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# Brainstorm: Head Injuries and the NFL, Part 5: On the Matter of Damaging Neural Circuits

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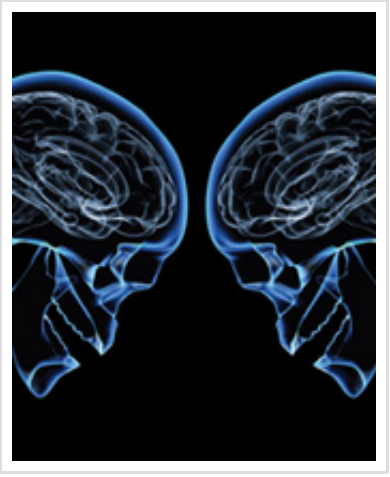

In the last installment, we examined the forces capable of causing brain injury, but left out the most important question: What happens to brain tissues unlucky enough to experience those forces? Now it is time to face the biological facts. In this installment, we will talk about neurological tissue and closed-head injuries.

I need to caution you that we will not conclude with an immediately satisfying discussion. One of the most frustrating aspects of CTE research is that the damage profiles are so variable. Some athletes suffer extreme damage to only a few areas of the brain. Some show tremendous damage throughout the brain. There may even be sports-specific neurological “hot-spots,” regions more vulnerable to certain types of blows to the head than other regions.

Why such unpredictability? There are so many variables to be considered. These include the type of sport being played, the length of time the athlete is in that sport, what regularly happens to the head while that athlete is playing, the overall physical shape of the athlete while on the field — even how well they chose their parents long before they became an athlete. Some players who suffered many hits don’t develop CTE until they are in their 70s. Others present symptoms in their mid-20s.

Regardless of these variables, the best strategy may be to discuss brain regions commonly damaged in CTE patients, then explain what happens to their behaviors as a result of the damage. I will warn you beforehand that we are going to plunge headlong into the arcane jargon-filled world of brain anatomy. And we’ll do it in several parts, beginning with something called the Papez circuit. I promise to be accurate. And, I hope, *clear*.

Many sports figures with CTE incur damage to a multiregion coalition of brain tissue called the Papez circuit. This circuit courses through regions smack-dab in the chewy emotional center of your brain. This circuit is really part of a

chain of neural tissue involving — hold your breath here — the *amygdalo-hippocampal-septo-hypothalamic-mesencephalic continuum*. For such a big name, its job description is really quite simple. Whenever you feel deeply emotional about something, or experience strong animal-like visceral feelings — like pass-rushers going after arrogant quarterbacks — you are using the Papez circuit.

You might expect that if there is damage to the Papez circuit — and many sports figures acquire this damage — a person would experience emotional deregulation. (That's often a fancy name for moodiness.) Maybe even emotional meltdown. That is exactly what one finds in patients possessing such damage. As we discussed in an earlier installment, such people can lash out violently at loved ones, display hyper-aggressive behavior, have near Richter-scale mood swings, suffer unrelenting suicidal depressions, or experience variations of all the above.

Changes in Papez-mediated mood — as serious as they are — represent only one kind of structure-function insult in CTE. In the next installment, we will go after three others, each of which demonstrates similar structure-function relationships. By the time we're done, it will probably be enough to show you why the NFL hates spearing. And why brain scientists say "amen" to their cautious point of view every Sunday afternoon.

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## Comments