The Effects of Light Exposure at Night on Circadian Regulation of Expression of and Damage from the Retrotransposon L1

Smither, Madison

This project explored the carcinogenic effects of light exposure at night (LAN). This research is important because LAN exposure, causing circadian disruption, is becoming increasingly widespread, and data show increased cancer rates in shift workers exposed to LAN. Linking LAN and carcinogenesis is the retrotransposon L1, which causes genomic instability. Suppressed by nocturnal melatonin production (entrains circadian rhythms) that decreases under LAN, L1 expression increases in cancer cells under LAN and is potentially related to tumor growth. It was hypothesized that exposure to LAN would affect expression of L1 mRNA and/or protein as well as cellular genes suppressing L1 in normal cells, causing increased genomic instability. Reads were generated from RNA extracted from testes of rats housed under normal light or LAN using Next-Generation Sequencing, aligned to the rat genome using STAR and RSEM, and analyzed using EBSEQ. LAN exposure caused drastic changes in the cell with 694 genes altered, some of which suppress L1, supporting increased L1 damage due to LAN despite minimal changes in the L1 transgene mRNA. Data support that L1 mRNA is not always altered by LAN but L1 proteins are, which will be tested in follow-up research as will the effects of LAN on L1 in other tissues. This project has led the lab in new research directions: many genes differentially expressed under LAN have unknown functions, including a novel gene demonstrating a striking differential expression under normal light. Preliminary studies of these genes point to other potential health effects from LAN that will be studied in future research.

Awards Won: