

## Pedagogical exploitation of the film "Concussion"



### « Concussion »

Beginning September, in Rugby matches, the referee will be able to take a player out if he thinks he has a concussion thanks to a blue card. This reduces the short-term risk of brain injury.

But you (who have just seen the film alone against everyone) know that there are longer-term risks such as CTE (chronic traumatic encephalopathy)...

Present the C.T.E. with a folder summarizing the results of the various workshops that are proposed to you.		
Skills	Evaluation criteria	Evaluation insufficient      correct sufficient
SED (Scientific elements from the documents)	<ul style="list-style-type: none"> <li>Data are rigorously entered</li> <li>The data must be interpreted to serve as arguments to address the problem.</li> </ul>	
Writing	<ul style="list-style-type: none"> <li>Legible writing, neat presentation</li> <li>Spelling</li> <li>Structured text (an idea= a paragraph)</li> </ul>	
Organizing	<ul style="list-style-type: none"> <li>An introduction that announces the problem and the approach that will be implemented</li> <li>Arguments organized in paragraphs, highlighting the logic of the reasoning and linking the scientific elements</li> <li>Conclusion in the form of a balance sheet</li> <li>Relevant integration of results.</li> </ul>	
Obtaining and presenting results	<ul style="list-style-type: none"> <li>Protocol and technical data sheet well used</li> <li>Mastery of the material: microscope, computer, camera,</li> <li>Compliance with the usual rules of presentation</li> </ul>	

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### Workshop n°1 : Brain Injuries

In the film *Concussion*, Dr. Omalu explains the risks associated with brain shock. How is the brain protected and how is it affected by a shock?

#### Doc N°1: link between the brain and the skull:

Perform the following dissection to see how the brain is connected to the skull.

- \* Attach the animal, head to the centre of the bowl, belly face against the cork with the pins (two in the mouth and tail so that the whiting does not move).
- \* Lift the skin of the head with the large pliers and cut it with scissors, then remove it. Remove the muscles from the top of the head with the pliers: the brain and the beginning of the spinal cord appear transparent under the skull which is hard.
- \* On the back of the head, right side, slide a scissor blade under the bones of the skull and cut the top of the skull from back to front. Make the same cut on the left side. Don't forget to cut the bone between the eyes.
- \* With the pliers, lift the top of the skull and cut off the last adhesions. Caution: be careful to remain superficial (do not push the scissors too deep). You discover the brain of whiting made up of several parts.
- \* Using pliers and scissors, remove the bones and flesh that separate the eye (right or left as desired) from the brain. Locate the large white wire that connects the eye to the brain: it is the optic nerve.

# TRAUMATIC BRAIN INJURIES

#### General

TBIs occur when the impact of a rapid acceleration, deceleration, or collision causes a brain injury. TBIs are classified as mild, moderate, or severe depending on the extent of damage to the victim's physical and cognitive abilities. TBIs can be especially dangerous if they disrupt blood flow to the brain or cause pressure in the skull.

#### TBI s Facts

According to the CDC, more than 1.7 million TBIs occur every year. Of these injuries:

- 52,000** result in death
- 275,000** cause hospitalization
- 1.4 million** require an emergency room visit

TBI s cost **\$76.5 billion** every year

**75%** TBIs are concussions

Children, teenagers, and the elderly are most likely to suffer a TBI. TBIs occur more commonly in males.

#### Common Causes

According to the CDC, the most common causes of TBIs are:

Cause	Percentage
Falls	35%
Car accidents	17%
Collisions	17%
Assaults	10%

#### Common Symptoms of TBI

These are some symptoms of TBI, but depend on the severity of the impact and the area of the brain affected

- Headache
- Dizziness
- Nausea
- Vomiting
- Lack of motor coordination
- Change in sleep patterns
- Emotional symptoms such as mood swings

#### Serious Symptoms of TBI

Difficulty thinking or concentrating, Severe headaches or nausea, Slurred speech, Memory problem, Unconsciousness, Seizures.

#### TBI in sports

According to the CDC children and teenagers suffer more than 170,000 TBIs during sports. The most common causes of these injuries were biking, football, playground activities, basketball, and soccer.

#### Long Term Side Effects

TBI can have long-term side effects. Victims may suffer from physical and cognitive impairment for months or years following a TBI. A study published in the journal of clinical and experiment psychology found that 60% of TBI victims showed signs of emotional dysfunction. TBIs also increase the risk of epilepsy, Alzheimer's disease, and Parkinson's disease. Additionally, approximately 5.3 million Americans are living with a TBI related disability.

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### Doc N°2: Head injuries

As you saw during the dissection, the skull is not stuck to the brain, it is separated by one of the envelopes that contains a liquid. In the event of a shock, the brain hits the skull, causing various traumas.

## Workshop n°2 : Nerve cells injured in an individual with CTEs

*In the film alone against all, Dr. Omalu goes home with microscopic slides made up of samples from an individual with CTE.*

*How are the nerve cells that are damaged organized in individuals with CTE ?*

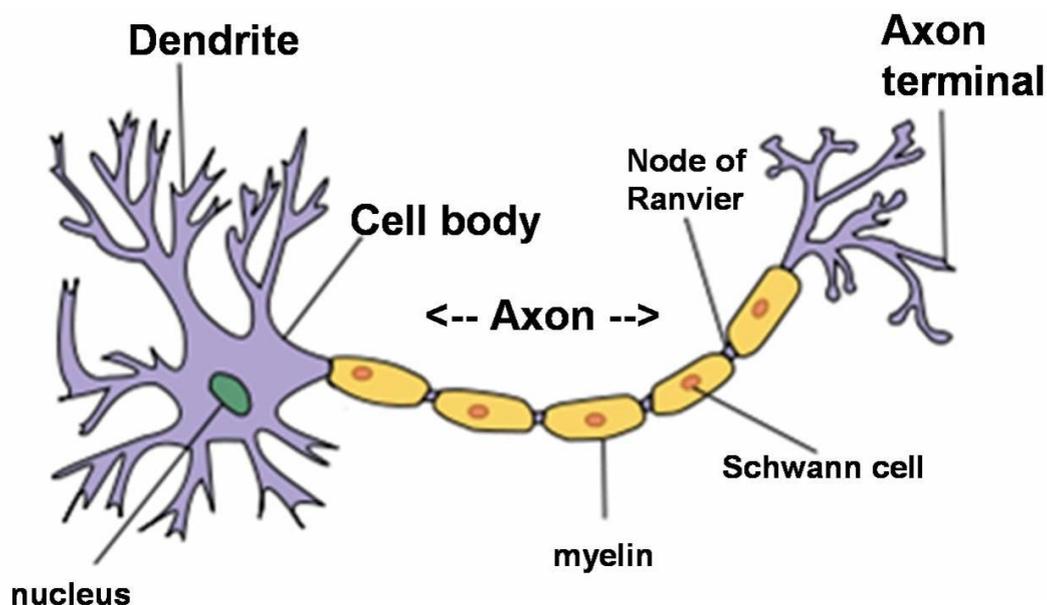
### Doc N°1 : The Nerve Cells :

Using the proposed blades, find the structure of a neuron.

How are the neurons organized in the brain?

### Doc N°2 : Functioning of a neuron:

A neuron is a nerve cell that carries information from the cell body to the nerve endings where the information is transmitted to another neuron. The transmission of information requires the transfer of molecules from the cell body to the neuronal endings.



Anatomical pattern of a neuron

Diagram representing certain neurons observed on Aaron Hernandez's brain  
+ below, Wallerian degeneration anatomical pattern

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### Doc N°3 : neuron and brain of a CTE victim::

Aaron Hernandez was an American footballer with CTE who died of the disease in 2017.

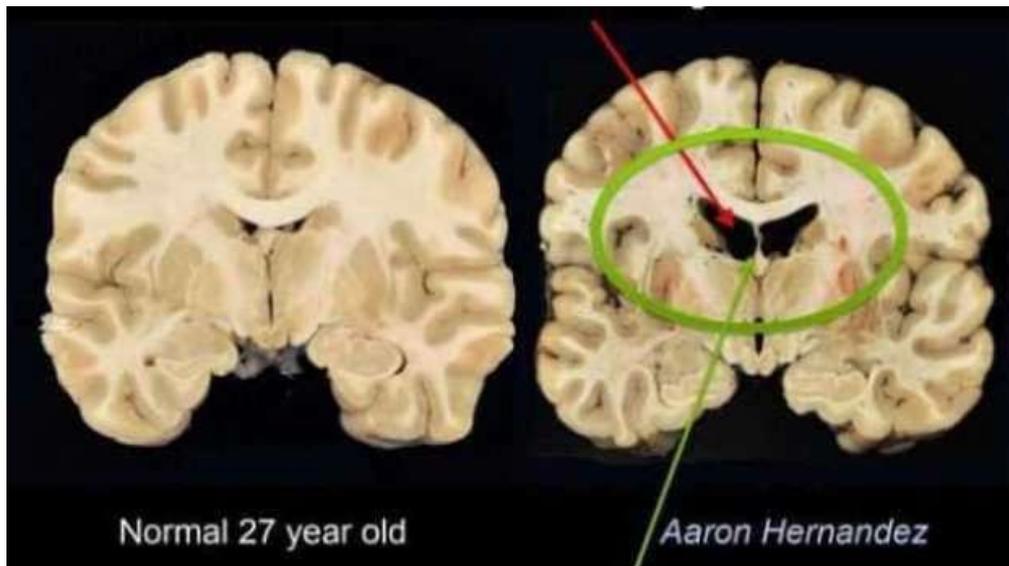
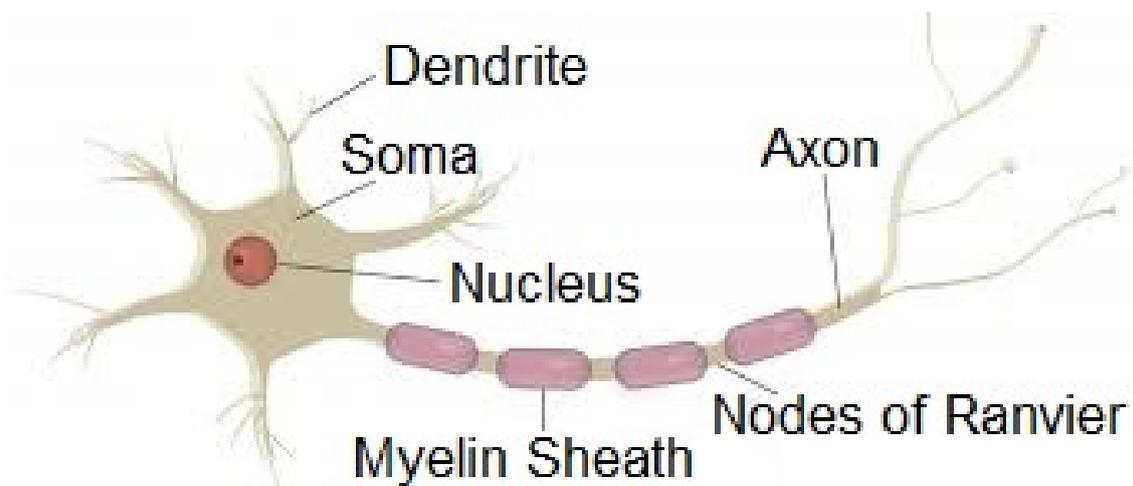


Diagram representing certain neurons observed on Aaron Hernandez's brain

Below, Wallerian degeneration anatomical pattern



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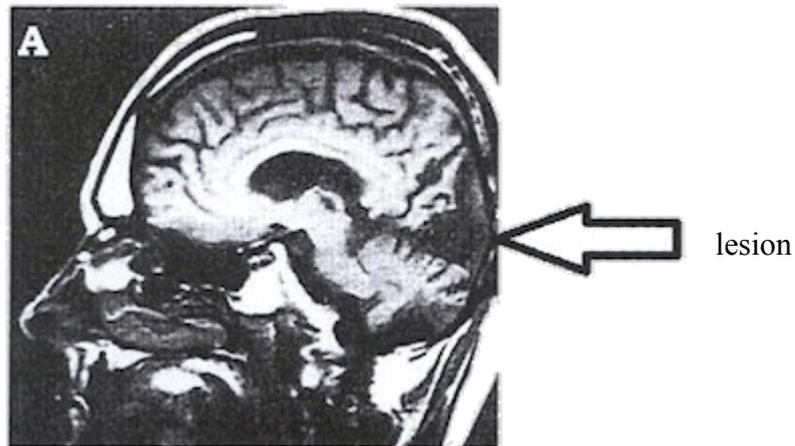
### Workshop 3: Impact of CTE on behaviour:

In the film "alone against all", many patients show signs of dementia.  
What area of the brain is linked to our emotions and how can trauma impact our emotions?

#### Doc N°1: Example of the consequence of a brain injury

The brain is regionalized. For example, the posterior part is involved in the vision.

Anatomical MRI (medical imaging technique for observing lesions) was performed on a blind person.



#### Doc N°2: f-MRI observation and localisation of emotion-related areas

An f-MRI is a medical imaging technique that visualizes the active areas of the brain following stimulation.

Use the edu-anatomist software to find the areas of the brain involved in emotions.

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### Workshop N°4: And today ...

In the film "alone against all", Dr. Omalu highlights symptoms and a practice without presenting any link...

Present the link between the trauma and the observed effects.

#### Doc N°1: The tau protein:

First, the TAU (Tubule-Associated Unit) protein is localized in neurons. This protein has as a function, the maintenance and the stability of the tubes that form the axonal skeleton.

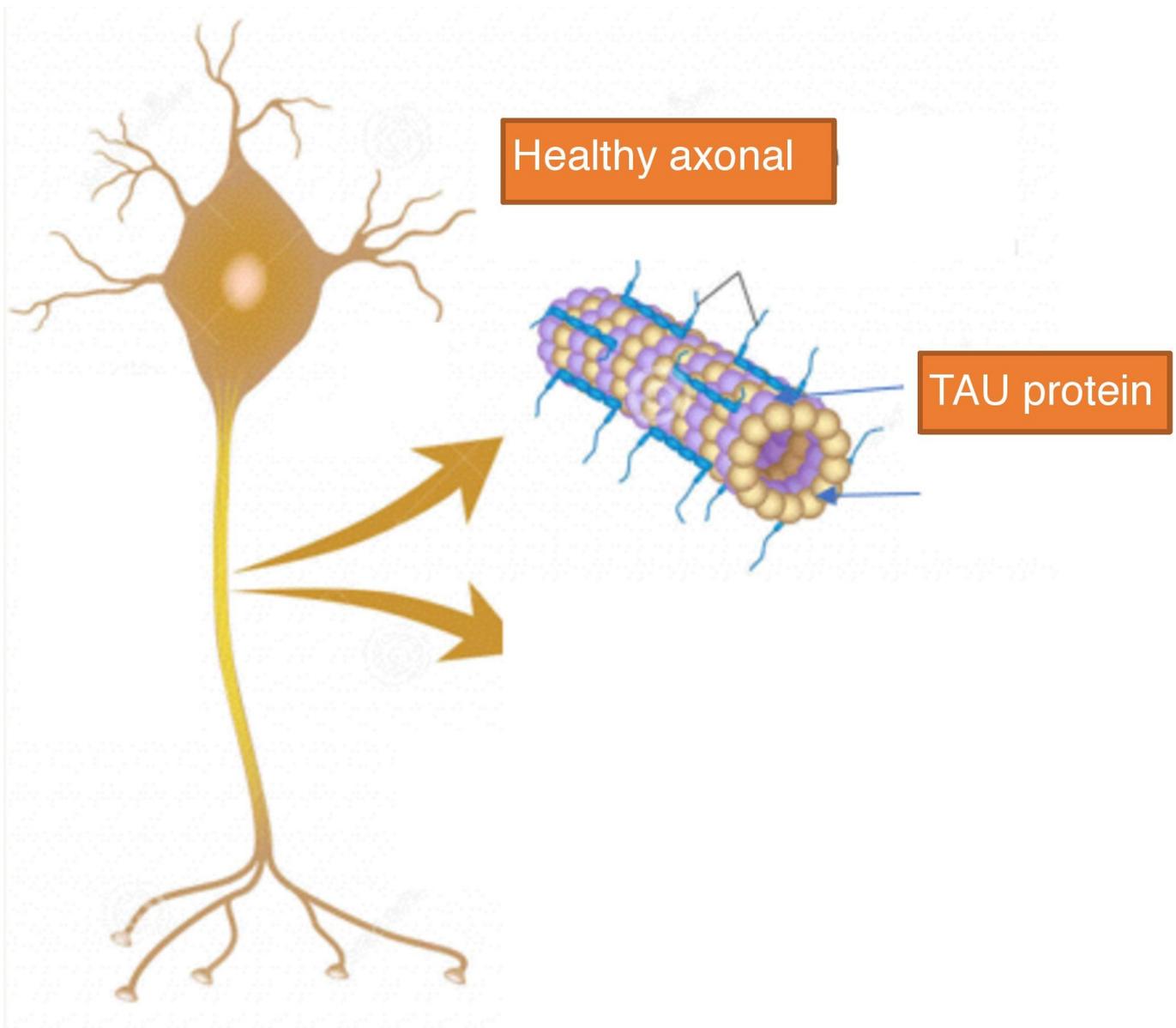


Diagram explaining the role of the TAU protein

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### Doc N°2 :Tauopathies

In case of cellular stress such as a shock, the tau protein loses its structure, it no longer performs its function and the axonal skeleton disappears.

In the case of concussion (but also Alzheimer's disease), the presence of aggregates of Tau protein is noted, which ultimately leads to the death of the neuron.

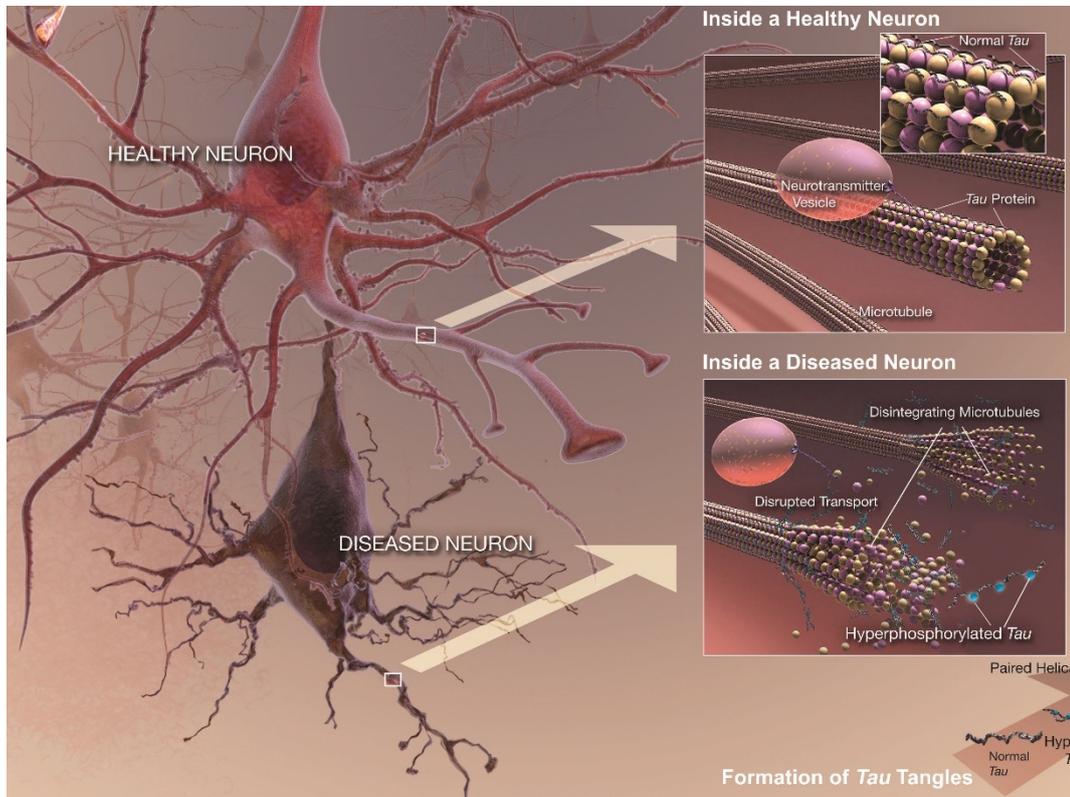


Diagram showing tauopathies

### Doc N°3: towards a new way of prevention....

After following more than two hundred professional hockey players, a team of scientists discovered that the blood concentration of TAU protein was significantly higher in the 28 players who had just suffered a concussion compared to the baseline measured on 47 athletes in the pre-season.

These studies suggest that the blood level of TAU protein could help professionals predict an athlete's return to play.