

ABSTRACT

The survival of the animals depends on their ability to memorize locations and to use behavioral spatial navigation strategies. The crucial structure for this type of behavior and memory is the hippocampus, by its ability to create a cognitive map. In this structure, there are specialized pyramidal cell called place cells. They respond by their complex firing pattern to specific animal's location in the environment. Even though many studies have investigated the role of hippocampal pyramidal cells in spatial navigation and object position discrimination, their function during inaccessible object position discrimination is not yet clarified. In our experiment, rats were trained in a behavioral task to discriminate between rewarded and non-rewarded positions of object located in an inaccessible space. We investigated the role of individual hippocampal cells during this task by single neuron electrophysiology.

The first aim of this study was to decide which of two configurations of objects presented on a computer screen during spatial object discrimination task rats can discriminate easily. The second aim is to show whether and how information about the position of inaccessible objects is represented in the hippocampus using single-neuron electrophysiology.

We found out, that animals did not reach learning criteria in the one-dimensional object-position discrimination (four objects equally spaced from left to right side on a computer screen). On the contrary, the rats fulfilled the learning criteria in the two-dimensional object-position discrimination (four objects displayed in the corners of the computer screen). This observation can be explained by the different distance between discriminated positions and their configuration. During two-dimensional object position discrimination, single neuron analysis shown that pyramidal cells in CA1 specifically responded by their firing activity to rewarded, or non-rewarded positions, but we have not found any single stimulus related activity. This could be explained by categorization of rewarded and non-rewarded positions. These results suggest that CA1 pyramidal cells play a crucial role in the discrimination of positions of objects located in inaccessible space.

Keywords: hippocampus, spatial cognition, object-position discrimination, inaccessible space, neuronal ensembles, electrophysiology