Journal of
Electrical Engineering and Electronic Technology

Abstract

Near field non-invasive electrophysiology of retrotrapezoid nucleus using amperometric cation sensor

Sujasha Gupta
The Ohio State University, United States

Abstract:
Central chemoreception is the process whereby the brainstem senses blood gas levels and adjusts homeostatic functions such as breathing and cardiovascular tone accordingly. Rodent evidence suggests that the retrotrapezoid nucleus (RTN) is a master regulator of central chemoreception through direct sensation of acidosis induced by CO2 levels1, 2. The oscillatory dynamics caused by pH changes as sensed by the RTN and its relationship to the fluctuations in cation flux is not clearly understood due to the current limitations of electrophysiology tools and this article presents our investigations to address this need. A cation selective sensor fabricated from polypyrrole doped with dodecyl benzenesulfonate is placed over RTN of an ex-vivo en bloc brain and cation concentration changes above the RTN is measured due to changes in externally imposed basal pH. The novelty of this technique lies in its feasibility to detect cation fluxes from the cells in the RTN region without having to access either sides of the cell membrane. Owing to the placement of the sensor in close proximity to the tissue, we refer to this technique as near-field electrophysiology3. It is observed that decreasing pH in the physiological range (7.4–7.2) results in a significant increase in cation concentration in the vicinity of RTN with a median value of ~5 μM. The utilization of such quantifiable measurement techniques to detect sub-threshold brain activity may help provide a platform for future neural network architectures. Findings from this paper present a quantifiable, sensitive, and robust electrophysiology technique with minimal damage to the underlying tissue.

Biography:
Sujasha Gupta has completed his PhD in Mechanical Engineering at the age of 29 years from The Ohio State University, United States. Her work focusses on developing neural interfacing devices for real-time monitoring of nerve health. She is an academic achievement award recipient, which was awarded during her Masters at University of Florida.

Recent Publications:

1. Guyenet, P.G. et al. Retrotrapezoid nucleus, respiratory chemosensitivity and breathing automaticity. Respiratory Physiology & Neurobiology 168, 59-68 (2009).
2. Mulkey, D.K. et al. Respiratory control by ventral surface chemoreceptor neurons in rats. Nature Neuroscience 7, 1360-1369 (2004).
3. Venugopal, V., Hery, T., Venkatesh, V. & Sundaresan, V.B. Mass and charge density effects on the saturation kinetics of polypyrrole doped with dodecylbenzene sulfonate. Journal of Intelligent Material Systems and Structures 28, 760-771 (2017).

3rd International Congress on Biosensors and Bioelectronics; July 20-21, 2020; Paris, France

Citation: Sujasha Gupta; Near field non-invasive electrophysiology of retrotrapezoid nucleus using amperometric cation sensor; Biosensors 2020; July 20-21, 2020; Paris, France.