Introduction

The mammalian dive response, or dive bradycardia, was first portrayed by Edmund Goodwyn in 1786 (Godek and Freeman, 2022). The

in the lowest heart rate compared to the other experimental conditions.

Methods

We used Neur 301X – Neuroscience: Neuron to Brain Lab Spring 2023 Lab 6 – Mammalian Dive Response Manual for all procedures (Schwalbe, 2023).

PowerLab and LabChart7 setup

Firstly, we connected the Finger Pulse Transducer to Input 1 in PowerLab and the Respiratory Belt Transducer to Input 2 in PowerLab. We connected the thermocouple to a T-pod, which was connected to Input 3 in PowerLab. Next, we set up LabChart7 settings according to the manual. Channel 1 was recording input from the Pulse Transducer (mV). Channel 2 was recording heart rate (BPM) from the finger pulse. Channel 3 was recording input from the Respiratory Belt Transducer (V). Channel 4 was recording respiratory rate (Hz) from the Respiratory Belt. Lastly, Channel 5 was recording the input from the thermocouple.

A volunteer from our group, Kotryna Andriuskeviciute, was the subject of this series of experiments. We attached the Finger Pulse Transducer to her middle f p. T A M took the same recordings immediately as she took her first breath after the breath holding. We let her rest for around 2 minutes and then recorded the heart rate and respiratory rate using LabChart after recovery.

Cold-water Immersion

The volunteer rested for around 5 minutes to settle down her heart rate fully. We used a plastic bin which was already filled almost a third of the way with ice to fill it up with cold tap water. We used the thermocouple to record the temperature of the water. We used the baseline data as the cold dive control. The volunteer then fully submerged her face into the cold water for around 35 seconds as we recorded the heart rate and respiratory rate on LabChart for the first 15 seconds of the dive and again for the last 15 seconds of the dive. We recorded the LabChart data again, immediately after the volunteer reemerged from the water and took her first breath. After letting the volunteer rest for two minutes, we recorded the LabChart data again as she was breathing normally.

Warm-water Immersion

The volunteer rested for around 5 minutes to settle her heart rate down fully. We reused the plastic bin by dumping the cold, icy water into the sink and filled it with warm tap water. We used the thermocouple to record the temperature of the water. We recorded control data before the warm dive as the volunteer was holding her breath for 40 seconds without submerging her face in water (data recorded during the first 15 seconds of breath holding, last 15 seconds of breath holding, immediately as she took her first breath, and after a 2-minute recovery period). The volunteer then fully submerged her face into the warm water for around 35 seconds as we recorded the heart rate and respiratory rate on LabChart for the first 15 seconds of the dive and again, for the last 15 seconds of the dive. We recorded the LabChart data again, immediately after the volunteer reemerged from the

BPM at rest to 72.34 BPM during the last 15 seconds of the breath holding. During the warm water immersion (water temperature: 29.8 degrees C), the mean heart rate increased from 75.73 BPM at rest to 82.73 BPM during the first 15 seconds of the dive. It decreased to 76.39 BPM during the last 15 seconds of the dive and then to 66.35 BPM immediately after the dive (Fig. 1). Compared to the percent difference from heart rate at rest, the mean heart rate decreased by 13% during the last 15 seconds of the warm dive control breath holding. In contrast, the mean heart rate increased by 2% during the last 15 seconds of the warm dive (Fig. 2).

Discussion

Studies testing the effects of water temperature on heart rate during diving bradycardia consistently found that immersion in cold temperature water elicited a lower heart rate when compared to immersion in warm water or breath holding without water immersion (Kawakami et al., 1967). Our data facilitates these findings and supports our hypothesis. The mean