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SPIKE SORTING AND ARTIFACT REJECTION BY INDEPENDENT COMPONENT ANALYSIS OF OPTICAL RECORDINGS FROM TRITONIA. G. D. Brown*, S. Yamada, H. Luebben, and T. J. Sejnowski. Computational Neurobiology Laboratory, The Salk Institute for Biological Studies, La Jolla, CA 92037.

We are applying independent component analysis (ICA) and other signal processing tools to the problem of multiple-neuron, multiple-detector optical recording data. Voltage-sensitive dye optical recordings were made in the isolated-brain preparation of the seaslug Tritonia. A brief electrical stimulus applied to a nerve root activates a fictive swimming pattern in this preparation. Many neurons important for swimming burst in phase with the fictive pattern and are therefore easy to recognize. Many other neurons are inhibited during swimming. Action potentials from the same neuron often appeared on multiple detectors, while each detector often recorded multiple neurons.

Spikes could be recovered with the ICA algorithm because the voltage across the membrane of each neuron is approximately a temporally independent source. Artifacts and noise also appear as independent sources in this step, but can be distinguished from spike trains by source identification techniques. A difference-of-gaussians filter was used to detect individual spikes. We can optimize the algorithm for our data set, for example by adusting the nonlinear-transfer function on the inputs to more accurately reflect the cumulative probability distribution of the neural signals. We are also exploring the possibility of using combined spatio-temporal ICA. Using ICA as the backbone of the analysis should reduce the time necessary for analysis of this type of data. These techniques will also apply to other types of multiple-unit recording, including arrays of extracellular wire electrodes.