Temperature fluctuations significantly affect dragonfly perception, study shows

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University of Adelaide researchers and collaborators from Lund University in Sweden have made a breakthrough in understanding how dragonflies' brains work.

The team, including Ph.D. candidate Mahdi Hussaini and Associate Professor Steven Wiederman from the University of Adelaide's School

of Biomedicine, analyzed the impact of temperature on the dragonfly's ability to perceive the world The findings have been published in the journal *Current Biology*.

"Dragonflies are poikilothermic animals with limited thermoregulation, which means the temperature of their entire bodies, including their brains, vary and change throughout the day," said Mr. Hussaini, who was also the paper's lead author.

"They have the ability to chase prey successfully whether in sunlight or under cloud cover, most likely due to small target motion detector (STMD) neurons in the visual pathway of a dragonfly's brain."

"These neurons are sensitive to target contrast, and are tuned to the target's size and velocity, but increased temperatures dramatically change the neuron's sensitivity and speed."

Dragonflies are apex predators and are highly evolved to chase small prey in cluttered scenes, with researchers using brain recordings to develop neuro-inspired, computational models for target-tracking applications.

This includes artificial vision systems that detect fast moving, aerial drones from autonomous vehicles.

"Inspiration from biology helps us to provide solutions to engineering problems from a different perspective," said Associate Professor Wiederman.

"Given that biology rapidly changes in response to external factors like temperature, we need to understand what role this plays in information processing.

"How the dragonfly brain interprets this changing information, to still provide a robust perception of what they see (and interact with) will be an intriguing avenue of future research, from both biological and engineering perspectives."

Associate Professor Wiederman said until now, no one understood how large the impact of external factors (like daily changes in temperature) is on the dragonfly's perception of the world (via changes in neurons' spiking activity).

Across a range of increasing temperatures, often experienced by a dragonfly on a summer's day, STMD neurons had an almost nine-fold increase in sensitivity to small moving targets.

More information: Mahdi M. Hussaini et al, Temperature modulates the tuning properties of small target motion detector neurons in the dragonfly visual system, *Current Biology* (2024). DOI: 10.1016/j.cub.2024.08.007

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