Abstract

The hippocampus is the key structure in formation of representations of space (cognitive maps) in rats. Formation of spatial representations of simple environments has been described in details, in this work we focused on emergence of a spatial map of a complex environment from individual simple maps.

A radial-arm maze was used to model a complex environment, where each arm was surrounded by unique pattern of proximal visual landmarks. *Long Evans* rats were allowed to explore gradually four different arms of the maze in a sequence of three sessions. During the first and second sessions rats separately visited two novel pairs of neighboring arms (arms 1 and 2 in the first session, arms 3 and 4 in the second session). In the third session rats were exposed to a new combination of already familiar arms (arms 2 and 3) to study how the two hippocampal maps, acquired originally as independent of each other, are integrated as the rat learns about their spatial relationship. Rats were exposed to this sequence of three sessions twice – before and after sleep. The activity of hippocampal neurons was recorded using a microelectrode system during the maze exploration and sleep.

Our first observations suggest that representation of a complex environment neither is a simple combination of preexisting individual maps, nor is it created completely *de novo*. Instead, it involves gradual modification of pre-existing maps that takes more time than a single exposure to the environment.

Keywords: hippocampus, sleep, place cells, spatial memory.