”;  
 “Anatomy, Biomechanics, Diagnosis, and Management of Athletic Low Back Pain”  
Sixth Annual Sports Medicine Update 91  
 Westford, MA
- 05/02/91 “Life-threatening Injuries to the Head and Neck”  
Minnesota Academy of Family Physicians  
 Minneapolis, MN
- 04/24/91 “Catastrophic Spine Injuries in All School Sports (1982-1989)”  
American Association of Neurological Surgeons  
 New Orleans, LA
- 04/12/91 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
National Sports Medicine Conference On The Beach  
 Halifax Medical Center  
 Family Practice Residency Program  
 Daytona Beach, FL
- 03/26/91 “Recognition and Management of Head Injuries”;  
 “Peripheral Nerve Entrapment”  
American College of Sports Medicine Team Physician Course  
 Orlando, FL
- 03/24/91 “Cord and Peripheral Nerve”;  
 “Spinal Stenosis: How to Evaluate”;  
 “On-the-Field Management of Acute Spinal Cord Injury”  
American College of Sports Medicine Team Physician Course  
 Orlando, FL
- 03/14/91 “Catastrophic Sports Injuries in High School and College Sports”  
Massachusetts Association for Health, Physical Education, Recreation and Dance,  
1991 Annual Convention  
 Randolph, MA

- 02/11/91 “Anatomy and Biomechanics of Athletic Cervical Spine & Head Injury”;  
 “Intraspinal and Extraspinal. Cervical Spine Injuries - Diagnosis and Management”  
Second National Kaiser Permanent Sports Medicine Conference  
 Snowbird, UT
- 02/10/91 “Anatomy, Biomechanics, Diagnosis and Management of Low Back Pain”  
Second National Kaiser Permanent Sports Medicine Conference  
 Snowbird, UT
- 02/01/91 “Spinal Stenosis: Identification and Therapy,”  
Medical Staff Scientific Meeting  
 Emerson Hospital  
 Concord, MA
- 01/10/91 “Lumbar Spinal Stenosis: Evaluation and Treatment/ Surgical Indications”  
Buffalo General Hospital Grand Rounds  
 Buffalo, NY
- 01/10/91 “Diabetes and Exercise”  
Mercy Hospital Grand Rounds  
 Buffalo, NY
- 01/09/91 “How to Live Painlessly With Your Low Back Disorder”  
 South Town Physicians  
 Blasdell, NY
- 12/04/90 “Feeling Fit for Life”  
Community Health Lecture Series  
 Emerson Hospital  
 Concord, MA
- 11/30/90 “Catastrophic Sports Injuries in High School and College Athletes”  
American Medical Tennis Association  
 Palm Springs, CA
- 11/29/90 “Sports Medicine in Primary Care”  
American Medical Tennis Association  
 Palm Springs, CA
- 11/26/90 “Neurologic Injuries: Assessment/Care at Scene of Injury”  
 Littleton Fire Department - EMT  
 Littleton, MA
- 11/17/90 “Epidemiology of Head Injuries in Sports and Return to Play Decision Making”  
 Swedish Hospital Medical Center  
Spine Institute Fall Symposium  
 Seattle, WA
- 11/16/90 “Epidemiology of Spinal Cord Injuries and Assessment of Intraspinal Injuries in Sports”  
 Swedish Hospital Medical Center  
Spine Institute Fall Symposium  
 Seattle, WA

- 11/07/90 “Steroid Abuse in the Athlete”;  
 “Cranial and Cervical Injuries in Sports”  
 Hahnemann. University School of Medicine  
 Philadelphia, PA
- 11/03/90 “Sports Injuries to the Lower Extremities”  
Nurse Practitioner Associates for Continuing Education National Primary Care Conference  
 Boston, MA
- 10/22/90 “Neurosurgical Athletic Injuries”  
Congress of Neurological Surgeons  
 Los Angeles, CA
- 10/16/90 “Osteoarthritis Due to Sports-related Injuries”  
Framingham Union Hospital Grand Rounds  
 Framingham, MA
- 10/12/90 “Sports Injuries and Low Back Pain”  
Bethany Medical Conference  
 Bethany Medical Center  
 Kansas City, KS
- 10/12/90 “Sports Injuries”  
 Trinity Lutheran Hospital  
 Kansas City, MO
- 10/11/90 “Prevention and Treatment of Catastrophic Sports Injuries”  
 Kansas University Medical Center;  
 Kansas City, MO
- 10/11/90 “Arthritic Low Back Pain”  
 Topeka Veterans Administration Hospital  
 Topeka,KS
- 10/11/90 “Low Back Pain - Management and Exercise of Diabetic Patients”  
 Providence - St. Margaret’s Hospital  
 Kansas City, KS
- 10/11/90 “How to Live Painlessly with Arthritic Low Back Pain”  
 Shawnee Mission Medical Center  
 Overland Park, KS
- 07/25/90 “Sports Medicine and Primary Care”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
 Waterville Valley, NH
- 07/24/90 “Anabolic Steroid Abuse in Athletics”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
 Waterville Valley, NH



- 07/23/90 “Catastrophic Sports Injuries in High School and College Sports”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
 Waterville Valley, NH
- 07/14/90 “Management of Osteoarthritic Sports Injuries”  
 Health-in-Action Day  
 Stratton Mountain, VT
- 07/11/90 “Health Benefits of Exercise”  
 New England Correctional Center  
 Concord, MA
- 05/24/90 “Intracranial Athletic Cervical Spine Injury”  
 Symposium Co-chairman: Athletic Cervical Spine Injury  
American College of Sports Medicine Annual Meeting  
 Salt Lake City, UT
- 05/24/90 “On-the-Field Evaluation of Head and Spine Injuries”  
 Clinical Workshop  
American College of Sports Medicine Annual Meeting  
 Salt Lake City, UT
- 05/23/90 “Neck Pain - Soccer”  
American College of Sports Medicine Annual Meeting  
 Salt Lake City, UT
- 05/23/90 “On-the-Field Evaluation of Head and Spine Injuries”  
 Clinical Workshop  
American College of Sports Medicine Annual Meeting  
 Salt Lake City, UT
- 05/22/90 “Head Injuries in Sports: Biomechanics, Prevention, and Treatment”  
 Clinical Lecture  
American College of Sports Medicine Annual Meeting  
 Salt Lake City, UT
- 05/07/90 Medical Resource for Breakout Medical Session  
National Catastrophic Head/Spinal Cord Sports Injury Consensus Meeting  
 National Federation of State High School Associations  
 Kansas City, MO
- 05/04/90 “Catastrophic Sports Injuries”  
 Conference Chairman  
Sports Medicine Update 90  
 Westford, MA
- 04/30/90 “The Athlete and the Neurosurgeon”  
 Breakfast Seminar Panel Chairman  
American Association of Neurological Surgeons  
 Nashville, TN
- 04/23/90 “Diagnosis, Prevention, and Treatment of Athletic Spine Injuries”  
 Kaiser Permanente HMO  
 Holyoke, MA

- 04/18/90 “Burners/ Stingers /Cervical Spine Injuries”;  
 “Concussions”  
First Annual Sports Medicine Conference on the Beach  
 Halifax Medical Center  
 Family Practice Residency Program  
 Daytona Beach, FL
- 04/06/90 “Sports Medicine: Bridging the Gap”  
 Penobscot Bay Medical Center  
 Rockland, ME
- 04/05/90 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Eastern Maine Medical Center  
 Bangor, ME
- 03/30/90 “Cervical and Low Back Pain: Diagnosis and Treatment”  
 St. Vincent Hospital Family Practice Residency Program  
 Erie, PA
- 03/30/90 “Catastrophic Sports Injuries”  
 Hamot Family Practice  
 Erie, PA
- 03/30/90 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Millcreek Community Hospital  
 Erie, PA
- 03/29/90 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Aviation Country Club  
 Erie, PA
- 03/23/90 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Hanscom Clinic - Hanscom Field Air Force Base  
 Bedford,MA
- 02/09/90 “Catastrophic Football Spine Injuries; 1977-1988”  
Joint Section on Disorders of the Spine and Peripheral Nerves  
American Association of Neurological Surgeons  
 Captiva Island, FL
- 02/03/90 “The Neurosurgeon and the Amateur Athlete”  
Downeast Association of Physician Assistants Winter Conference  
 Bethel, ME
- 01/12/90 “Exercise for Health vs Fitness: How much is enough?”  
Community Health Lecture Series  
 Emerson Hospital  
 Concord, MA
- 10/24/89 “Adolescents and Anabolic Steroids”  
Pediatric Grand Rounds  
 Baystate Medical Center  
 Springfield, MA

- 10/17/89 “Prevention and Treatment of Spinal Injuries in Athletes”  
St. Francis Health Care Foundation Endowed Lecture Series  
 St. Francis Hospital  
 Poughkeepsie, NY
- 10/04/89 “Steroids - The Threat and Dangers”  
Massachusetts Interscholastic Athletic Association, Inc Annual Sports Injury Conference  
 Milford, MA
- 09/23/89 “Indications/ Contra-Indications For Surgery in the Arthritic Patient”  
 Health-in-Action Day  
 Nova Scotia, Canada
- 09/16/89 “Rehabilitation at Fitness Centers”  
 Sponsored by Nautilus Sports Medical Industries, Inc.  
 Vista International Hotel  
 Elizabeth, NJ
- 07/25/89 “Anabolic Steroid Abuse in Athletics”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
 Waterville Valley, NH
- 07/24/89 “Catastrophic Sports Injuries in High School and College Sports”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
 Waterville Valley, NH
- 06/13/89 “Case Presentations”  
Monroe County Highland Hospital Grand Rounds  
 Rochester, NY
- 06/13/89 “Cervical and Low Back Spine”  
Monroe County Highland Hospital Grand Rounds  
 Rochester, NY
- 06/12/89 “Cervical and Low Back Spine”  
Sponsored by Monroe County Highland Hospital Physicians Assistants  
 Pittsford, NY
- 06/10/89 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Sheehan Memorial Hospital  
 Buffalo, NY
- 06/10/89 “Low Back Pain: Etiology, Diagnosis, and Treatment”  
Our Lady of Victory Hospital Grand Rounds  
 Lackawanna, NY
- 06/05/89 “Sports Medicine in Primary Care”  
 Williamsville, NY
- 06/05/89 “Sports Medicine in Primary Care”  
 Niagara Falls Memorial Hospital  
 Niagara Falls, NY

- 05/05/89            “Steroid Abuse in Athletics”  
Sports Medicine Update 89  
 Westford, MA
- 04/28/89            “Cervical and Lumbar Osteoarthritis,”  
St. Anne’s Hospital Grand Rounds  
 Fall River, MA
- 04/24/89            “Medical Management of Low Back Pain”  
 Hunt Memorial Hospital  
 Danvers, MA
- 04/12/89            “Nutrition and Exercise For the Senior Citizen”  
 Trinitarian Church  
 Concord, MA
- 04/10/89            “Prevention and Treatment of Athletic Spine Injuries”  
 Sponsored by Cooley Dickinson Hospital  
 Northampton, MA
- 03/17/89            “Chronic Low Back Pain”  
St. John’s Hospital Grand Rounds  
 Lowell, MA
- 03/16/89            “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Mercy Hospital  
 Buffalo, NY
- 03/16/89            “Prevention and Treatment of Athletic Spine Injuries”  
Millard Fillmore Hospital Grand Rounds  
 Buffalo, NY
- 03/15/89            “Low Back Pain: Etiology, Diagnosis, and Treatment”  
 Blasdell, NY
- 03/02/89            “Common Sports Injuries”  
 Youville Hospital  
 Cambridge, MA
- 02/24/89            “Catastrophic Sports Injuries”  
6th Annual Office-Based Sports Medicine Conference  
 Sun Valley, ID  
 Sponsored by University of California School of Medicine at San Francisco
- 02/24/89            “When to Return to Contact Sports After a Concussion”  
6th Annual Office-Based Sports, Medicine Conference  
 Sun Valley, ID  
 Sponsored by University of California School of Medicine at San Francisco
- 02/24/89            “Athletic Low Back Pain”  
6th Annual Office-Based Sports Medicine Conference  
 Sun Valley, ID  
 Sponsored by University of California School of Medicine at San Francisco

- 02/22/89            “Acute and Chronic Brain Injuries in Boxing and Other Collision Sports”  
6th Annual Office-Based Sports Medicine Conference  
 Sun Valley, ID  
 Sponsored by University of California School of Medicine at San Francisco
- 02/22/89            “On-the-Field-Management of Athletic Head and Spine Injuries”  
6th Annual Office-Based Sports Medicine Conference  
 Sun Valley, ID  
 Sponsored by University of California School of Medicine at San Francisco
- 02/08/89            “Osteoarthritis of the Lumbar Spine”  
New Britain Hospital Grand Rounds  
 New Britain, CT
- 02/08/89            “Sports Medicine In Primary Care”  
Stamford Hospital Grand Rounds  
 Stamford, CT
- 02/07/89            “Feeling Fit After Forty”  
Community Health Lecture Series  
 Emerson Hospital  
 Concord, MA
- 02/03/89            “Osteoarthritis of the Lumbar Spine”  
 Harvard Community Health Plan  
 Braintree, MA
- 01/20/89            “Catastrophic Injuries in High School and College Athletes”  
The Second International Symposium on the Prevention of  
 Catastrophic Sports and Recreational Injuries to the Spine and Head  
 Toronto ,Canada
- 01/19/89            “Head Injuries: The Experience in the United States”  
The Second International Symposium on the Prevention of  
 Catastrophic Sports and Recreational Injuries to the Spine and Head  
 Toronto, Canada
- 01/18/89            “Steroid Abuse in Athletics”  
Sports Medicine Symposium Connecticut State Medical Society  
 Choate School  
 Wallingford, CT
- 01/17/89            “Catastrophic Sports Injuries”  
Connecticut State Medical Society  
 Cheshire, CT
- 01/11/89            “Diagnosis and Treatment of Degenerative Cervical and Lumbar Spine Disease”  
Henry Heywood Hospital Grand Rounds  
 Gardner, MA
- 01/11/89            “Athletic Low Back Pain”  
 Sports Medicine Systems  
 Newton, MA

- 12/20/88 “Low Back Pain”  
Milford-Whitinsville Regional Hospital Grand Rounds  
 Milford, MA
- 12/10/88 “Head and Neck Injuries in Sports”;  
 “On-the-Field Management of Head and Neck Injuries”  
American Physical Therapy Association  
 Hilton Head Island, SC
- 11/21/88 “Women and Sports - Special Concerns”  
 The Daisy Flour Mill  
 Rochester, NY
- 11/21/88 “Sports Medicine In Primary Care”  
Genesee Memorial Hospital Grand Rounds  
 Batavia, NY
- 11/11/88 “Which Sports Are At Greatest Risk and What Is Being Done”;  
 “Sports Medicine-Sports Science: Bridging the Gap”  
Kent County Hospital Grand Rounds  
 Warwick, RI
- 10/28/88 “Osteoarthritis Due To Spinal Injuries”  
Cutler Army Hospital Grand Rounds  
 Fort Devens, MA
- 10/07/88 “Health Enhancement Through Physical Conditioning”  
 Concord Fitness Club  
 Concord, MA
- 10/05/88 “Head and Neck Injuries”  
Sports Medicine Workshop  
 Boxborough, MA
- 09/29/88 “Arthritic Low Back Pain”  
Health-In-Action Day  
 Boston, MA
- 09/22/88 “Prevention and Recognition of Athletic Head and Spine Injuries”  
Sports Medicine Update: Prevention and Treatment of Fall Sports Injuries  
 Albany Medical College  
 Albany, NY
- 09/13/88 “Emergency Care of the Injured Athlete”  
 Littleton Junior-Senior High School  
 Littleton, MA
- 08/12/88 “Osteoarthritis and Sports Injuries”  
Brockton Hospital Grand Rounds  
 Brockton, MA

- 07/27/88           “Catastrophic Sports Injuries”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
Waterville Valley, NH
- 07/26/88           “When To Return To Contact Sports After A Head Injury”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
Waterville Valley, NH
- 07/25/88           “Prevention of Athletic Spine Injuries”  
Omni Specialty Sports Medicine Update American Medical Tennis Association  
Waterville Valley, NH
- 06/24/88           “‘The Diagnosis and Treatment of Degenerative Cervical and Lumbar Spine Disease”  
Binghamton General Hospital Grand Rounds  
Binghamton, NY
- 06/24/88           “Low Back Pain: Etiology, Diagnosis, and Treatment”  
Binghamton, NY
- 06/23/88           “Athletic Catastrophic Sports Injury Study (1931-1987):  
Which Sports Are At Greatest Risk and What Is Being Done To Reduce Injury”  
Binghamton, NY
- 06/17/88           “Osteoarthritis - As It Relates To Sports Injuries”  
St. John’s Hospital Grand Rounds  
Lowell, MA
- 06/10/88           “Catastrophic Sports Injuries: Which Sports Are At Greatest Risk  
and What Is Being Done To Reduce Injury”  
Sports Medicine Update ‘88  
Westford, MA
- 05/31/88           “Head and Neck Injuries in Rugby”  
International Conference on Rugby Injuries  
Boston, MA
- 05/28/88           “Sudden Death - Ice Hockey”  
American College of Sports Medicine Annual Meeting  
Dallas, TX
- 05/28/88           “Catastrophic Sports Injuries: Which Sports Are At Greatest Risk  
and What Is Being Done To Reduce Injury”  
American College of Sports Medicine Annual Meeting  
Dallas, TX
- 05/27/88           “Discogenic Low Back Pain”  
American College of Sports Medicine Annual Meeting  
Dallas, TX
- 05/26/88           “Cervical Spine Evaluation”  
Clinical Workshop  
American College of Sports Medicine Annual Meeting  
Dallas, TX

- 05/26/88           “Headache and Convulsion - Aerobic Exercise”  
Clinical Lecture  
American College of Sports Medicine Annual Meeting  
Dallas, TX
- 05/25/88           “When to Return to Contact Sports After a Cerebral Concussion”  
Tutorial Lecture  
American College of Sports Medicine Annual Meeting  
Dallas, TX
- 04/28/88           “Football Catastrophic Sports Injury Experience 1987”  
Sports Medicine Section  
American Association of Neurological Surgeons  
Toronto, Canada
- 04/25/88           “When to Return to Contact Sports After Head Injury”  
Panel Chairman: Breakfast Seminar  
American Association of Neurological Surgeons  
Toronto, Canada
- 03/24/88           “High School and College Catastrophic Sports Injury Survey:  
Which Sports Are At Greatest Risk and What is Being Done To Reduce Injury”  
Drake University Sports Medicine Conference  
Des Moines, IA
- 03/24/88           Returning to Action After a Head Injury”  
Drake University Sports Medicine Conference  
Des Moines, IA
- 03/10/88           “Catastrophic Injuries in High School and College Athletes”  
Writer’s Conference American College of-Sports Medicine  
New York, NY
- 03/05/88           “Return to Contact Sports After a Cerebral Concussion”  
Fitness in Sports Fourth Annual Conference  
Fort Worth, TX
- 02/09/88           “Feeling Fit After Forty”  
Community Health-Lecture Series  
Emerson Hospital  
Concord, MA
- 01/31/88           “Update on Field Management of Head and Neck Injury”  
1988 Lake Placid Sports Medicine Conference  
Lake Placid, NY
- 01/30/88           “Concussion in Athletes”  
1988 Lake Placid Sports Medicine Conference  
Lake Placid, NY
- 11/06/87           “Head, Neck, and Back Injuries”  
American College of Sports Medicine, New England Chapter  
Worcester, MA



- 11/04/87 “Low Back Pain”  
Nashoba Community Hospital Grand Rounds  
 Ayer, MA
- 09/20/87 “When to Return to Contact Sports After a Head Injury”  
New Hampshire Medical Society  
 Mt. Washington, NH
- 08/07/87 “When to Return to Contact Sports After a Cerebral Concussion”  
Community Health Lecture  
 Emerson Hospital  
 Concord, MA
- 08/03/87 “Comparison of Exercycle and Monark Bicycles: Maximal Oxygen Uptakes”  
 Exercycle Corporation  
 Newport, RI
- 07/28/87 “New Concepts in the Treatment of Spinal Injuries”  
Symmes Hospital Grand Rounds  
 Arlington, MA
- 06/05/87 “When to Return to Contact Sports After a Cerebral Concussion”  
New England Neurosurgical Society  
 Cambridge, MA
- 05/29/87 “On-Site Evaluation of Head and Spine Injuries”  
 Clinical Workshop  
American College of Sports Medicine Annual Meeting  
 Las Vegas, NV
- 05/29/87 “Acute and Chronic Brain Injury in Contact Sports:  
 Historical Perspective and Overview”  
American College of Sports Medicine Annual Meeting  
 Las Vegas, NV
- 05/29/87 “Acute and Chronic Brain Injury in Contact Sports”  
 Symposium Chairman  
American College of Sports Medicine Annual Meeting  
 Las Vegas, NV
- 05/08/87 “Role of the Neurosurgeon In Sports Medicine”  
 Panel Chairman: Breakfast Seminar  
American Association of Neurological Surgeons  
 Dallas, TX
- 05/01/98 When to Return to Contact Sports After a Cerebral Concussion  
Sports Medicine Update '87  
 Westford, MA
- 04/24/87 “Extracranial Vascular Disease - The Carotid Endarterectomy Controversy”  
Primary Care in Stroke: Putting the Puzzle Together  
 Westford, MA

- 04/06/87           “Brain Injuries In Football and Boxing - Can They be Prevented?”  
Hot Topics in Sports Medicine and Sports Science ‘87  
New York, NY -
- 02/27/87           “Medical Aspects of Boxing”  
American College of Sports Medicine Clinical Conference  
Keystone, CO
- 02/26/87           “Discogenic Disease - Surgical and Non-Surgical Approaches”  
American College of Sports Medicine Clinical Conference  
Keystone, CO
- 02/24/87           “Concussion - What Is It?: Guidelines for Returning to Sports”  
American College of Sports Medicine Clinical Conference  
Keystone, CO
- 02/23/87           “Acute and Chronic Brain Injury and Contact Sports”  
American College of Sports Medicine Clinical Conference  
Keystone, CO
- 01/08/87           “Guidelines for Return to Contact Sports After a Cerebral Concussion”  
International Symposium on the Prevention of Catastrophic Sport, and Recreational Injuries to the Spine and Head  
Toronto, Canada
- 01/07/87           “The Activities Leading to Head Injury”  
International Symposium on the Prevention of Catastrophic Sports and Recreational Injuries to the Spine and Head  
Toronto, Canada

**EXHIBIT “2”**

NO.	CASE
1.	<i>Arbec v. Hardin</i> (Ark. Garland Cir. Ct., 2012)
2.	<i>Arrington v. National Collegiate Athletic Association et al</i> (N.D. Ill. 2013)
3.	<i>Coubal v. Brian A. Chapman</i> (Wis. Cir. Ct. 2014)
4.	<i>Council v. Falik</i> , (Cir. Ct. Md., Prince Georges Cnty. 2012)
5.	<i>Council v. Joel L. Falik, M.D.</i> (Md. Cir. Ct. 2012)
6.	<i>Cox; Brown v. Mount Sinai Hospital</i> (Ill. Cir. Ct., Cook Cnty. 2015)
7.	<i>Davenport v. North Fulton Anesthesia Assocs., P.C.</i> (Ga. Fulton Cnty. 2012)
8.	<i>Dougherty v. Montclair Board of Education</i> (N.J. Essex Super. Ct. 2013)
9.	<i>Dymeck v. Tina M. Jacobs, D.O.</i> (Pa. Ct. C.P. 2014)
10.	<i>Estate of Latifeh Bedwan v. Irving Leslie Fuld, M.D.</i> (Ill. Cir. Ct., Cook Cnty. 2015)
11.	<i>Estate of Phyllis Haegler; Ernest Haegler v. Lawrence &amp; Memorial</i> ; (Conn. Super.Ct. 2015)
12.	<i>Gault v. Sequim Sch. Dist. No. 323</i> (Super. Ct. Washington, Clallam County 2012)
13.	<i>Hoover v. Reading Hospital &amp; Medical Center d/b/a Reading Hospital</i> (Pa. Ct. Common Pleas 2014)
14.	<i>In re National Collegiate Athletic Association Student-Athlete Concussion Injury Litigation</i> , (N.D. Ill. 2014)
15.	<i>Johnson v. Hawthorne Psychiatric Associates</i> (Ill. Cir. Ct. 2015)
16.	<i>King v. Patti Labelle a/K/a Patricia Edwards, Zuri Kye Edwards, Efrem Holmes, and Norma Harris</i> (S.D. Tex. 2014)
17.	<i>Lambert v. Henry Ford Health System</i> (Mich. Cir. Ct. 2013)
18.	<i>Leach v. James</i> (Texas Court 7th Court of Appeals 2014)
19.	<i>Lock v. State of Connecticut; John Machado; Leonid Mandel</i> (Conn. Super. Ct., Hartford Jud. Dist. 2016)
20.	<i>Maxwell v. Castle Sales Company, Inc.</i> (Ill. Cir. Ct. 2015)
21.	<i>Mayall v. USA Water Polo Inc.</i> (C.D. Cal. 2015)
22.	<i>Nagle v. Spartanburg Regional Health Services District, Inc.</i> , (S.C. Cir. Ct. 2014)

NO.	CASE
23.	<i>Namoff v. DC United</i> (D.C. Super. Ct. 2013)
24.	<i>Nasuti, Jr. v. Cooper University Hospital</i> (N.J. Super. Ct. 2012)
25.	<i>Onyshko v. NCAA</i> (Pa. C.P. 2015)
26.	<i>Polidori v. D. Greg Anderson, M.D.</i> (Pa. Ct. C.P. 2012)
27.	<i>Pondelicek v. Kenneth S. Hieferman, M.D.</i> (Ill. Cir. Ct. Cook Cnty. 2013)
28.	<i>Porcaro v. Hartford Hospital; Neurosurgeons of Central Connecticut, PC</i> (Conn. Super. Ct. 2014)
29.	<i>Salem v. Port Authority of New York and New Jersey</i> (N.Y. Sup. Ct. 2013)
30.	<i>Sarko v. Lehigh Valley Hospital</i> (Pa. Ct. C.P. 2013)
31.	<i>Sidari v. Geisinger Wyoming Valley Medical Center</i> (Pa. Ct. Common Pleas 2014)
32.	<i>Silk v. Bowling Green State University</i> (Oh. Ct. Claims 2016)
33.	<i>Twitchel v. Lee Buono, M.D.</i> (Ark. Cir. Ct. 2013)
34.	<i>Vercher v. Chiari Institute</i> (E.D.N.Y. 2015)
35.	<i>Wilgeroth v. Murphy</i> (Fla. 9th Cir. Ct. 2012)
36.	<i>Wren v. James L. Stone, M.D.</i> (Ill. Cir. Ct. 2013)

**EXHIBIT “3”**

## Publications and Documents Reviewed

- A.C. McKee *et al.*, *Chronic Traumatic Encephalopathy in Athletes: Progressive Tauopathy after Repetitive Head Injury*, 68 J. NEUROPATHOLOGY EXPERIMENTAL NEUROLOGY 709 (2009).
- A.C. McKee *et al.*, *TDP-43 Proteinopathy and Motor Neuron Disease in Chronic Traumatic Encephalopathy*, 69 J. NEUROPATHOLOGY EXPERIMENTAL NEUROLOGY 918 (2010).
- A.C. McKee *et al.*, *The spectrum of disease in chronic traumatic encephalopathy*, 136 BRAIN 1 (2013).
- A.M. Fjell *et al.*, *Critical ages in the life course of the adult brain: nonlinear subcortical aging*, 34 NEUROBIOL AGING 10 (2013).
- A.M. Fjell *et al.*, *High consistency of regional cortical thinning in aging across multiple samples*, 19 CEREBRAL CORTEX 9 (2009).
- B.E. Gavett *et al.*, *Chronic Traumatic Encephalopathy: A Potential Late Effect of Sport-Related Concussive and Subconcussive Head Trauma*, 30 CLINICAL SPORTS MED. 179 (2011).
- B.E. Gavett *et al.*, *Mild Traumatic Brain Injury: A Risk Factor for Neurodegeneration*, 2 ALZHEIMER'S RES. THERAPY 18 (2010).
- B.I. Omalu *et al.*, *Chronic Traumatic Encephalopathy in a National Football League Player*, 57 NEUROSURGERY 128 (2005).
- B.I. Omalu *et al.*, *Chronic Traumatic Encephalopathy in a National Football League Player: Part II*, 59 NEUROSURGERY 1086 (2006).
- B.I. Omalu *et al.*, *Chronic Traumatic Encephalopathy, Suicides and Parasuicides in Professional American Athletes: The Role of the Forensic Pathologist*, 31 AM. J. FORENSIC MED. PATHOLOGY 130 (2010).
- B.S. Elkin, B. Morrison 3<sup>rd</sup>, *Region-specific tolerance criteria for the living brain*, 51 STAPP CAR CRASH J., 127-38 (2007).
- Bain, D. Meaney, *Tissue-level thresholds for axonal damage in an experimental model of central nervous system white matter injury*, 122 J. BIOMECH., 615-22 (2000).
- Bigler, *Traumatic brain injury, neuroimaging, and neurodegeneration*, 7 FRONTIERS IN HUMAN NEUROSCIENCE 395 (2013).
- C.W. Majerske, J.P. Mihalik, D. Ren, *et al.*, *Concussion in sports: postconcussive activity levels, symptoms, and neurocognitive performance*, 43 J. ATHL. TRAIN 3 (2008).

- *Committee on Head Injury Nomenclature of the Congress of Neurological Surgeons. Glossary of head injury, including some definitions of injury to the cervical spine*, CLIN. NEUROSURG. 12 (1966).
- *Costanza et al., Review: Contact Sport-Related Chronic Traumatic Encephalopathy in the Elderly: Clinical Expression and Structural Substrates*, 37 NEUROPATHOLOGY APPLIED NEUROBIOLOGY 570 (2011).
- *D.F. Meaney et al., Biomechanical analysis of experimental diffuse axonal injury*, 12 JOURNAL OF NEUROTRAUMA 4 (1995).
- *D.H. Daneshvar et al., Helmets and Mouth Guards: The Role of Personal Equipment in Preventing Sport- Related Concussions*, 30 CLINICAL SPORTS MED. 145 (2011).
- *D.H. Daneshvar et al., The Epidemiology of Sport-Related Concussion*, 30 CLINICAL SPORTS MED. 1 (2011).
- *D.H. Salat et al., Age-related alterations in white matter microstructure measured by diffusion tensor imaging*, 26 NEUROBIOL AGING 8 (2005).
- *D.J. Madden et al., Cerebral white matter integrity and cognitive aging: contributions from diffusion tensor imaging*, 19 NEUROPSYCHOL REV. 415 (2009).
- *D.J. Tisserand et al., Regional frontal cortical volumes decrease differentially in aging: an MRI study to compare volumetric approaches and voxel-based morphometry*, 17 NEUROIMAGE 2 (2002).
- *D.R. Oppenheimer, Microscopic lesions in the brain following head injury*, 31 JOURNAL OF NEUROLOGY, NEUROSURGERY AND PSYCHIATRY 4 (1968).
- *DIAGNOSE CTE Research Project*, BOSTON UNIVERSITY, <https://www.bu.edu/cte/our-research/diagnose-cte-research-project/> (last visited June 30, 2016).
- *Dickstein, et al., Structural MRI and Molecular PET Imaging (AV45 and AV1451) in the Diagnosis of Chronic Traumatic Encephalopathy In Vivo: Study of a Retired NFL Player*, 86 NEUROLOGY 16, SUPPLEMENT P4-046 (2016).
- *E. Masliah et al., Synaptic remodeling during aging and in Alzheimer's disease*, 9 J. ALZHEIMERS DIS. 3 (2006).
- *E.J. Lehman et al., Neurodegenerative causes of death among retired National Football League players*, 79 NEUROLOGY 19 (2012).
- *F.M. Gunning-Dixon et al., Aging of cerebral white matter: a review of MRI findings*, 24 INT'L J. GERIATR. PSYCHIATRY 2 (2009).
- *Gronwall & P. Wrightson, Cumulative effects of concussion*, 306 LANCET 7943 (1975).



- H. Ling *et al.*, *Neurological consequences of traumatic brain injuries in sports*, MOLECULAR AND CELLULAR NEUROSCIENCE 66 (2015).
- H. Sekino, N. Nakamura, K. Yuki, *et al.*, *Brain lesions detected by CT scans in cases of minor head injuries*, 21 NEUROLOGIA MEDICO-CHIRURGICA 7 (1981).
- H. Takahashi, S. Manaka, K. Sano, *Changes in extracellular potassium concentration in cortex and brain stem during the acute phase of experimental closed head injury*, 116 JOURNAL OF NEUROSURGERY 6 (1981).
- H.L. Parker, *Traumatic encephalopathy ('punch drunk') of professional pugilists*, 15 J NEUROL PSYCHOPATHOL. 57 (1934).
- H.S. Martland, *Punch drunk*, 91 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 15 (1928).
- I.K. Koerte, *et al.*, *A prospective study of physician-observed concussion during a varsity university hockey season: white matter integrity in ice hockey players. Part 3 of 4*, 33 NEUROSURGICAL FOCUS 6 (2012).
- I.K. Koerte, *et al.*, *White matter integrity in the brains of professional soccer players without a symptomatic concussion*, 308 JAMA 18 (2012).
- J. Agel, E. J. Harvey, *A 7-year review of men's and women's ice hockey injuries in the NCAA*, 53 CANADIAN JOURNAL OF SURGERY 5 (2010).
- J. Hart, *Neuroimaging of cognitive dysfunction and depression in aging retired National Football League players: a cross-sectional study*, 70 JAMA NEUROLOGY 3 (2013).
- J. Izraelski, *Concussions in the NHL: A Narrative Review of the Literature*, 58 JOURNAL OF THE CANADIAN CHIROPRACTIC ASSOCIATION 4 (2014).
- J. M. Breslow, *New: 87 Deceased NFL Players Test Positive for Brain Disease*, FRONTLINE (Sept. 18, 2015), <http://www.pbs.org/wgbh/frontline/article/new-87-deceased-nfl-players-test-positive-for-brain-disease/>.
- J. Ponsford *et al.*, *Factors influencing outcome following mild traumatic brain injury in adults*, 6 J. INT'L NEUROPSYCHOL SOC.5 (2000).
- J.A. Corsellis & J.B. Brierley, *Observations on the Pathology of Insidious Dementia Following Head Injury*, 105 J. MENTAL SCI. 714 (1959).
- J.A. Corsellis *et al.*, *The aftermath of boxing*, 3 PSYCHOL MED. 3 (1973).
- J.A. Millspaugh, *Dementia pugilistica*, 35 U.S. NAVAL MED. BULL. 297 (1937).

- J.B. McQuillen, E.N. McQuillen & P. Morrow, *Trauma, Sports, and Malignant Cerebral Edema*, 9 AM. J. FORENSIC MED. PATHOLOGY 12 (1988).
- J.D. Barry, *The clinical spectrum of sport-related traumatic brain injury*, 9 NATURE REVIEWS NEUROLOGY 4 (2013).
- J.F. Geddes *et al.*, *Neuronal Cytoskeletal Changes are an Early Consequence of Repetitive Head Injury*, 98 ACTA NEUROPATHOLOGY 171 (1999).
- J.L. Stone, P. Vimal, & J.E. Bailes, *The history of neurosurgical treatment of sports concussion*, NEUROSURGERY 75 (2014).
- J.R. Barrio, *et al.*, *In vivo characterization of chronic traumatic encephalopathy using [F-18] FDDNP PET brain imaging*, 112 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 16 (2015).
- J. G. Teasdale, M.D.M. Hadley, P. Macpherso & J.O. Rowan, *Brain Lesions Detected by Magnetic Resonance Imaging in Mild and Severe Head Injuries*, LANCET 445 (1986).
- K. Ommaya, *The Head: Kinematics and Brain Injury Mechanisms*, in THE BIOMECHANICS OF IMPACT TRAUMA 120 (B. Aldman and A. Chapon ed., 1984).
- K. Zanetti, *et al.*, *Identifying injury characteristics for three player positions in American football using physical and finite element modeling reconstructions*, PROCEEDINGS OF IRCOBI (2013).
- K.F. Bieniek *et al.*, *Chronic traumatic encephalopathy pathology in a neurodegenerative disorders brain bank*, 130 ACTA NEUROPATHOLOGICA 6 (2015).
- K.G. Harmon *et al.*, *American Medical Society for Sports Medicine position statement: concussion in sport*, 47 BRITISH J. SPORTS MED. 1 (2013).
- K.M. Galetta, *et al.*, *The King-Devick test as a determinant of head trauma and concussion in boxers and MMA fighters*, 76 NEUROLOGY 17 (2011).
- K.M. Guskiewicz *et al.*, *Association between recurrent concussion and late-life cognitive impairment in retired professional football players*, 57 NEUROSURGERY 4 (2005).
- K.M. Guskiewicz *et al.*, *Cumulative effects associated with recurrent concussion in collegiate football players: the NCAA Concussion Study*, 290 JAMA 19 (2003).
- K.M. Guskiewicz *et al.*, *National Athletic Trainers' Association Position Statement: Management of Sport-Related Concussion*, 39 J. ATHLETIC TRAINING 280 (2004).
- K.M. Guskiewicz *et al.*, *Recurrent concussion and risk of depression in retired professional football players*, 39 MEDICINE AND SCIENCE IN SPORTS AND EXERCISE 6 (2007).

- L. Moretti *et al.*, *Cognitive decline in older adults with a history of traumatic brain injury*, 11 LANCET NEUROL. 12 (2012).
- L.E. Goldstein *et al.*, *Chronic Traumatic Encephalopathy in Blast-Exposed Military Veterans and a Blast Neurotrauma Mouse Model*, 72 SCI. TRANSLATIONAL MED. 134 (2012).
- L.R. Gentry, J.C. Godersky, B. Thompson & V.D. Dunn, *Prospective Comparative Study of Intermediate Field MR and CT in Evaluation of Closed Head Trauma*, 150 AM. J. ROENGENOLOGY 673 (1988).
- M. Aubry, R.C. Cantu, J. Dvorak, *et al.*, *Summary and agreement statement of the First International Conference on Concussion in Sport, Vienna 2001*, 36 BRITISH JOURNAL OF SPORTS MED. 1 (2002).
- M. Critchley, *Medical Aspects of Boxing, Particularly from a Neurological Standpoint*, BRIT. MED. J. 357 (1957).
- M. Critchley, *Punch-drunk syndromes: the chronic traumatic encephalopathy of boxers*, HOMMAGE A CLOVIS VINCENT (1949).
- M. Osnato, & V. Giliberti, *Postconcussion neurosis-traumatic encephalitis: a conception of postconcussion phenomena*, 18 ARCHIVES OF NEUROLOGY AND PSYCHIATRY 2 (1927).
- M.H. Chappell *et al.*, *Distribution of microstructural damage in the brains of professional boxers: a diffusion MRI study*, 24 J. MAGNETIC RESONANCE IMAGING 3 (2006).
- N. Raz *et al.*, *Differential aging of the brain: patterns, cognitive correlates and modifiers*, 30 NEUROSCI BIOBEHAV REV. 6 (2006).
- N. Raz *et al.*, *Selective aging of the human cerebral cortex observed in vivo: differential vulnerability of the prefrontal gray matter*, 7 CEREB CORTEX 3 (1997).
- N.J. Brown *et al.*, *Effect of cognitive activity level on duration of post-concussion symptoms*, 133 PEDIATRICS 2 (2014).
- Nancy Armour, *Armour: NFL exec's admission of link between football and CTE long*, USA TODAY, Mar. 16, 2016 12:15 a.m. EDT, <http://www.usatoday.com/story/sports/nfl/2016/03/15/nfl-cte-concussions-congress/81799838/>.
- P. McCrory, K. Johnston, W. Meeuwisse, *et al.*, *Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004*, 39 BR. J. SPORTS MED. 4 (2005).

- P. McCrory, W. Meeuwisse, *et al.*, *Consensus statement on concussion in sport: The 4th international conference on concussion in sport, Zurich, November 2012*, 48 JOURNAL OF ATHLETIC TRAINING 4 (2013).
- P.R. Hof, R. Knabe, P. Bovier & C. Bouras, *Neuropathological Observations in a Case of Autism Presenting With Self-Injury Behavior*, 82 ACTA NEUROPATHOLOGY 321 (1991) (Eur.).
- P.R. McCrory, & S.F. Berkovic, *Concussion The history of clinical and pathophysiological concepts and misconceptions*, 57 NEUROLOGY 12 (2001).
- P.S. Echlin *et al.*, *A Prospective Study of Physician-Observed Concussions During Junior Ice Hockey: Implications for Incidence Rates*, 29 NEUROSURGICAL FOCUS 5 (2010).
- Paré, *The workes of that famous chirurgion Ambrose Parey. Translated out of Latin and compared with the French*, LONDON: COTES & YOUNG (1579).
- R.A. Moody, S. Ruamsuke & S.F. Mullan, *An Evaluation of Decompression in Experimental Head Injury*, 29 J. NEUROSURGERY 586 (1968).
- R.A. Stern *et al.*, *Longterm Consequences of Repetitive Brain Trauma: Chronic Traumatic Encephalopathy*, 3 PHYSICAL MED. REHABILITATION S460 (2011).
- R.A. Wennberg, C.H. Tator, *Concussion incidence and time lost from play in the NHL during the past ten years*, 35 THE CANADIAN JOURNAL OF NEUROLOGICAL SCIENCES 5 (2008).
- R.C. Cantu & R. Voy, *Second Impact Syndrome: A Risk in any Contact Sport*, 23 PHYSICIAN SPORTSMED. 27 (1995).
- R.C. Cantu, *An overview of concussion consensus statements since 2000*, 21 NEUROSURGICAL FOCUS 4 (2006).
- R.C. Cantu, *Guidelines for return to contact sports after a cerebral concussion*, 14 PHYSICIAN SPORTSMED. 10 (1986).
- R.C. Cantu, *Second Impact Syndrome: Immediate Management*, 20 PHYSICIAN SPORTSMED. 55 (1992).
- R.C. Cantu, *Second-impact syndrome*, CLIN. SPORTS MED. 17 (1998).
- R.C. Schneider, & F.C. Kriss *Decisions concerning cerebral concussions in football players*, 1 MED. SCI. SPORTS 2 (1969).
- R.C. Schneider, *HEAD AND NECK INJURIES IN FOOTBALL: MECHANISMS, TREATMENT, AND PREVENTION* (Williams & Wilkins) (1973).

- R.L. Saunders & R.E. Harbaugh, *Second Impact in Catastrophic Contact-Sports Head Trauma*, 252 JAMA 538 (1984).
- R.W. Rimel, *et al. Disability caused by minor head injury*, 9 NEUROSURGERY 3 (1981).
- Randolph & M.W. Kirkwood, *What are the real risks of sport-related concussion, and are they modifiable?*, 15 J. INT'L NEUROPSYCHOLOGICAL SOC'Y 4 (2009).
- S. Tremblay *et al.*, *Diffuse white matter tract abnormalities in clinically normal ageing retired athletes with a history of sports-related concussions*, BRAIN (2014).
- S. Tremblay *et al.*, *Sports concussions and aging: a neuroimaging investigation*, 23 CEREBRAL CORTEX 5, (2013).
- Schwarz *et al.*, *N.F.L.'s Flawed Concussion Research and Ties to Tobacco Industry*, NEW YORK TIMES (March 24, 2016).
- Singh, *et al.*, *A new model of traumatic axonal injury to determine the effects of strain and displacement rates*, 50 STAPP CAR CRASH JOURNAL, 601-23 (2006).
- Smith, *Review: the long-term consequences of microglial activation following acute traumatic brain injury*, 39 NEUROPATHOL. APPL. NEUROBIOL. 1 (2013).
- Symonds, *Concussion and its sequelae*, 279 THE LANCET 7219 (1962).
- T. Holsinger *et al.*, *Head injury in early adulthood and the lifetime risk of depression*, 59 ARCHIVES OF GENERAL PSYCHIATRY 1 (2002).
- T. Mori, Y. Katayama & T. Kawamata, *Acute Hemisphere Swelling Associated with Thin Subdural Hematomas: Pathophysiology of Repetitive Head Injury in Sports*, 96 ACTA NEUROCHIRURGICA SUPP. 40 (2006) (Eur.).
- T. Saing *et al.*, *Frontal Cortex Neuropathology in Dementia Pugilistica*, 29 J. NEUROTRAUMA 1054 (2012).
- T. Yuen, *et al.*, *Sodium channelopathy induced by mild axonal trauma worsens outcome after a repeat injury*, 87 J. NEUROSCI. RES. 16, 3620–25 (2009).
- T.M. Talvage *et al.*, *Functionally-Detected Cognitive Impairment in High School Football Players Without Clinically-Diagnosed Concussion*, 31 J. NEUROTRAMA 4 (2013).
- T.N. Hunt, M.S. Ferrara, R.A. Bornstein & T.A. Baumgartner, *The Reliability of the Modified Balance Error Scoring System*, 19 CLINICAL J. SPORT MED. 471 (2009).
- T.W. Langfitt, J.D. Weinstein & N.F. Kassell, *Cerebral Vasomotor Paralysis Produced by Intracranial Hypertension*, 15 NEUROLOGY 622 (1965).

- W.H. Williams, S. Potter, H. Ryland, *Mild traumatic brain injury and Postconcussion Syndrome: a neuropsychological perspective*, J. NEUROL. NEUROSURG. PSYCHIATRY 81 (2010).
- Y. Katayama, D.P. Becker, T. Tamura, & D.A. Hovda, *Massive increases in extracellular potassium and the indiscriminate release of glutamate following concussive brain injury*, 112 JOURNAL OF NEUROSURGERY 2 (1990).
- Y. Zhou *et al.*, *Mild traumatic brain injury: longitudinal regional brain volume changes*, 267 RADIOLOGY 3 (2013).
- NHL0025775.
- NHL0034241.
- NHL0035193.
- NHL0072530.
- NHL0098266.
- NHL0116289.
- NHL0143203.
- NHL0155220.
- NHL1637504.
- NHL1827768.
- NHL2054172.
- NHL2477910.
- NHL0040512.