

The effects of Traumatic Brain Injury on sleep in mouse models of Alzheimer's disease



PRESENTER:

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CHIMERA is a novel, surgery-free, and reproducible method to mimic human Traumatic Brain Injuries in mice.

BACKGROUND

- Traumatic Brain Injuries (TBI), such as concussions are common among contact sport athletes
- These athletes often suffer from sleep disturbances, which increases risk for Alzheimer's disease (AD)
- This project uses CHIMERA (Closed-Head Injury Model of Engineered Rotational Acceleration) to mimic human TBI in mice with AD genes
- We want to study how TBI affects sleep in mice with AD genes. This project has 3 components:
 1. Mimic human TBI in mice with CHIMERA (current phase)
 2. Monitor & assess effects of TBI on sleep patterns
 3. Evaluate whether TBI can be prevented with post-concussion medication

METHODS: NOVEL APPROACH TO INDUCING TBI

Compared to surgical methods of inducing TBI, CHIMERA offers many advantages:

1. Surgery-free: reduces pain caused by incisions
2. Quick: anesthesia & impact within 5-7 minutes, opposed to 30-minute surgeries
3. Lower morbidity: less rate of skull fracture → less likely to remove subjects due to severe injury
4. Precise & reproducible: consistent impact energy and head velocity across subjects

EXPECTED RESULTS POST-TBI

1. Sleep disruptions such as increased wakefulness & decreased sleep (important for memory & brain development) → both increase risk for AD
2. We expect TBI to increase rate of AD pathology development in the brain

FUTURE RESEARCH

- Assess sleep patterns via electroencephalography (EEG) and investigate whether AD progression can be slowed with post-concussion medication

ALZHEIMER'S DISEASE

- Over 44 million people live with dementia worldwide (AD is a type of dementia)
- A neurodegenerative disease that affects memory, thinking, and behavior
- Characterized by memory loss & cognitive dysfunction, severe enough to interfere with daily life & functioning
- Risk factors: sleep disturbances, brain injuries, age, mild cognitive impairment
- No cure but treatments aim to improve function & manage symptoms

REFERENCES

McNamara, E. H., Grillakis, A. A., Tucker, L. B., & McCabe, J. T. (2020). The closed-head impact model of engineered rotational acceleration (CHIMERA) as an application for traumatic brain injury pre-clinical research: A status report. *Experimental Neurology*, 333.

<https://doi.org/10.1016/j.expneurol.2020.113409>

Rensing, N., Moy, B., Friedman, J. L., Galindo, R., & Wong, M. (2018). Longitudinal analysis of developmental changes in electroencephalography patterns and sleep-wake states of the neonatal mouse. *PLOS ONE*, 13(11): e0207031.

<https://doi.org/10.1371/journal.pone.0207031>

Alzheimer's Association. (n.d.). *Alzheimer's and Dementia in Canada*.

<https://www.alz.org/ca/dementia-alzheimers-canada.asp>

Image: Donald Page (2009). *Two college football players collide head-first during a 2009 game* [Photograph]. Southcreek Global.

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