

Identifying the Neural Mechanisms Regulating Sequential Behaviors in Male Sexual Activity

Researchers at University of Tsukuba have uncovered the neural mechanisms that regulate sequential male sexual behaviors through studies in male mice. Their findings reveal that acetylcholine neurons modulate dopamine neurons projecting to the ventral shell of the nucleus accumbens, thereby orchestrating the execution of each behavioral phase. Notably, stimulating acetylcholine neurons during sexual activity was found to induce ejaculation.

Tsukuba, Japan—Male mice follow a stereotypical sequence of sexual behaviors, transitioning from initial interaction with an estrous female to ejaculation. This sequence includes sniffing, mounting, and intromission, all of which are crucial for reproductive success. However, the specific brain mechanisms underlying these behavioral transitions remained unclear until now.

In this study, researchers demonstrated that dopamine, a key neurotransmitter in the brain's reward system, plays a pivotal role in governing behavioral shifts. Using fiber photometry, they comprehensively measured dopamine input patterns to the nucleus accumbens, a region known for its substantial dopamine input. Their findings showed that dopamine levels in a specific subregion—the ventral shell of the nucleus accumbens (vsNAc)—were closely linked to behavioral transitions. Furthermore, rhythmic dopamine input to the vsNAc during intromission, which aligns with male movement patterns, was regulated by acetylcholine innervation of the vsNAc.

The study also revealed that the final intromission before ejaculation exhibited a distinct dopamine activity pattern compared to prior intromissions. Artificially stimulating acetylcholine neurons during intromission replicated this dopamine response, directly triggering ejaculation.

These findings provide the first evidence of a specific nucleus accumbens subregion playing a critical role in controlling sexual behavior and ejaculation. Ejaculatory dysfunction is a known side effect of psychiatric disorders such as depression, as well as certain psychotropic medications. These discoveries open new avenues for developing treatments for ejaculatory disorders and related conditions, potentially improving therapies for patients with psychiatric disorders or medication-induced dysfunction.

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