

What is CTE?



CTE At a Glance: [Click to View Infographic.](#)

Chronic Traumatic Encephalopathy (CTE) is a progressive degenerative disease of the brain found in athletes, military veterans, and others with a history of repetitive brain trauma. Brain trauma can cause a build-up of an abnormal type of a protein called tau, which slowly kills brain cells. Once started, these changes in the brain appear to continue to progress even after exposure to brain trauma has ended. Possible symptoms include memory loss, confusion, impaired judgment, paranoia, impulse control problems, aggression, depression, and eventually progressive dementia. Symptoms can begin to appear months, years, or even decades after trauma has ended. Currently, CTE can only be diagnosed after death by brain tissue analysis.

The discovery of CTE in the brains of athletes like Mike Webster, Dave Duerson and Junior Seau has launched the disease firmly into the public consciousness. To date, 87 of 91 former NFL players whose brains were studied at the VA-BU-CLF Brain bank have been diagnosed with CTE. So how did we get here?

A Long History

CTE was first described in 1928, when Dr. Harrison Martland described a group of boxers as having “punch drunk syndrome.” Over the next 75 years, several researchers reported similar findings in boxers and victims of brain trauma, but fewer than 50 cases were confirmed. The name Chronic Traumatic Encephalopathy (CTE) was first used in the 1960's and **became the established name**. In 2005, a Pittsburgh pathologist named Bennet Omalu published the first evidence of CTE in an American football player: former Pittsburgh Steeler Mike Webster.

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The diagnosis that changed the game

The diagnosis of CTE in a football player caught the attention of Concussion Legacy Foundation co-founders **Chris Nowinski** and **Dr. Robert Cantu**. They began an outreach program for brain donation among athletes, ultimately creating the Concussion Legacy Foundation. Soon after founding, the Concussion Legacy Foundation partnered with Boston University and the Veterans Administration to form the VA-BU-CLF Brain Bank, led by Dr. Ann McKee. The Brain Bank has coordinated the study of over 260 brains and confirmed CTE in over 150 athletes and military veterans. This research program, in partnership with clinical and translational research programs at the BU CTE Center, has revolutionized how we understand the disease

Dr. Ann McKee on CTE "A protein gone haywire"

The story of CTE is the story of the tau protein. Tau is a critical brain protein that helps stabilize and support certain structures within brain cells, including the cell's internal transportation system. Repeated injury can cause tau to misfold and change its shape. The misfolded tau releases into the cell, setting off a chain reaction that causes it to clump together. The clumps slowly kill neurons and spread to nearby cells.

A map of destruction

In 2015, researchers from the VA-BU-CLF Brain Bank led an NIH conference with 15 leading CTE scientists to determine diagnostic criteria for CTE. The experts **unanimously agreed** that the signature of

CTE is a unique distribution of Tau tangles unlike any other brain disease. In CTE, unlike any other disease, Tau tangles first appear around the blood vessels in the depths of the sulci, or valleys of the brain's cortical folds. As the disease progresses, the Tau spreads to other areas of the brain, and in late stage disease the entire brain can be overcome with tangles.