

Proposal Title: The Effect of Development on Metabolic Rate of *Mus Musculus*

Principle Investigators: Paula Phan Amir Zand

Investigator Background: Amir Zand completed a project on the effect of temperature on the metabolic rate of Anole lizards, currently has a high school diploma, and is working on a bachelor degree in Biological Sciences and has worked as a volunteer at Mission Hospital emergency room. Paula Phan is currently attending Saddleback College and is planning to transfer to University of California San Diego.

Project Summary

The hypothesis the investigators are testing for is the metabolic rate of the fully developed mice, which will be significantly greater than the metabolic rate of previous stages in life. In developing stages of mice (*Mus musculus*), pinkies are newborn mice that have not yet grown fur; fuzzies have some fur but are not very mobile, Fur starts to grow some three days after birth and the eyes open one to two weeks after birth, hoppers have a full coat of hair and are fully mobile but are smaller than adult mice. (Schmidt-Nielsen, 1984). Metabolic rate is the rate at which energy is consumed by an organism in a unit of time (Campbell *et al.*, 2008). The investigators are to test the metabolic rate in resting white mice in different periods of development. It is taken into account the variables such as insulation (Mount 1971). The larger the body mass, the more energy is required to perform daily actions (Gillooly *et al.*, 2001). When in cooler environment, the metabolic rate will be low due to protein reactions which will decrease, not allowing as much energy to be produced (Eldgar and Harvey 1987). If mouse is left undisturbed, the mouse will use minimum required energy. If mouse is stimulated and exerts energy, more energy is required to perform actions, therefore increasing metabolic rate (Degen *et al.*, 1998). Investigators will calculate the weight specific metabolic rate using the slope of the line then dividing by the weight of the individual mice. The formula used will be

$$MR = \frac{\text{Slope}}{\text{Sec.}} \times \frac{60\text{sec}}{\text{min}} \times \frac{60\text{min}}{\text{hr}} \times \frac{1}{\text{wt}}$$

The results will help the investigators determine if metabolic rate differs among the development of a species. If there is a significant difference among the metabolic rate of pinkies, fuzzies, hoppers, and fully developed mice, a follow up will be conducted to determine if development in other species has a significant difference in metabolic rate.

Project Description

The objectives in the experiment is to see whether the metabolic rate of adult mice will be significantly greater than previous stages of development. The investigators are predicting that the metabolic rate of the adult mice will increase as the mice mature in their stages of life. The investigators will obtain the mice needed for the experiment from Petco, Aliso Viejo; ten female newborn white mice will be purchased. Investigators will weigh mice prior to experiments using an electronic scale. After weights are recorded, the investigators will place newborn mice into sealed containers with GLX

probe to measure CO₂ production. A cover will then be placed over the container and left undisturbed for a period of five minutes to minimize stimulation. After mice have adapted to the environment, the investigators will use the CO₂ probe and measure resting CO₂ production over a span of ten minutes. After three trials, the mice will be placed back into the cage with a heat lamp to help maintain regulatory body heat, due to lack of insulation in newborn white mice. After a waiting period of two weeks, pinkies will have developed into fuzzies and experiment will be tested under same conditions. After another period of two weeks, fuzzies will have matured into hoppers, the experiment will rerun for the third procedure. If time permits, mice will be allowed to fully mature into adult stage and the test will run for a final time. If time does not permit, adult white mice will be purchased from Petco for the final step in this procedure.

References

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6. Mount, L. E. "Metabolic Rate and Thermal Insulation in Albino and Hairless Mice." Journal of Physiology 217(1971): 315-326.
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Budget

1. Newborn White Mice: Petco, Aliso Viejo CA
2. GLX sensors & Probes: Provided in Lab
3. Electronic Scale: Provided in Lab
4. Heat Lamp, Cage, Bedding: Already Provided

