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| Paper Title: | Applying in situ Sequencing to Dissociated Neuronal Networks to Study Network Dynamics          |
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Abstract

Dynamics in neuronal networks is a basis of brain functions, which is composed of system-wide electrical activity. Little is known about linkage between gene expressions in individual neurons and network dynamics at a network level. This study aimed to develop a method for examining gene expression and electrical activity of each neuron in network. Preserving cell positional information is inevitable for comparing gene expression pattern and electrical activity. We employed a state-of-the-art method in molecular biology, called hybridization-based in situ sequencing, which can detect mRNA molecules from cultured neurons. Rat cortical neurons were cultured on a high-density microelectrode array. Spontaneous activity was recorded, and then the cells were subjected to gene expression analysis. We confirmed high reliability of mRNA detection with an improved method for aligning images. Our method is feasible for studying the relationship between gene expression and activity dynamics.

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