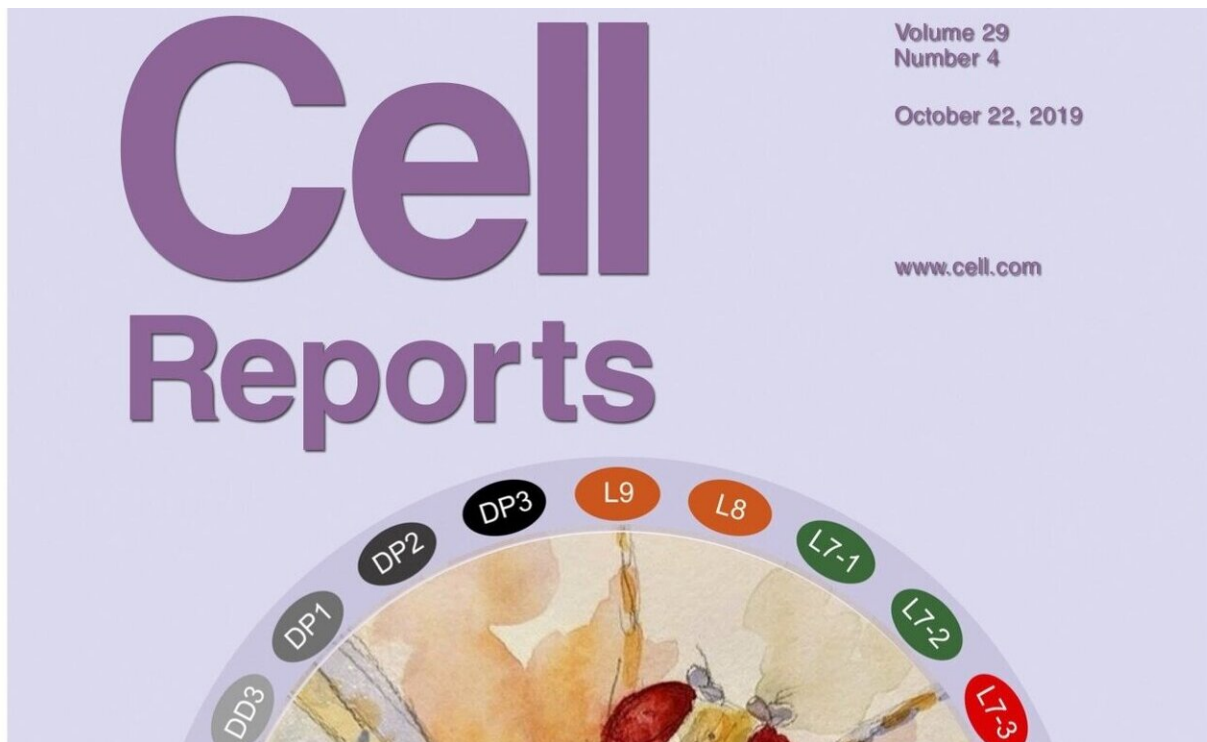


Scientists unpack how taste neurons control food intake

October 22 2019, by Iqbal Pittalwala



Cover of the Oct. 22 issue of *Cell Reports*. Credit: Cell Press

Using the common fruit fly as a model, a research team led by scientists at the University of California, Riverside, studied how taste neurons control feeding behaviors and found that flies genetically modified to have only these neurons can avoid many aversive chemicals, such as bitter compounds, acids, and high concentrations of salt.

"This work extends our understanding of the function of internal [taste neurons](#) present in organs in the pharynx toward ensuring that unpalatable foods are not consumed," said Anupama Dahanukar, an associate professor in the Department of Molecular, Cell, and Systems Biology at UC Riverside, who led the research team. "An understanding of how feeding behavior is controlled in insects may provide insights into developing strategies for controlling [insect pests](#) and disease vectors."

Insects have multiple taste neurons present in different body parts. External taste neurons are in the labellum, legs, and wing margins; internal ones are located in the pharynx. Over the last few decades, researchers have focused on how external taste neurons sense various chemicals.

"Because of their internal location, pharyngeal organs have not been the focus of many insect studies," Dahanukar said. "But precisely because of their location, they are likely to be critical for controlling food intake."

Study results appear in *Cell Reports*; the research paper is featured on the cover of the Oct. 22 issue of the journal.

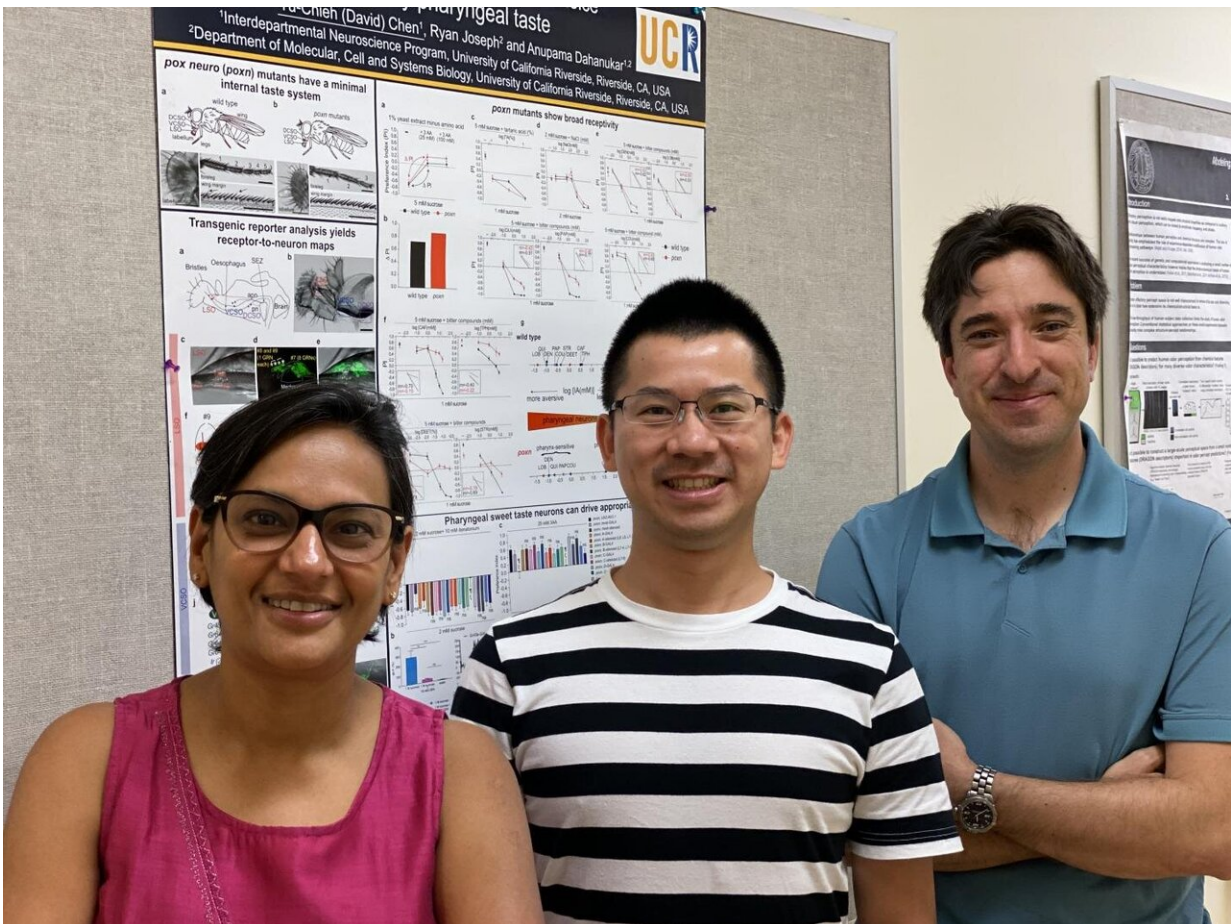
"What's interesting about our findings is that pharyngeal taste neurons have broad functionality for avoiding ingestion of different categories of chemicals, avoidance can be achieved by more than one type of neuron, and activation of just a single pharyngeal neuron can suppress food intake," Dahanukar said.

To understand which subsets of pharyngeal neurons are responsible for detecting bitter, acid, and high salt tastes, the research team went a step further to find the responsible neuronal population for each category of aversive chemicals. The researchers used a genetic toolkit to manipulate select classes of pharyngeal taste neurons in the fruit fly and examine the

consequences of these manipulations.

"We found that rejection of different categories of aversive compounds is dependent on distinct combinations of pharyngeal taste neurons," said Yu-Chieh David Chen, a former graduate student in Dahanukar's lab and the first author of the research paper.

To understand where these pharyngeal neurons convey taste information in the [fly brain](#), Chen used a newly developed circuit-tracing technique, called trans-Tango, to map the downstream neuronal circuits connecting each subset of pharyngeal neurons. Taste sensory neurons constitute the primary neurons. Neurons that connect to these [sensory neurons](#) are the second-order neurons; they process taste information in the brain.



Anupama Dahanukar, David Chen (center), and Ryan Matthew Joseph of UC Riverside. Credit: Dahanukar lab, UC Riverside.

"Our mapping results reveal that second-order taste neurons processing sweet and bitter tastes project to two main brain regions," said Chen, a Howard Hughes Medical Institute International Student Research Fellow and soon to be postdoctoral researcher at New York University. "In many cases, single pharyngeal [taste neurons](#) showed connections with multiple second-order neurons that projected to both brain regions, suggesting that even specific taste information may be broadly conveyed across several brain regions."

Chen stressed that fundamental knowledge about how the brain is wired is crucial for understanding how sensory inputs are translated into behavioral outputs.

"We expect our study will lead to a greater understanding of how taste information is coded in the brain and lay the foundation for systemwide analyses of relationships between sensory input and behavioral output," he said.

Dahanukar added that feeding is a critical behavior in all animals, essential for survival, and tightly regulated to control both the quality and quantity of ingested substances.

"Now that we have some understanding of their organization and function in a genetic model insect, we can apply it to studying [pharyngeal](#) organs and how they control feeding in insects that are more relevant from a health or economic perspective, such as mosquitoes and

crop-damaging pests. After all, an insect's feeding behavior is pertinent to how much damage it causes," she said.

More information: Yu-Chieh David Chen et al, Combinatorial Pharyngeal Taste Coding for Feeding Avoidance in Adult *Drosophila*, *Cell Reports* (2019). [DOI: 10.1016/j.celrep.2019.09.036](https://doi.org/10.1016/j.celrep.2019.09.036)

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