Fine-tuning of bitter taste receptors may be key to animal survival

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One key to animal survival is bitter taste——the better to avoid ingesting potentially harmful poisons or foods. The evolution of bitter taste has been a hot topic amongst evolutionary biologists, and with more and more DNA data available, a rich area of exploration.

Now, professor Maik Behrens, et. al. examined the genetic repertoire of bitter taste receptor genes in chickens and frogs, which represent two extremes. Chickens only have 3 bitter taste receptor genes (Tas2rs), while frogs have more than 50 (humans are somewhere in the middle). They studied the different molecular properties of cloned Tas2r genes and measured their responses when exposed to a panel of 46 natural or synthetic bitter compounds.

First, they constructed a gene tree for a selection of Tas2r genes of various vertebrate species and showed that all avian genes come from the same 3 ancestral genes. Frogs were found to have 5 ancestral genes, indicating that their expanded repertoire was due to later gene duplication events.

They showed that all the three chicken Tas2rs are "broadly tuned" for bitter taste, whereas six frog Tas2rs tested are mixed consisting of broadly as well as narrowly tuned receptors. Interestingly, both chicken and frog receptor repertoires responded to about half of the compounds, showing that the tuning range rather the number of Tas2r genes was a critical factor. In general, individual substances activated different receptors in clearly separated concentration ranges, which may also

provide a clue to the role of bitter taste diversity in enhancing the chance of survival.

The authors conclude that a low number of functional Tas2r genes found in chickens can be compensated by an increased average tuning width. They speculate that the environmental duality of amphibian life, living on both land and water, may account for the increased Tas2r gene diversity in frogs. In mixed aquatic and terrestrial environments amphibians such as frogs may have encountered a larger number of bitter compounds, causing the evolutionary pressure to provide a larger taste receptor repertoire.

The findings appear in the advanced online edition of *Molecular Biology and Evolution*.

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