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FUNCTIONAL AND COMPARATIVE MORPHOLOGY OF THE NASAL CAVITY IN PHYLLOSTOMID BATS

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Abstract
The functional morphology and evolution of the nasal cavity is poorly understood. The New World Leaf-nosed bats of the family Phyllostomidae are an excellent group of mammals in which to study the evolution of the nose and nasal cavity. Phyllostomids span a wide dietary diversity, which

is correlated both with the shape of the rostrum as well as with reliance on olfaction, one of the key functions mediated by the nose and the focus of my dissertation. How does dietary diversity relate to differences in the olfactory anatomy of phyllostomids?

I examined three neurological features thought to relate to olfactory capability, with my hypothesis being that fruit-and nectar-feeding bats rely more on olfaction than insect-feeders. I expected that fruit- and nectar-feeders would have relatively greater numbers of the three neuronal measures that I selected compared to insect-feeders. My results mostly supported this prediction, lending support to the basic idea that bats with different diets rely on olfaction to different degrees.

To sense odors in the environment, incoming air loaded with odorant molecules must make its way to the back of the nasal cavity, where the olfactory epithelium is located. Do bats with different diets differ in terms of olfactory airflow? In this part of my dissertation, I first performed a computer modeling experiment that tested the hypothesis that the size of the olfactory recess (a key feature of many keen-smelling mammals) relates to differences in important aspects of olfactory airflow. I found that, all else being equal, a larger olfactory recess improves olfactory airflow. Next I performed a comparative study on six species of bats with different diets, expecting to find differences in patterns and rates of olfactory airflow. Instead I found relatively little variation in all of the measured parameters across the species I selected. These results suggest that the morphology of the nasal cavity may not be under strong selective pressure to accommodate different demands on the olfactory system. Investigating this idea more fully, and its consequences for the evolution of the nose and of the skull more broadly, would be an exciting avenue for future research.