

## **The role of the superior colliculus in goal-directed movements in rats**

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The superior colliculus (SC) is known to integrate sensory information across multiple modalities and to play an important role in motor output. In primates, the SC has been shown to be critical for the selection and production of saccadic eye movements to visual targets. In rats, stimulation of the SC causes head and body movements in a direction determined by the specific site of stimulation. However, whether such motor output is relevant to the movements undertaken during goal-directed behavior remains unknown, because the activity of rat SC neurons during behaviors requiring movement toward a goal has not been assessed.

In order to address this issue, we simultaneously recorded from multiple SC neurons in rats performing a two-alternative choice odor discrimination. The rat was required to sample an odor at a central port, and, depending on which odor was presented, to move to the left or the right goal port, where it would receive a water reward. This task is well-suited to the study of goal-directed movement because each trial required the rat to plan and execute a movement in one of two discrete directions (left or right) in order to receive reward. In addition, odor-related responses and movement-related responses could be readily distinguished because more than one odor was associated with each side, and because on a significant minority of trials the rats chose the incorrect side for a particular odor. Rats typically performed several hundred trials within each recording session.

We analyzed neuronal activity while the rat sampled the odor and presumably planned its movement, and while it executed its movement from the center to a side port. We found that the firing rates of many SC neurons were modulated during these periods. Moreover, the activity of a subpopulation of these neurons was selective for the direction of movement, either prospectively (during odor sampling) or contemporaneously (during the movement itself). Thus, the SC appears to play a role in the planning and execution of goal directed movements in rats. Future studies will attempt to identify the sources of olfactory input to the SC, and to determine whether the observed SC activity is causally related to the chosen movement, with the ultimate goal of elucidating the role played by the SC in goal-directed decision-making.