Mice in Barns (M.I.B.)

Natalie Swingle Mentored by Dr. Rita Pujari
NASA CoP at Great Basin College, Biology Department

Introduction:

- Rodents are the leading animal used in laboratory testing with the mouse (*Mus musculus*) being the most prevalent mouse species used. (1)
- Translatable data is being able to take the data, in this example from the mice studies, and use it to predict effective treatments and usage in human conditions. However, only 14% of the studies with mice produce translatable data.(3)
- Traditional testing in mice often takes place in a sterile laboratory setting, with lab bred mice (*Mus musculus*).
- A possible solution to this situation would be the use of more natural experimental conditions, as well as including wild bred mice.
- The aim is not to replace traditional lab studies but rather to complement them with real-world context.
- In this project we will highlight the differences in data and how they can complement each other to provide a more holistic picture. This in turn will produce a higher rate of translatable data from mouse to human studies.

Hypotheses:

Hypothesis #1: Wild mouse and lab bred mouse will perform differently in the maze. Highlighting the difference in results that can be obtained by including the wild bred mouse.

Hypothesis #2: When the experiment is moved to the enclosed natural setting, both groups of mice, lab bred and the wild bred mouse, will perform differently than the clinical laboratory setting.

Research:

- The purpose of the elevated plus maze is to measure anxiety and record anxiety related behavior.
- Since mice have a natural aversion to open and elevated spaces, the plus maze records their behavior and length of time that the rodent will spend in each of the arms of the maze as well as the times that they enter the arms.
- These movements are recorded via a camera mounted above the maze and the data is then analyzed in a software program, that gives researchers the amount of time spent in each arm and the number of times each arm was entered.
- This data is then used to determine if the mouse had more anxiety, which would be shown by them avoiding or spending very little time in the open arms, to being more relaxed which would show the mouse exploring more of the maze, including open arms.
- The elevated plus maze will be setup in both the clinical laboratory testing environment, as well as in an enclosed natural setting.
- This should offer us two sets of data that can be analyzed in tandem to create a more translatable set of data and illustrate a more holistic representation of the mouses behavior.

Use of Natural Setting

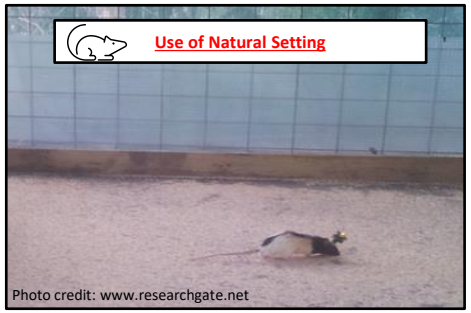


Figure 1: Example of a natural setting

Include Wild bred mice

Figure 2: Wild bred *Mus musculus*

Measure Anxiety

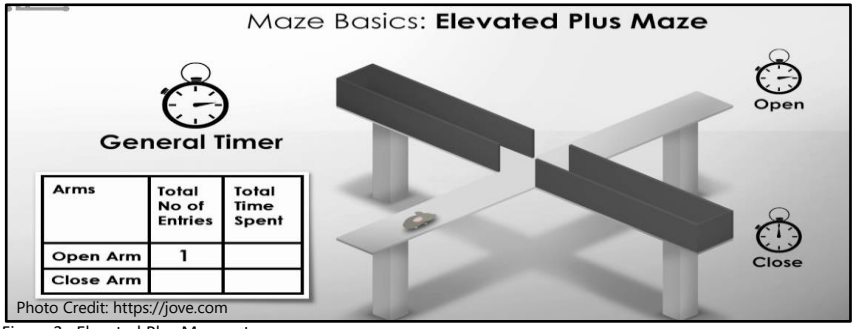
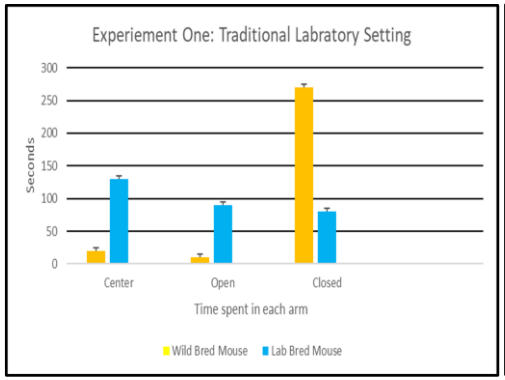
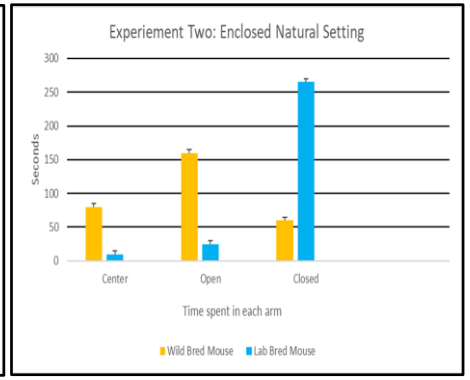


Figure 3: Elevated Plus Maze setup

Real World Data





Conclusion:

- In order to increase the percentage of real-world data and producing better results, this project recommends that researchers include the use of the wild bred mouse in their study, as well as conduct the experiment in a more natural setting environment.
- This is not meant to replace the traditional laboratory testing, but to be ran in tandem so as to offer researchers an additional set of data that they can use to see a more holistic real-world picture.
- By combining data from traditional laboratory testing with that of a more natural environment setting, paired with the use of Wild bred mice, researchers can gain invaluable data that can assist them in obtaining more translatable results.

Future Direction

- This information will be presented at the NASA State meeting, as well as shared with The Institute of Laboratory Animal Research, a peer reviewed journal and research organization.
- To further this study and the physiological effects of the Swingles Barn, I would like to study several ROS biomarkers such as MDA, Nitrotyrosine, S-glutathionylation, and Antioxidant Enzymes. These biomarkers could give insight into the effects related to anxiety throughout the participants body, which is important to monitor because of the implications that these can have on vital processes, such as cell dysfunction, necrosis, as well as altering the function of different cellular proteins.
- By limiting the stress felt by the animal in the research study, researchers are reducing several systematic error factors from their data and will achieve results that will have higher rates of translatability.
- This information could be especially important for organizations such as NASA who study the effects of certain conditions in space and travel for humans and use mice for such experiments. This could provide them a more detailed set of data to guide future funding and research projects.

References

Melina, R. Why do medical researchers use mice? . Live Science. [Online] 2010. https://livescience.com/32860-why-do-medical-researchers-use-mice.html.

What happens when lab animals go wild. Beans, Carolyn. 13, 2018, PNAS, Vol. 115, pp. 3196-3199.

Health, National Institute of Mental. Image Ep. National Institute of Mental Health. [Online] http://rsb .info.nih.gov/ij/.

Elevated Plus Maze for Mice. Munekazu Komada, Keizo Takao, and Tsuyoshi Miyakawa. 1088, s.l. : The Journal of Visualized Experiments, 2008, Vol. 22.

This material is based upon work supported by the National Aeronautics and Space Administration under Cooperative Agreement No. 80NSSC20M0043.
Grant No: NNX15AI02H