Characterization and Mitigation of Train Vibrations in a Laboratory Facility

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Abstract

Excessive environmental vibrations can have deleterious effects in a variety of animals. Despite the potentially detrimental effects vibrations may have on animal health and experimental results, they remain poorly understood in the animal laboratory setting. This study investigates the consequences of excessive train vibrations on the breeding success of laboratory mice. An instrumented cage, featuring a high sensitivity microphone and accelerometer, was used to characterize the vibrations and noise in a vivarium that is in close proximity to an active railroad. The passing trains cause vibrations of a magnitude that is three times larger than the ambient vibrations caused by the mice. The majority of the noise recorded within the laboratory facility was below the audible range of mice and was thus considered to not have a significant effect on them. Low breeding rates were observed and are hypothesized to be the result of the train vibrations. To verify the effect of the train vibrations, a controlled vibration study was conducted by using a custom-built electromagnetic shaker to simulate the train vibrations. Mice, which were unaccustomed to train vibrations, served as the test subjects and were vibrated in a facility far from the railroad tracks. The stress levels of the mice test groups, featuring both males and females, were compared to control groups in order to establish the significance of the results. It was determined that vibrations similar to those produced by a passing train can create large fluctuations in the stress levels of female mice. These fluctuations in stress levels warrant concern due to the negative effects that stress can have on mice and, consequently, on experimental outcomes. In order to alleviate further negative impacts on laboratory research, a vibration isolating caster system will be designed to replace the one currently being used on the flat, wire racks on which the mouse are housed.

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