INTERNATIONAL CONFERENCE ON CELL SCIENCE AND REGENERATIVE MEDICINE

Serena Y. Kuang1, Xiaoqi Yang2, Bruce Z. Gao3

1Oakland University William Beaumont School of Medicine, Rochester, USA
2Icahn School of Medicine at Mount Sinai, New York, USA
3Clemson University, Clemson, USA

Fast and Reversible Inhibition of Bursting Activity by CO2-Induced Acidity in Chick Forebrain Cultures

Abstract: Introduction: It is well-established that increased CO2 leads to extracellular acidification and reduced neuronal excitability in mammalian and amphibian models. However, the response of avian neurons to CO2-induced acidity remains less understood. This study investigates how chick forebrain neurons (C-FBNs) cultured on microelectrode array (MEA) chips respond to CO2-induced acidification. Research Questions: 1) How quickly does the inhibitory effect on the cultures' mean bursting rate (MBR) take place? 2) How does the MBR recover following CO2 removal? Methods: C-FBN cultures were grown on MEA chips, and baseline burst activity was recorded. The CO2 partial pressure (PCO2) was gradually increased from 0.5% to 4.5% in 0.5% increments, with MBR calculated from 73 active channels across three MEA chips. Cell viability was assessed using an LDH assay prior to CO2 removal. Results: 1) MBR inhibition was immediate with increasing PCO2 each step, reaching 100% inhibition at 2.5-3.5% PCO2. 2) MBR recovery started right after CO2 removal; within 10 to 15 minutes, MBR varied, with some channels exhibiting lower, normal, or higher-than-baseline MBR. 3) The pH decreased from 7.14 ± 0.17 to 6.93 ± 0.08 as PCO2 increased, indicating high sensitivity of C-FBN cultures to subtle acidity changes. 4) LDH absorbance was significantly elevated before CO2 removal ($p < 0.05$). Conclusions: 1) Chick FBN cultures exhibited reproducibility and sensitivity to pH changes induced by CO2, suggesting a broader, evolutionarily conserved neuronal response to acidification. 2) The LDH assay should be performed after each PCO2 increment to define the safe acidity range. 3) The rapid and reversible response of C-FBN cultures positions them as a promising, cost-effective platform for studying neuronal excitability, pharmacological testing, and pH sensitivity.

Keywords: chick forebrain, MEA, mean bursting rate, CO2, pH, excitability

Biography: Serena Y. Kuang, Oakland University William Beaumont School of Medicine, USA. Kuang is an associate professor specializing in Neuroscience and Physiology at the Department of Foundational Medical Studies at Oakland University William Beaumont School of Medicine. She earned her M.D. in China and later obtained her Ph.D. in Neuroengineering from Clemson University. She spent two years as a postdoctoral researcher in the Neurophysiology Section at NIDA/NIH. Her research focuses on three main areas: developing and characterizing chick forebrain neuron-based biosensors using microelectrode array platforms, creating mathematical models of countercurrent multiplication in the mammalian kidney, and advancing education in medical and physiology disciplines.

Her earlier work successfully established a sensitive functional chick forebrain neuron biosensor, which has proven to be an invaluable tool for multidisciplinary studies, particularly in pharmacology and toxicology. More recently, her research on countercurrent multiplication (CCM) has provided a theoretical breakthrough in understanding this complex process, paving the way for interdisciplinary collaborations to further advance research in this field.

ISBN: 978-1-0685851-4-2