Modeling Prenatal Nicotine Exposure with Hydra littoralis

Calizzi, Christopher (School: College Park High School)

Despite pronounced negative side effects on developing babies, 10.7% of women smoke regularly during pregnancy. In hopes of reducing smoking during pregnancy, nicotine patches, vaping, and other, cleaner sources of nicotine are being investigated; however, the effects of these alternatives on prenatal development are still unclear. The goal of this project was to identify whether nicotine itself is harmful to prenatal development. To model embryonic development, Hydra littoralis were used due to their unique ability to regenerate entire body segments using stem cells. 20 hydra were fed Daphnia magna, then bisected 8 hours later and placed into petri dishes containing 5 different concentrations of nicotine created using a serial dilution. 3 groups contained nicotine blood concentration for low, moderate, and heavy use of nicotine products, 1 group contained 10 times the highest reasonable nicotine blood concentration, and 1 group contained no nicotine as a control. The hydra's rate of regeneration was monitored for 5 days until all hydra either finished regenerating or died. All of the hydra in the 2 highest nicotine concentrations and control regenerated successfully between 84 and 120 hours, suggesting that the nicotine had no negative effects on regeneration and may have even increased regeneration rate. Peculiarly, in the two lowest nicotine concentrations, all the hydra died. This surprising result was attributed to the presence of a preservative in the nicotine, sodium benzoate, which became more concentrated due to its adherence to pipettes in the serial dilution process. Overall, the results suggest that nicotine alone is not harmful to the growth and differentiation of cells, but preservatives, dyes and flavorings can potentially cause drastic side effects.

Awards Won: