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MODIFIED ELECTROPHYSIOLOGICAL RESPONSES OF NEURONS AND GLIAL CELLS ACUTELY ISOLATED FROM THE HIBERNATING LAND SNAIL

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Hibernation is a physiological state that enables certain animal species to survive severe environmental conditions during the cold periods. In hibernation state the brain activity is maintained at a very low, but functionally responsive level, indicating that neurons and glial cells undergo certain physiological modifications. These modifications should be characterized as a neuroprotective, since the brain of hibernated animals endures extreme physiological conditions without any damage. In the present study we examined the electrophysiological responses of neurons and glial cells all acutely isolated from active and hibernating land snail Helix pomatia by the patch-clamp technique. Hibernating state lasted six months. Data obtained revealed that the steady-state outward neuronal current density was significantly lower in hibernation. In addition, the fast $Na+$ inward current density was significantly reduced in the population of isolated hibernated neurons, indicating that neuronal activity is suppressed in hibernation. The lower neuronal activity was supported by the suppressed electrophysiological response of glial cells. Thus, hibernated glia had significantly lower specific membrane conductance and reduced inward current density compared to active glia. Particularly important was the modification of the glial inwardly rectifying potassium (Kir) channel activity, essential for the coupling of the function of glial cells with neuronal activity. Thus, in the presence of BaCl2, Ba2+-sensitive current density mediated by the glial Kir channels was significantly lower in hibernation. Altogether, our data indicate that overall suppression of neuronal and glial activity is important natural neuroprotective strategy necessary.