

## Combining Applications: Fear Conditioning and Telemetry for a Better Understanding of PTSD

### Introduction

Post-Traumatic Stress disorder (PTSD), a subtype of anxiety disorder, is manifested as emotional and physical hyperresponsiveness. The trigger of such responses is associated with traumatic events outside the range of usual human experience, such as military combat, life threatening attacks or devastating natural disasters. If left untreated or undertreated, painful repercussions may be debilitating and severely impact a person's quality of life. More importantly, these responses can lead to deadly cardiovascular events.

The most commonly used PTSD animal model is created using a method known as fear conditioning. During fear conditioning, an innocuous stimulus (e.g. sound) is timely paired to a painful event (e.g. footshock). Several repetitions of these pairings induce a fear response in rodents quantified as freezing, which means there is no movement in cases of threat stimulus, except breathing. The freezing behavior is then displayed when the sound occurs again, absent of the painful event. After a period following the fear conditioning (e.g. 24 hours), the subjects will generally undergo a behavioral protocol called fear extinction. The animal is exposed again to the same sound, only this time the subjects will learn how to dissociate the sound (innocuous event) from the previously generated memory. Therefore, a reduction of freezing behavior is observed.

### The Challenge

Although freezing behavior is well studied, the associated physiological responses during the conditioning period are poorly understood. Such responses are of importance because PTSD is often accompanied by an increased risk of life threatening occurrences, such as acute cardiac episodes and

coronary heart diseases (CHD). A recent paper studied an animal model of fear conditioning, resembling human PTSD, with specific attention to cardiovascular responses<sup>1</sup>.

### The Solution

Researchers used a Coulbourn isolation cubical to induce fear conditioning and Coulbourn's Freezeframe 3.2 software to detect and assess the freezing behavior in a mouse model of PTSD. Cardiovascular responses were monitored with the Data Sciences International physiological monitoring platform using HD-X11 telemetry and Ponemah acquisition and analysis software.

### The Results

The research revealed that during fear extinction, mean arterial blood pressure was the only reliable indicator of extinction in this model of fear conditioning, while heart rate data showed that there was little difference between the extinction and non-extinction groups. In addition, it appears that the decreased cardiovascular responses to extinction are independent of activity changes of the animal. It is worth noting that the fear extinction cardiovascular response protocol was performed in the home cages, as previously shown, due to human interaction which could heavily affect cardiovascular responses.

### The Successes

This study demonstrated for the first time that blood pressure responses and fear responses can be studied together for assessing improvement of PTSD treatments. Future studies will clarify the impact of extinction based therapies on the cardiovascular system for PTSD patients and lead to improved outcomes.

### References:

<sup>1</sup>Swiercz, A. P., Seligowski, A. V., Park, J., & Marvar, P. J. (2018). Extinction of Fear Memory Attenuates Conditioned Cardiovascular Fear Reactivity. *Frontiers in Behavioral Neuroscience*, 12.

