Exploring mechanisms for circadian phototransduction in *Rattus norvegicus* using light spectrum

by

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ABSTRACT

The light-dark (LD) patterns experienced by both humans and laboratory animals provide a synchronizing cue that resets a light-entrainable circadian pacemaker each day. In order to bridge ecological data from human LD exposures to lab animal LD exposures, we need to know how to scale the light stimulus and how to measure the synchronization of the LD pattern to rest/activity patterns. Phasor analysis used as a measure of circadian entrainment (Miller, Bierman, Figueiro, Schernhammer, & Rea, 2010) has been shown to be a useful technique in quantifying circadian disruption for both humans and rodents as measured by a desynchronized pattern of locomotor rest/activity relative to LD exposure. Bullough, Figueiro, Possidente, Parsons, & Rea (2005) determined the absolute and spectral sensitivity for circadian phototransduction for the C57BL/6 mouse, so the ecological data from humans to this strain of mouse can be bridged using that spectral sensitivity function in conjunction with phasor analysis.

The experiments conducted for this thesis were aimed at determining the absolute and spectral sensitivity for circadian phototransduction, measured as a light-induced phase shift in the circadian pattern of locomotor activity, for Long Evans rats (a pigmented outbred strain of *Rattus norvegicus*), thus providing a foundation to bridge the ecological data from humans to another laboratory animal strain.

In addition, it is important to know whether the circadian system response in rodents demonstrates an additive response to polychromatic light sources. The human circadian system demonstrates spectral opponency resulting in a subadditive response to polychromatic light (Figueiro, Bullough, Bierman, & Rea, 2005), whereas Bullough et al. (2005) determined that the circadian system of C57BL/6 mice demonstrates an additive response to polychromatic light containing short and long wavelengths.

The surprising results from this thesis suggests that the circadian system of Long Evans rats may have spectral opponency leading to a superadditive response to polychromatic light containing short and long wavelengths. The results are also suggestive that the circadian system of Long Evans rats is not more sensitive to narrowband wavelengths than the circadian system of C57BL/6 mice.