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The dynamics of the thermal memory of *C. elegans*[1] WILLIAM RYU, KONSTANTINE PALANSKI, University of Toronto, FREDERIC BARTUMEUS, Centre for Advanced Studies of Blanes, ILYA NEMENMAN, Emory University — *C. elegans* has the capacity to learn associatively. For example, *C. elegans* associates temperature with food and performs thermotaxis towards this temperature when placed on a spatial thermal gradient. However, very little is understood how *C. elegans* acquires this thermal memory. We have developed a novel droplet-based microfluidic assay to measure the dynamics of the thermal memory of *C. elegans*. Individual animals are placed in an array of microdroplets on a slide, and a linear temperature gradient of 0.5 deg/cm is applied to the array. By measuring the swimming motions of *C. elegans* in the droplets, we show that they can perform thermotaxis. By calculating an index of this taxis behavior over time, we quantify the worm's thermal memory and measure its dynamics when the animals are exposed to different conditions of feeding and starvation. Over a time scale of hours, we find that the thermal preference of wild-type worms decays and will actually become inverted and that mutations in the insulin signaling pathway perturb the dynamics. This biphasic conditional association can be explained with a reinforcement learning model with independent reinforcement and avoidance pathways with distinct time scales.

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