

Press Release

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Watching neuronal cells at work

Scientists improve a method for observing neuronal activity in the brain

Every impression and any information that we pick up is processed in the brain through the electrical activity of neurons. To get a better understanding of these processes, it is the long standing dream of many scientists to be able to observe single neurons at work. In the recent years, calcium imaging has proven to be a powerful tool in this respect. By means of a fluorescent signal, the method allows to detect the activity of a large number of neurons in the brain simultaneously with high resolution. However, every method can only be used effectively when its potentials and pitfalls are well known. With a detailed analysis of the neuronal activity in the olfactory bulb of tadpoles, Bei-Jung Lin, Detlev Schild and colleagues at the Bernstein Center for Computational Neuroscience and University of Göttingen have shed some light on the applicability of this promising technology. They could show that the method is suitable for some cell types more than for others.

Most methods for analyzing the neuronal activity in the brain either have an insufficient temporal and spatial resolution or they are so intricate and time-consuming that only a small number of cells can be analyzed. Calcium-imaging covers exactly this gap between too gross and too fine an analysis. The calcium concentration of a neuronal cell rises when it sends out an electrical impulse. This rise in calcium can be easily detected using a fluorescent calcium indicator.

Calcium, however, has multiple functions in a cell. As Schild and his colleagues demonstrated, not every rise in calcium in a neuronal cell must necessarily reflect a neuronal impulse. Whether or not the calcium level is a reliable indicator for the electrical activity of a cell very much depends on the cell type. By recording the electrical activity of single cells in the olfactory bulb, the scientists could compare the cell's neuronal activity with the fluorescent calcium signal. For so called mitral cells, a specialized cell type of the olfactory bulb, they found a clear correlation between the calcium concentration and the neuronal activity. For granular cells, in contrast, such a correlation could not be established.

With this study, Schild and his colleagues have paved the way for a detailed analysis of the olfactory bulb and its response to odors. In addition, their work is a seminal step in the methodology of calcium



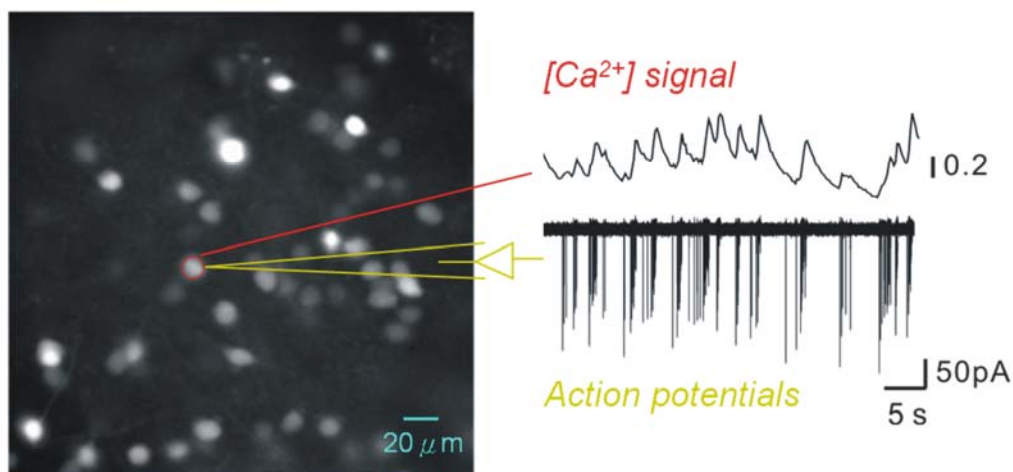
imaging. Whereas most scientists as yet have generally assumed a close correlation between the calcium concentration and the cells neuronal activity, Schild and his co-worker have shown that this is not necessarily the case. For every cell type under investigation, this correlation first needs to be established.

Original publication:

Lin, B.-J., Chen, T.-W. & Schild D (2007). Cell type-specific relationships between spiking and $[Ca^{2+}]_i$ in neurons of the Xenopus tadpole olfactory bulb. *J Physiol.* 582: 163-75.

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The Federal Ministry of Education and Science (BMBF) has founded four Bernstein Centers for Computational Neuroscience (BCCN) in Berlin, Freiburg, Göttingen, and Munich. The interdisciplinary field of research combines experiments with data analysis and computer simulation on the basis of well-defined theoretical concepts. The central aim of Computational Neuroscience is to identify the neuronal basis of brain performance.

The BCCN Göttingen is a joint center of the Georg-August-University Göttingen, the Max Planck Institute for Dynamics and Self-Organization, the Max Planck Institute for Biophysical Chemistry, the Max Planck Institute for Experimental Medicine, the German Primate Center, and Otto Bock HealthCare GmbH.



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