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Control of behavioral flexibility by the lateral habenula

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Abstract

The ability to rapidly switch behaviors in dynamic environments is fundamental to survival across species. Recognizing when an ongoing behavioral strategy should be replaced by an alternative one requires the integration of a diverse number of cues both internal and external to the organism including hunger, stress, or the presence of reward predictive cues. Increasingly sophisticated behavioral paradigms coupled with state of the art electrophysiological and pharmacological approaches have delineated a brain circuit involved in behavioral flexibility. However, how diverse contextual cues are integrated to influence strategy selection on a trial by trial basis remains largely unknown. One promising candidate for integration of internal and external cues to determine whether an ongoing behavioral strategy is appropriate is the lateral habenula (LHb). The LHb receives input from many brain areas that signal both internal and external environmental contexts and in turn projects to areas involved in behavioral monitoring and plasticity. This review examines how these connections, combined with recent pharmacological and electrophysiological results reveal a critical role for the LHb in behavioral flexibility in dynamic environments. This proposed role extends the known contributions of the LHb to motivated behaviors and suggests that the fundamental role of the LHb in these behaviors goes beyond signaling rewards and punishments to dopaminergic systems.