Involvement of GluR2/3 subtypes of Glutamate receptors in mammalian diving reflex

Vishnu Mudrakola, Karyn DiNovo, Paul F. McCulloch
Chicago College of Osteopathic Medicine, Midwestern University, Downers Grove, IL

Introduction

The mammalian diving reflex is a response to underwater submersion that consists of several independent reflexes that result in apnea, dramatically reduced heart rate, and altered blood flow to maintain proper perfusion of the face and neck. This reflex response is a very potent and interesting reflex with large effects on the whole body. The diving reflex is commonly known as the mammalian diving reflex. The effects of the diving reflex are to maintain normal breathing and cardiovascular performance. However, these effects are not always observed. In some cases, the diving reflex is not observed at all. The aim of this study is to investigate the effects of ammonia stimulation on the diving reflex.

Methods

The diving reflex was studied using a water maze paradigm using a large water-filled plexiglass tank. After swim training, the rats were trained to dive by setting up the maze so that swimming underwater is necessary to complete the maze. The rats were trained twice a day, and they were trained for 2 weeks. The rats were trained for 10 minutes per day. After the training, the rats were perfused intracardially and fixed in 4% PFA.

Visualization:

The Nikon 90iF fluorescence microscope was used to count Fos positive neurons in the superficial and deep medullary dorsal horn. After staining, the sections were incubated in a blocking solution for 1 hour. After blocking, the sections were incubated in primary antibody specific to the Glutamate receptor of interest (GluR2/3). The sections were then washed, and the sections were incubated in secondary antibodies. The sections were then washed again, and the sections were incubated in nuclear stain. The sections were then washed again, and the sections were mounted on glass slides.

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Conclusions

We were able to show colocalization of GluR2/3 and GluR5 in the MDH. Both fos expression and colocalization of the receptor were significantly greater in the MDH than in the paratrigeminal nucleus. However, there were significantly more fos in the superficial lamina of the MDH, and only GluR2/3 expression in the deep MDH was noted. The data suggests that GluR2/3 expression is more important than GluR5 expression in the MDH.

Data analysis:

The cell counts showed a significantly greater number of fos positive neurons in the superficial lamina of the MDH compared to the deep laminae. The cell counts showed a significantly greater number of fos positive neurons in the superficial laminae of the MDH compared to the deep laminae.

FIGURE 1: Experiment Design

FIGURE 3: Dive:NH3 Comparison

Panel 1: Fos & GluR2/3 Immunohistochemistry

Panel 2: Confocal images confirming colocalization

Results

Non-postured Superficial Deep

Postured Superficial Deep

Non-postured Superficial Deep

*Statistical analysis was performed using SigmaStat software.