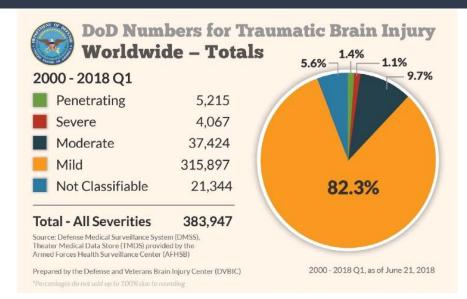
Impact of Mild Blast Traumatic Brain Injury on Tanycyte Function

Uniformed Services University of the Health Sciences Dr. T. John Wu Lindsay Greenspan

Summer Timeline

- Spring Break
 - Pipetting and BCA Assay
- June 9th
 - Rodent Handling Training
- June 27
 - Began learning immunohistochemistry (IHC)
- July 27
 - Began running IHC with male and female mice (blast and sham)
- August 11
 - Final run of IHC and beginning of analysis and imaging
- August 18
 - Poster presentation at USUHS

Introduction



Injury severity	Loss of consciousness	Post-traumatic amnesia	Glasgow Coma Scale
Mild	< 30 min	< 24 <u>hr</u>	13 - 15
Moderate	30 min – 1 day	1 – 7 days	9 – 12
Severe	> 1 day	> 7 days	3 - 8

What is Traumatic Brain Injury (TBI)?

- TBI "results from a violent blow or jolt to the head or body"
- Mild TBI may have temporary effects on brain cells, whereas more severe TBI results in severe bruising, torn tissues, bleeding and other complications that can lead to long-term complications

PRIMARY BLAST INJURY

SHRAPNEL

BLAST

WAVE

ENERGY

PULSE

An explosion generates a blast wave traveling faster than sound and creating a surge of high pressure followed by a vacuum. Studies show that the blast wave shoots through armor and soldiers' skulls and brains, even if it doesn't draw blood. While the exact mechanisms by which it damages the brain's cells and circuits are still being studied, the blast wave's pressure has been shown to compress the torso, impacting blood vessels, which send damaging energy pulses into the brain. The pressure can also be transferred partially through the skull, interacting with the brain.

FRONTAL

LOBE

OCCIPITAL

LOBE

SECONDARY BLAST INJURY

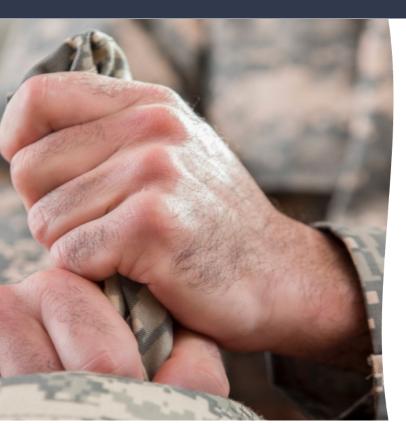
Shrapnel and debris propelled by the blast can strike a soldier's head, causing either a closed-head injury through blunt force or a penetrating head injury that damages brain tissue.

TERTIARY BLAST

INJURY

The kinetic energy generated and released by an explosion can accelerate a soldier's body through the air and into the ground or nearby solid object. Once the body stops, the brain continues to move in the direction of the force, hitting the interior of the skull and then bouncing back into the opposite side, causing a <u>coup-contrecoup</u> injury.

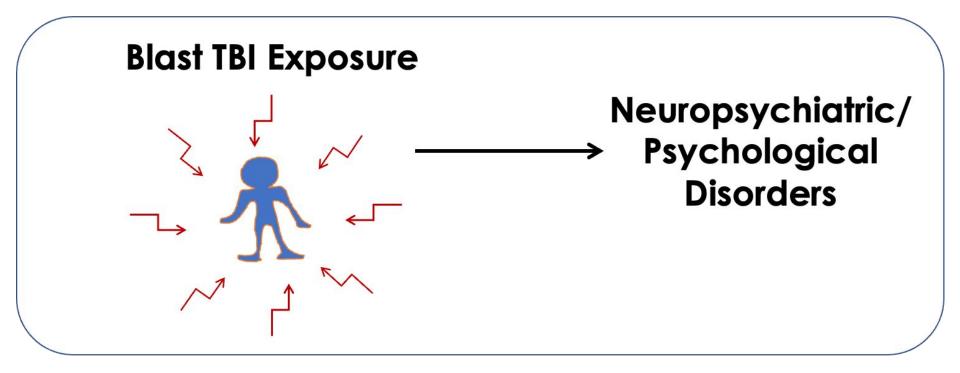
Blast Traumatic Brain Injury

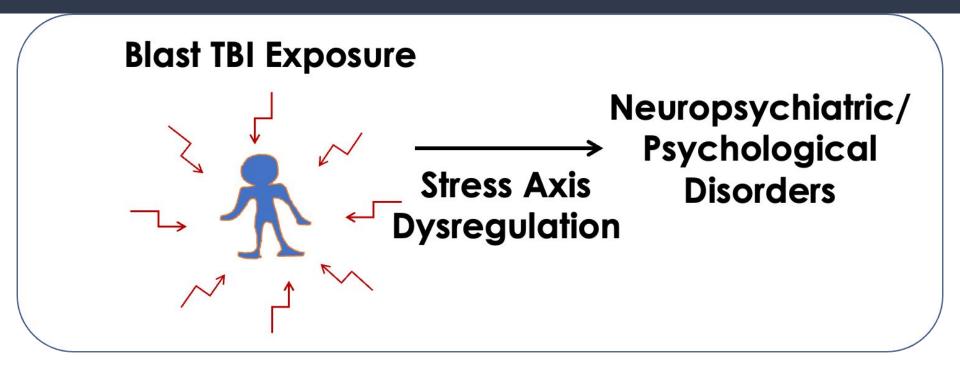


•TBIs result in neuroendocrine deficits in about 1/3 of people.

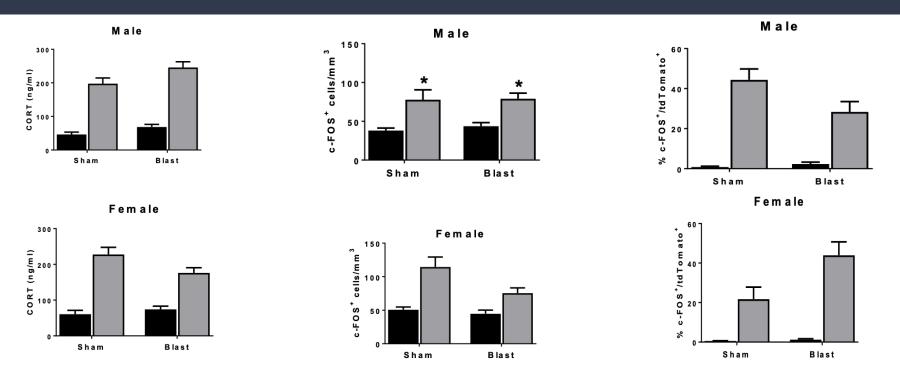
•Approximately a third of all combat injuries treated at the Walter Reed Army Medical Center (WRAMC) in early 2008 involved TBI

•In instances of mbTBI the prevalence of psychiatric disorders increases, including anxiety, depression, and post-traumatic stress disorder (PTSD)





Stress



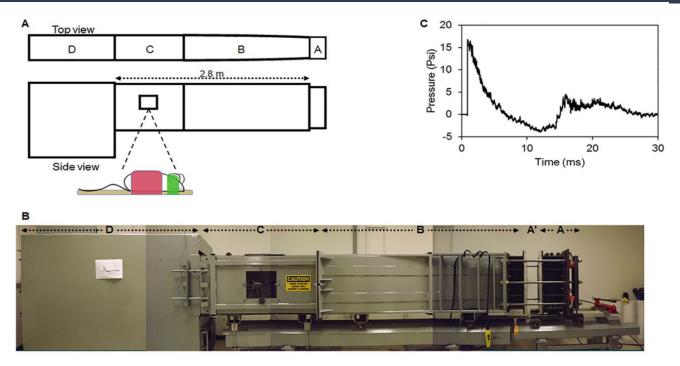
A, Russell et al. Differential Responses of the HPA axis to Mild Blast Traumatic Brain Injury in Male and Female Mice. Endocrinology, 2018

Anxiety

Open Arm Time **Closed Arm Time** Sham 150-Blast 250 200 Time (sec) (sec) 150 е Е Н 50 0 0 Male Female Male Female

Traumatic Brain Injury in Male and Female Mice. Endocrinology,, Russell et al. Differential Responses of the HPA axis to Mild Blast . 2018A

Model of TBI

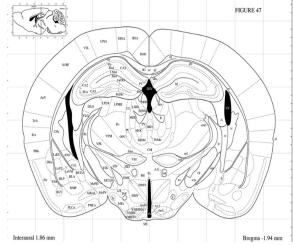


A, Russell et al. Differential Responses of the HPA axis to Mild Blast Traumatic Brain Injury in Male and Female Mice. Endocrinology, 2018

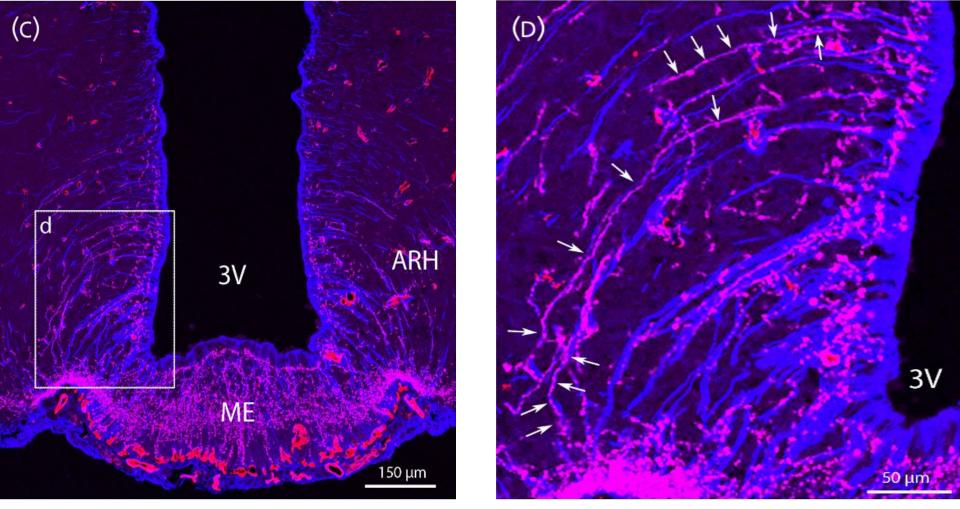
What are Tanycytes

Ependymal cells found within the third (and fourth) ventricles of the brain with processes reaching into the hypothalamus
Link the central nervous system (CNS) to hypophyseal portal blood through cerebrospinal fluid (CSF)
Connects CSF to neuroendocrine events
Within the median eminence (ME), which links the hypothalamus to the pituitary gland, tanycytes aid in the regulation of hypothalamic functions including:

- Neuroendocrine output
- Energy balance
- Diffusion of blood-borne molecules
- Reproductive ageing



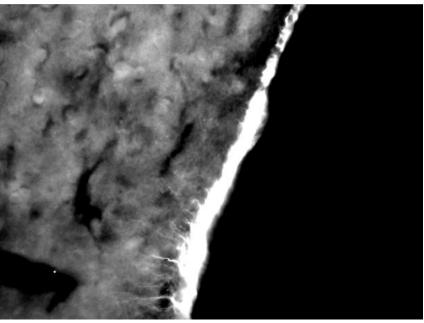
Franklin and Paxinos, The mouse brain in stereotaxic coordinates, Third Edition. Academic Press, 2008. Coronal section taken at Bregma -1.90 to -2.18 mm



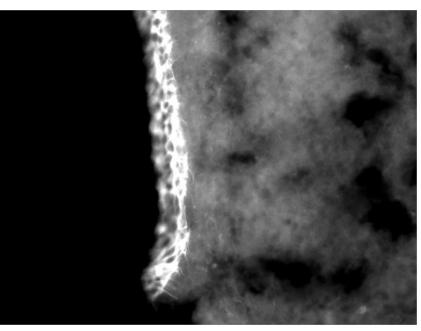
Prevot, V, Sharif, A. The polygamous GnRH neuron: Astrocytic and tanycytic communication with a neuroendocrine neuronal population. *J Neuroendocrinol*. 2022

Results

Male Sham



Male Blast



Takeaways

New Skills

- Working with fluorescent and confocal microscopes
- Developing and adapting experimental design
- Presenting complex findings to all ranges of comprehension
- Learning how to behave in a professional laboratory setting Reflections
 - Practice doesn't always make perfect
 - Asking questions is key
 - Understanding past work is necessary to move forward
 - Account for traffic on the beltway

Acknowledgements

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