Investigating the Impact of Tire-Wear Particles on the Regeneration of Dugesia tigrina

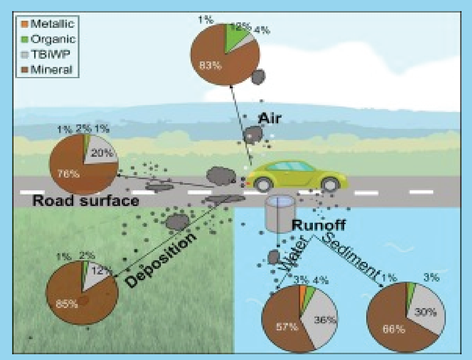
Emily Xu and Ashley Hurjak
Flintridge Sacred Heart Academy
440 St Katherine Drive, La Canada, CA 91011

Project Statement

Understanding tire-wear particles' impact on the environment, especially freshwater organisms, is crucial. With a neurological system similar to humans and as a freshwater, bottom-dwelling primary consumer prone to ingest microplastics in sediments, Dugesia tigrina will allow investigation of TWPs' impacts on freshwater organisms. and the ecosystem. While ingestion of polystyrene microplastics has been shown to slow the regeneration of planaria in some articles, the impacts of TWPs on regeneration have not been sufficiently studied. Our project investigates the effect of accumulated ingestion of TWP on the regeneration rate of Dugesia tigrina at environmentally relevant concentrations.

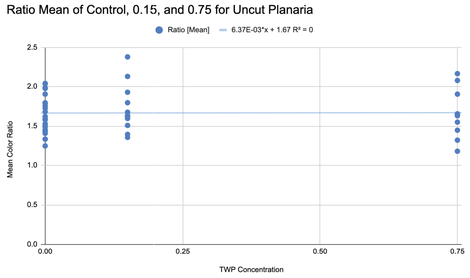
Importance

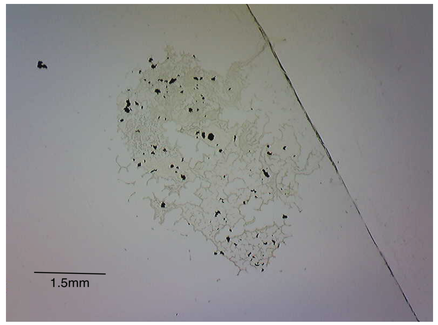
Tire Wear Particles (TWPs) have remained relatively understudied in comparison to other sources of microplastic pollution like Polyethylene (PE). TWPs are generated from friction between tires and the road, which includes both rubber from the tires and road wear particles (Kovochich et al, 2021). These microplastics are washed into bodies of water from the road and end up in fish and other organisms, working up the food chain and affecting the freshwater ecosystem.

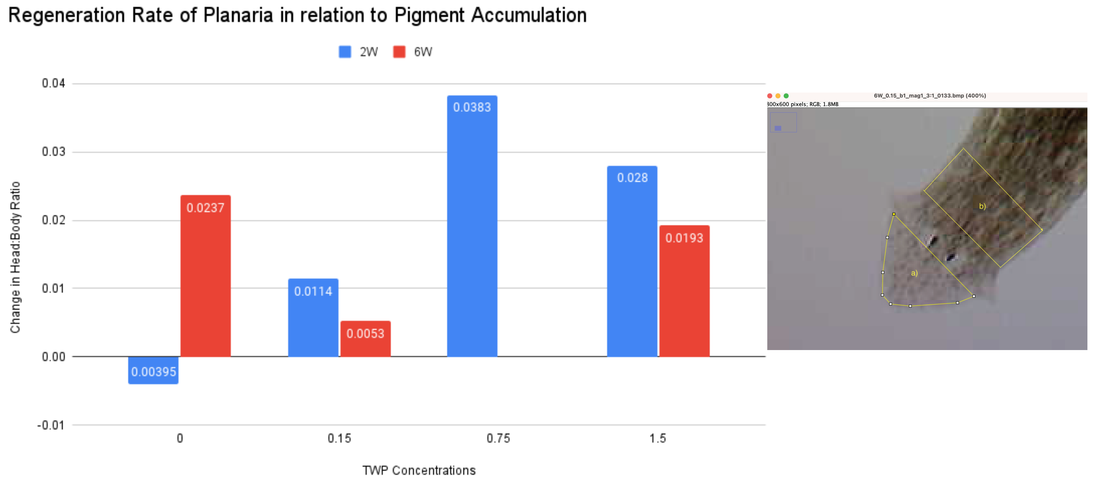


Scan QR Code for Full Paper

Planaria Regeneration Adapted to Tire Wear Microplastic Poisoning







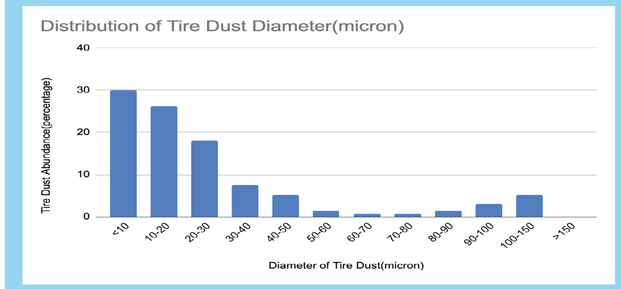
Eyespot Regeneration is not dependent on TWP ingestion (both groups show full eyespots on Day 6)

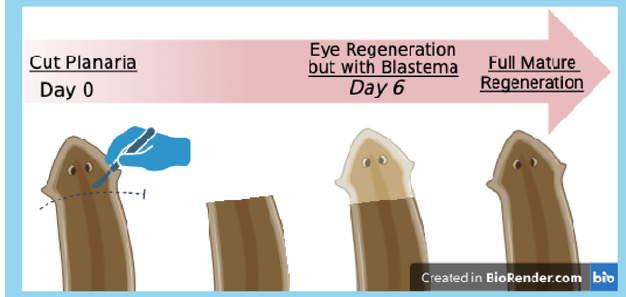
Head:Body Color Ratio for uncut worms not affected by TWP ingestion

2 Week Experimental Group shows a faster change in regeneration rate in groups with higher TWP concentration
-> affirmed the effect of TWP on regeneration
-> higher biological challenge lead to an accelerated regeneration process

6 Weeks Experimental Group shows similar regeneration rate for control and 1.5% TWP concentration group
-> possible adaptation to TWP poisoning

Methods





TWP taken from a car tire and characterized by Andrews et al. 2024. Planaria were fed for 2 weeks or 6 weeks, after which their heads were cut. Elapsed days for photoreceptor formation and trends in the pigment formation of the regenerated head were observed.

Selected References

Cesarini, G., Coppola, F., Campos, D., Venditti, I., Battocchio, C., Di Giulio, A., ... & Scalici, M. (2023). Nanoplastic exposure inhibits feeding and delays regeneration in a freshwater planarian. Environmental Pollution, 121959.

Gambino, G., Falleni, A., Nigro, M., Salvetti, A., Cecchettini, A., Ippolito, C., ... & Rossi, L. (2020). Dynamics of interaction and effects of microplastics on planarian tissue regeneration and cellular homeostasis. Aquatic Toxicology, 218, 105354.

Acknowledgements

Thanks to Flintridge Sacred Heart for providing the funding, resources, and facilities of this project. We are also grateful for all the guidance that Mr. Ty Buxman and Mr. Bruce Waggoner provided in data collection, graph analysis, experiment design, and other aspects of the research. We also give thanks to Jianing Xu, Lauren Larson, and Guinevere Andrews, whose work characterized the size distribution of the tire wear particles we used.