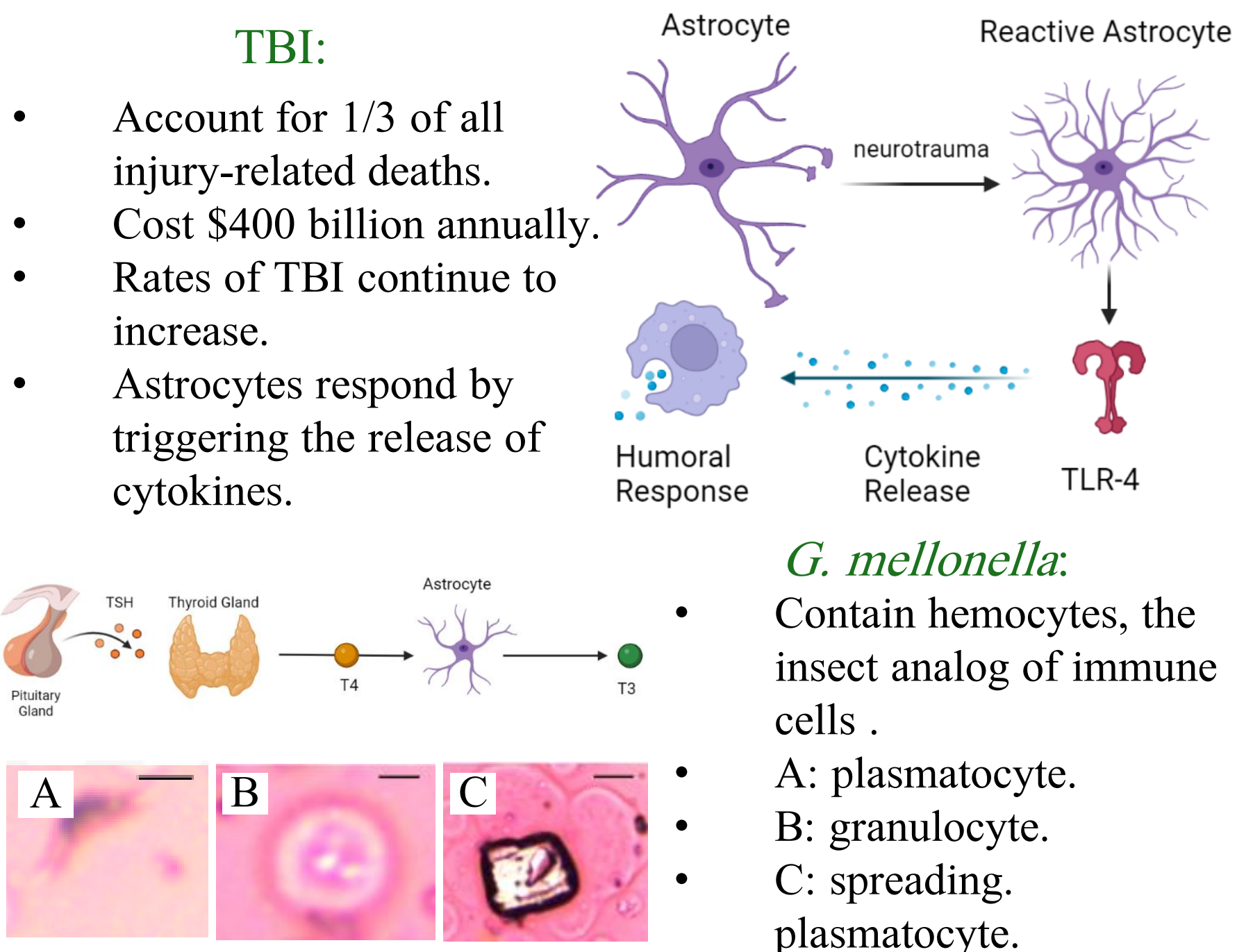


# Thyroid Hormone Treatment of Neurological Trauma Using the Model *Galleria mellonella*

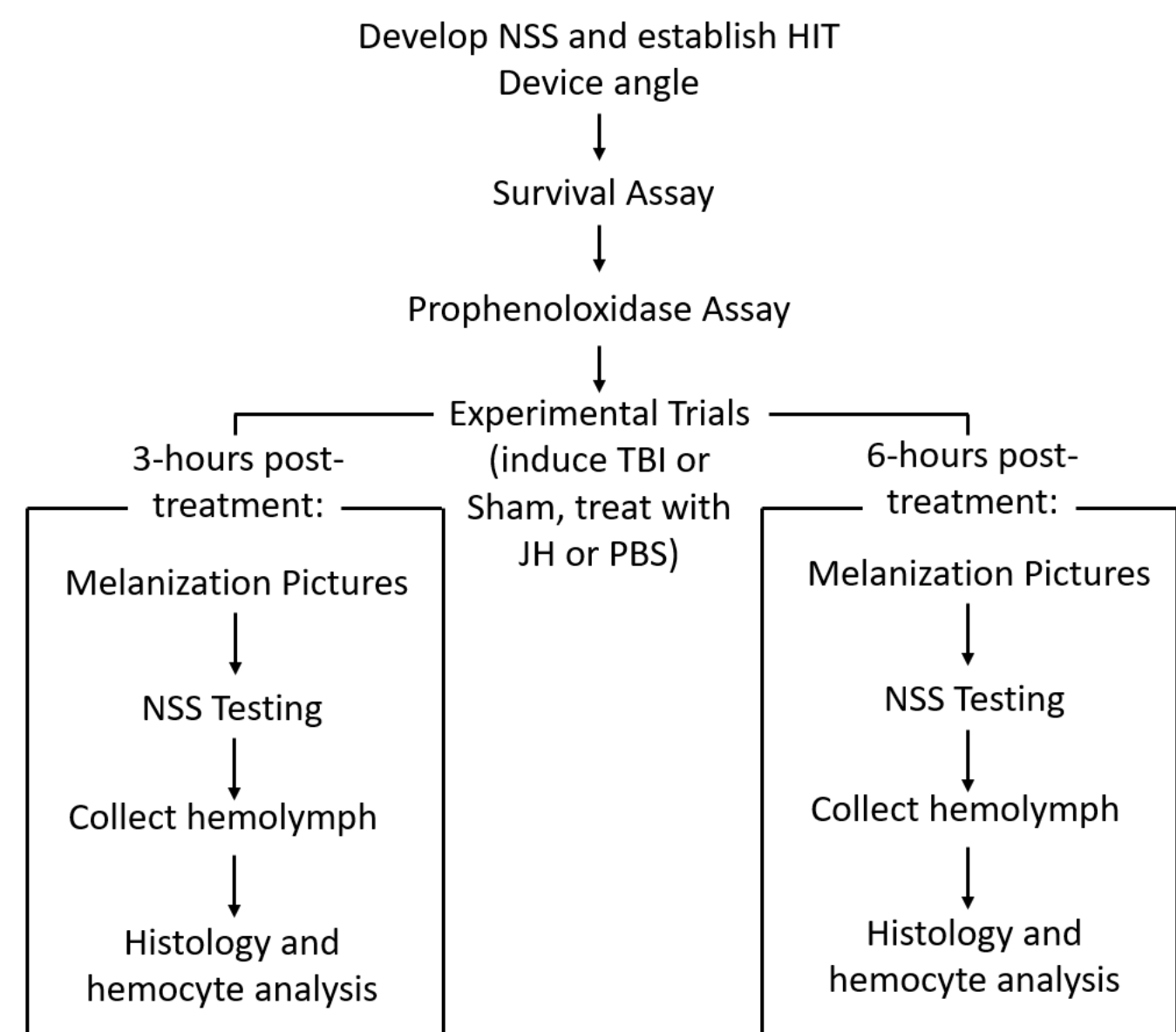
## 1: Scientific Questions

The endocrine, immune, and nervous systems all involve thyroid hormone (T3) when responding to traumatic brain injury (TBI). This interrelatedness sparked the research idea: will Juvenile Hormone (JH), as a proxy for T3, attenuate cellular and behavioral signs of TBI in a novel caterpillar model (*G. mellonella*)?



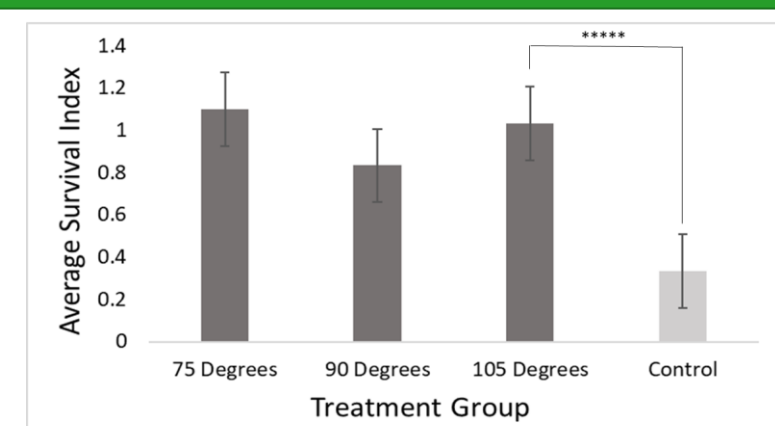
## 2: Methods

*G. Mellonella* were sorted randomly into four treatment groups: JH-TBI, PBS-TBI, JH-Sham, and PBS-Sham. Sham refers to groups that did not receive TBI, and PBS is a negative control treatment.



- Neurological Severity Score (NSS):** behavioral test for *G. mellonella* motor skills. Adapted from mouse models. Lower scores indicate better motor function, as points are received for failure to complete tasks.
- HIT Device:** “High Impact Trauma” Device. Delivers blunt force trauma to induce TBI.
- Prophenoloxidase Assay:** explore the relationship between TBI and oxidative stress. Oxidative stress is responsible for many post-TBI effects.

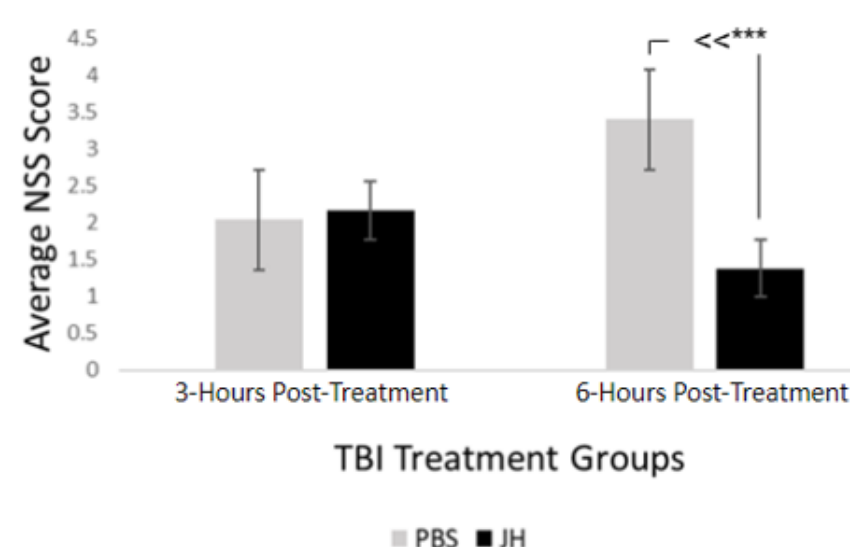
## 3: Results



Survival of TBI *G. mellonella* and survival of Sham *G. mellonella* after 10 days. Caterpillars given 105-degree TBI had a higher fatality rate than caterpillars treated with sham, represented by the tall “105 Degrees” bar.

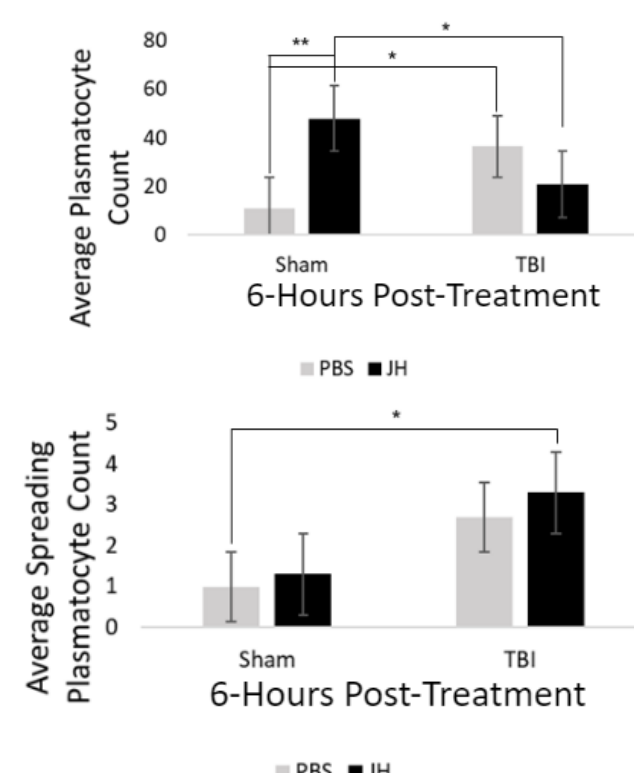


Hemolymph peroxide concentration assay. Left: Concentration scale used. Middle: 3-hours post-TBI or Sham. Right: 6-hours post-TBI (U) or Sham (H). 6-hours post-TBI and post-Sham, the TBI caterpillars experienced oxidative stress and the Sham caterpillars did not.



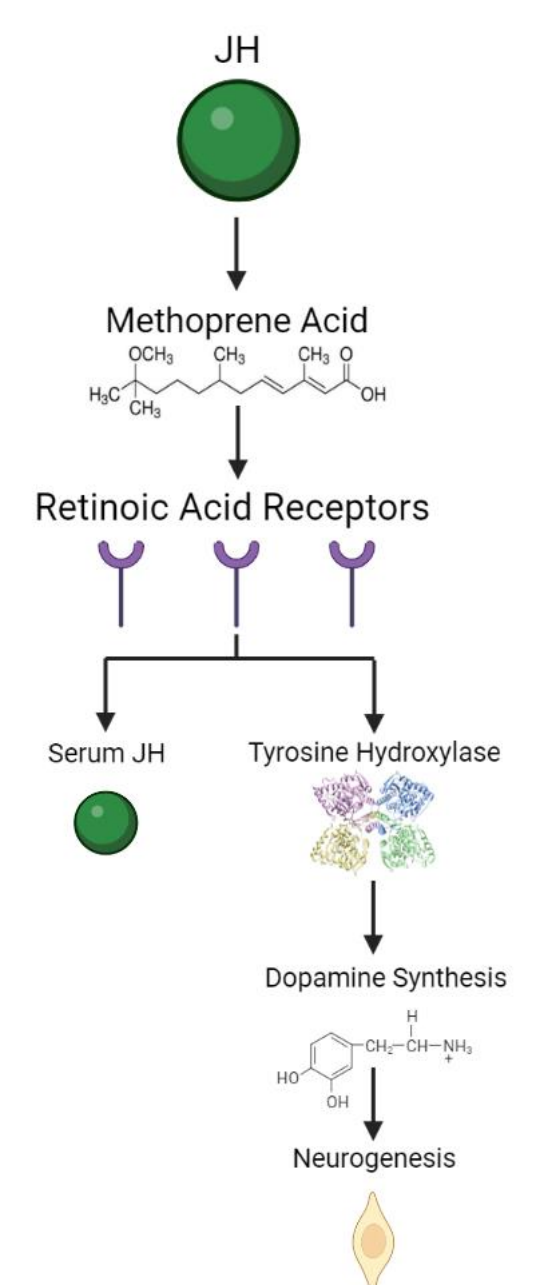
Juvenile Hormone Attenuates Behavioral Symptoms of TBI. There were significant differences between the TBI treatment groups at 6-hours post-treatment, with JH-TBI caterpillars receiving significantly lower average NSS scores than PBS-TBI, indicating superior motor function.

At 6-hours post-treatment, there were significant differences between treatment groups’ numbers of plasmatocytes and numbers of spreading plasmatocytes. JH-TBI had significantly fewer plasmatocytes than JH-Sham, JH-Sham had significantly more plasmatocytes than PBS-Sham, and PBS-Sham had significantly fewer plasmatocytes than PBS-TBI. Additionally, JH-TBI had significantly more spreading plasmatocytes than PBS-Sham.



## 4: Discussion

- Neurological trauma shortens *G. mellonella* lifespan.
- Oxidative stress is correlated with decreased lifespan and poor motor function.
- JH may improve motor function regardless of trauma via a pathway that induces neurogenesis.
- Hemocytes play different roles in trauma response.
- Cytokine presence influences trauma recovery.
- Conclusions:
  - T3 may effectively facilitate enduring recovery from TBI.
  - G. mellonella* effectively model TBI.
- Future Work:
  - T3 treatment dosage.
  - Explore other signaling pathways that could be involved in TBI recovery.



## References

Hard copies of the complete reference list are available. All images created by the author except for the Hydrogen Peroxide Testing Color Chart, cited below:  
 The worldwide leader in pH test manufacturing since 1934 - We specialize in manufacturing the most trusted pH test papers, strips and pH testing solutions. (n.d.). Retrieved September 13, 2022, from <https://www.microessentiallab.com/ProductInfo/F24-HYDGN-00030K-VPS.asp>