



# Wing Surface Tactile Receptors: Electron Microscopy and Flight Behavior



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## Background

Hairs on wing membranes of Microchiropteran bats are thought to provide feedback on boundary layer airflow necessary for estimations of aerodynamic properties of the bat's flexible hand-wings. Zook (2006) described hairs on the wing membrane that he suggested may serve to stabilize flight by detecting airflow.

We examine the structure of these wing dome hairs with scanning electron and light microscopy in *Eptesicus fuscus*.

We further examine the behavioral function of these wing hairs through flight behavior analysis of wing manipulated bats.



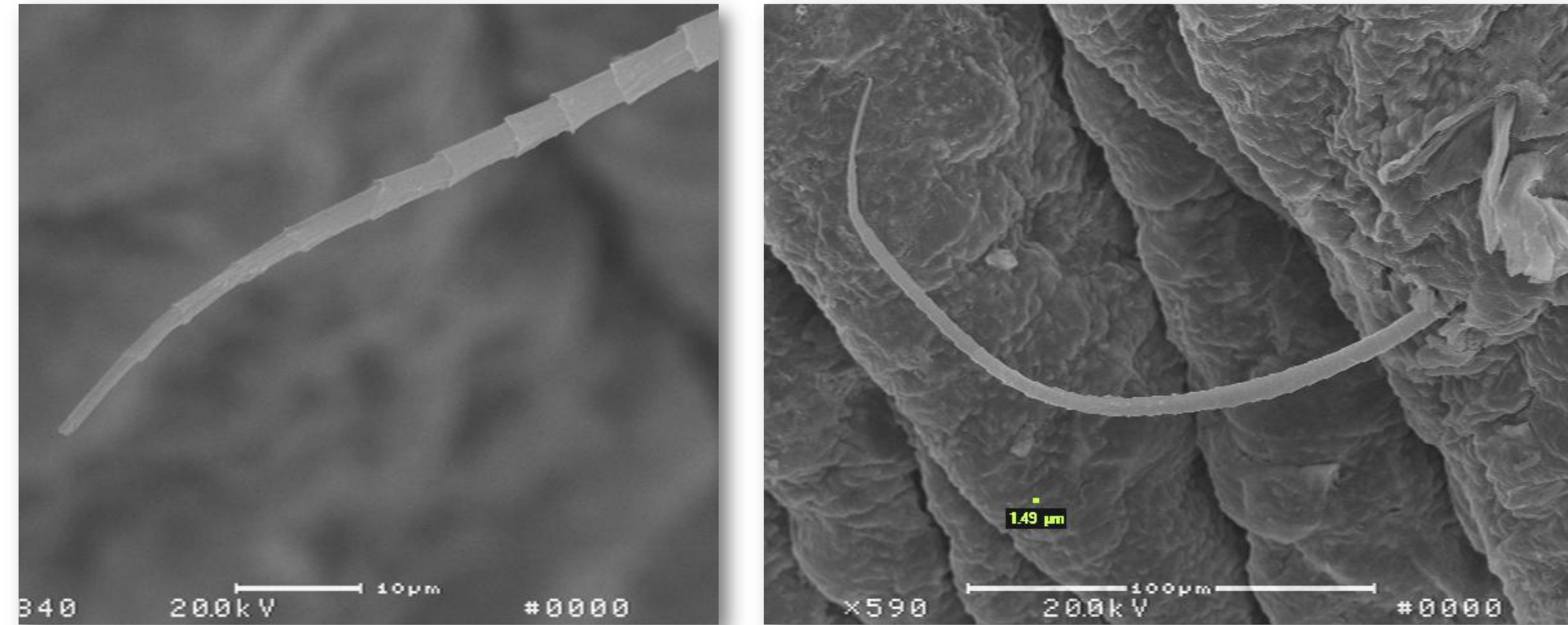
Myotis welwitschii - Nineteenth-century lithograph detailing hair domes. Maxim, H. (1912) The possible prevention of sea collisions. Sci. Am. Suppl. V74, 148-150.

## References

Zook, J. (2006) Somatosensory Adaptations of Flying Mammals. In. Evolution of Nervous Systems Vol. 3, pp. 215-226 J.H. Kaas, ed., Academic Press: Oxford.

## Methods

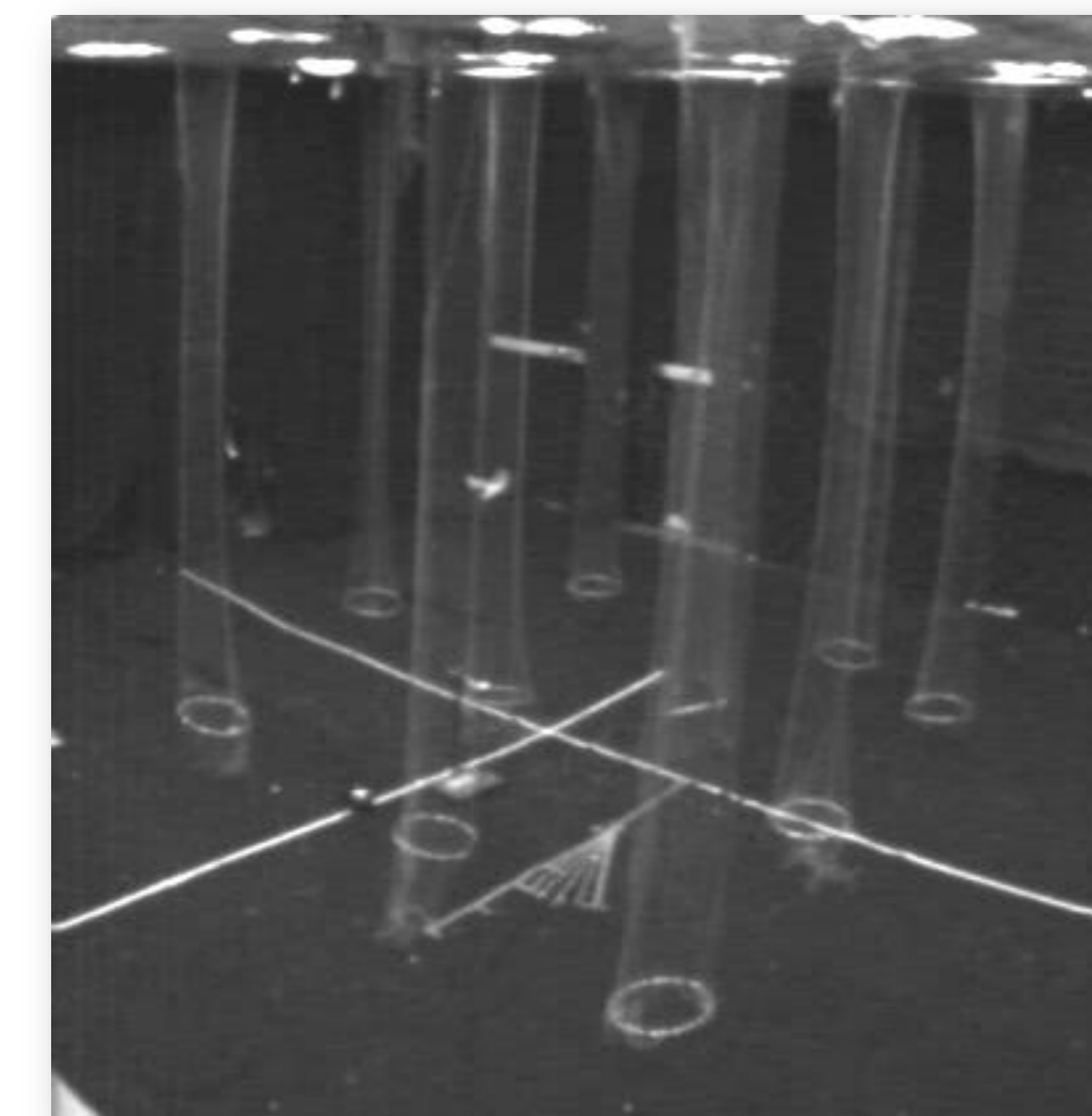
### Scanning Electron Microscopy (AMRAY 1820D)



Antenna like hairs with narrow tips (500-2000 um length, 200-700 nm tip diameter)

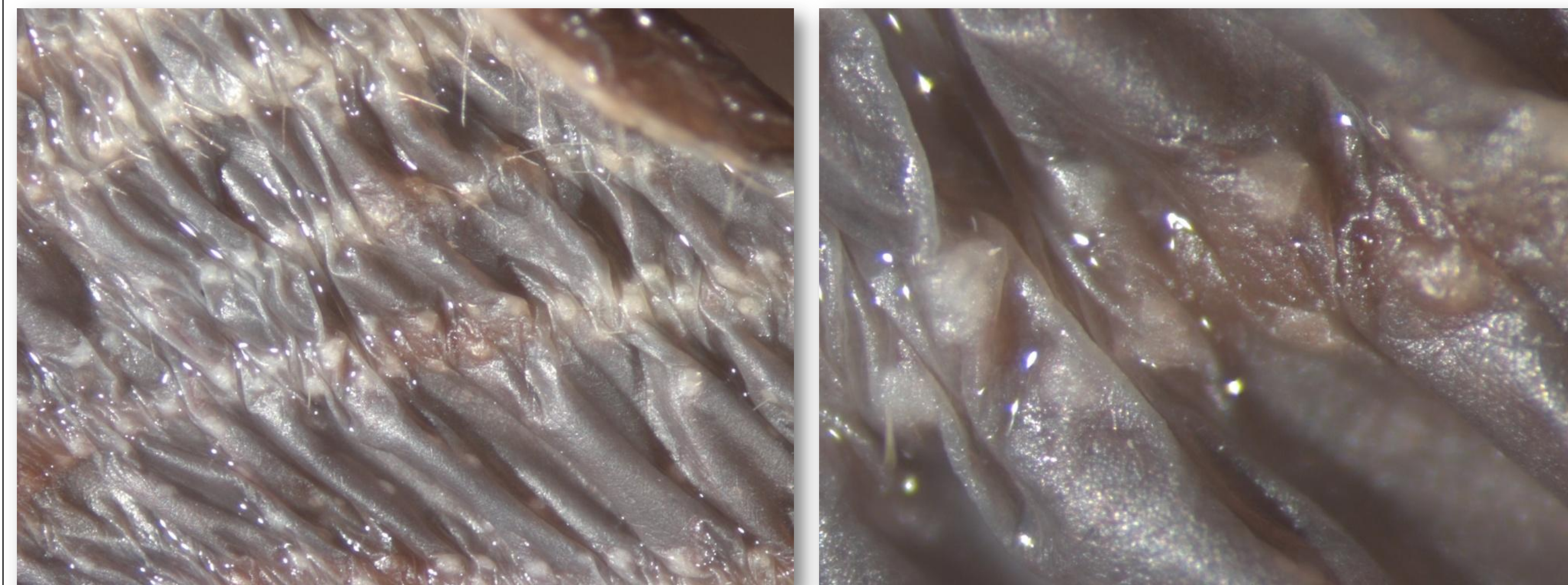
### Behavioral Tests

Bats flown in a large flight room with hanging cylindrical "trees" – wire hoops with mist net wrapped around to serve as obstacles. A mealworm was hung within the obstacles to encourage the bats to fly through them.



### Hair Removal

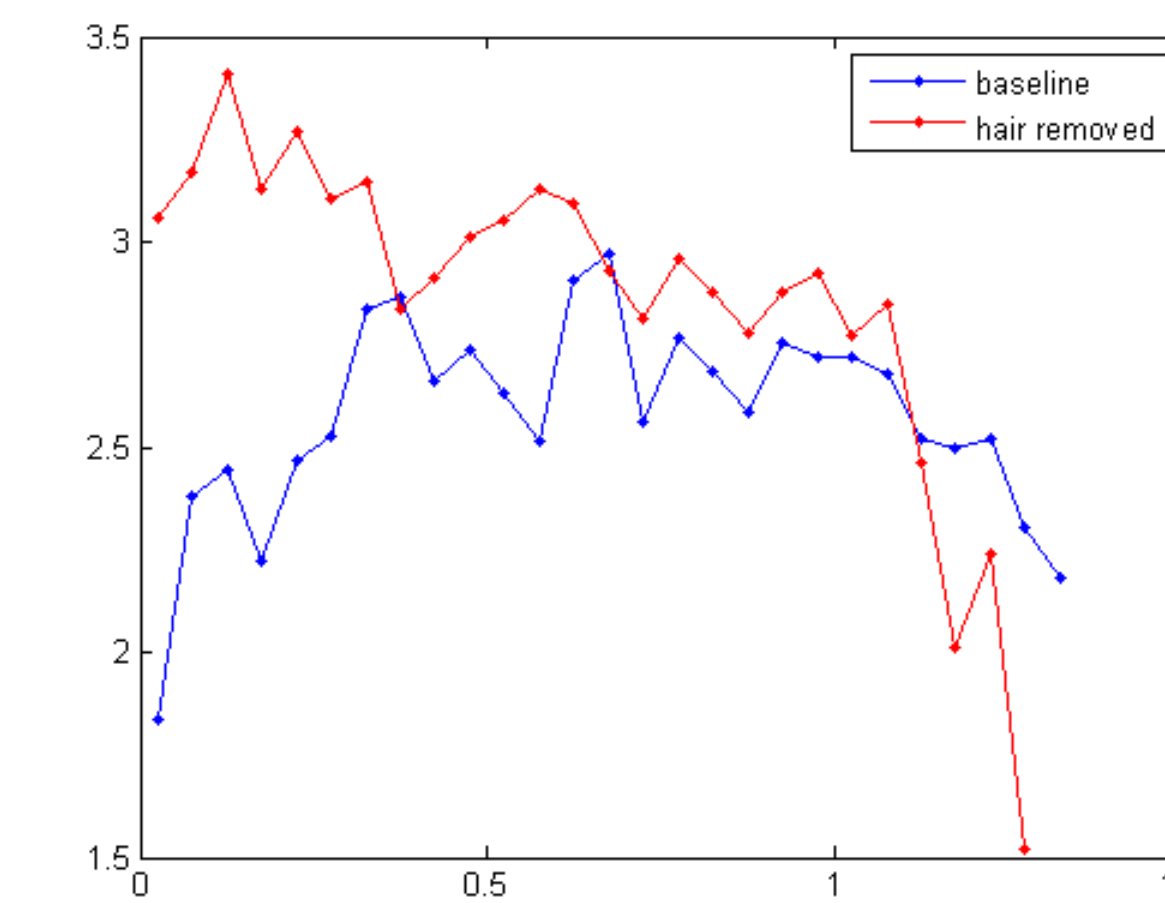
Hairs were removed from the trailing or leading edge of the wing on four bats (two analyzed) with depilatory cream (Veet®, 50% concentration, two minutes)



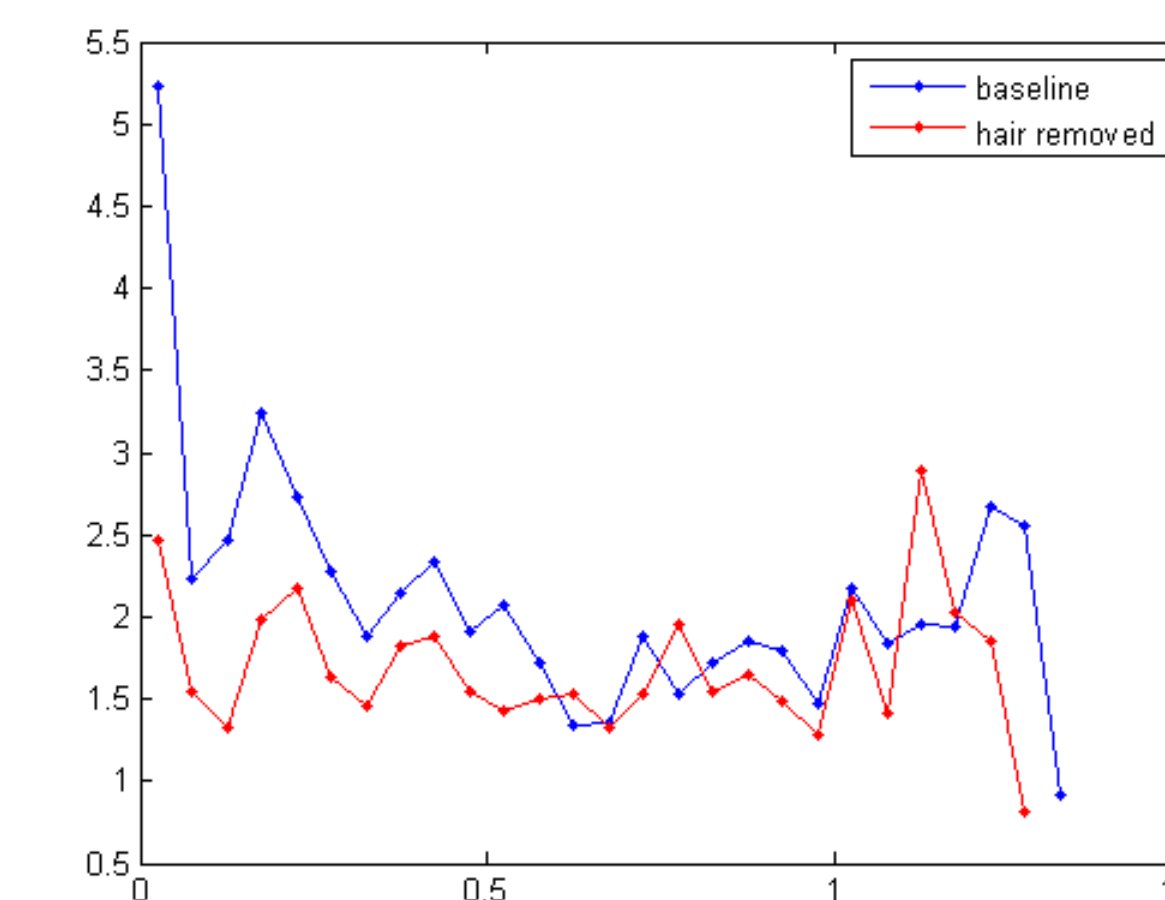
## Results

### BAT 1

#### Average flight speed (m/sec)



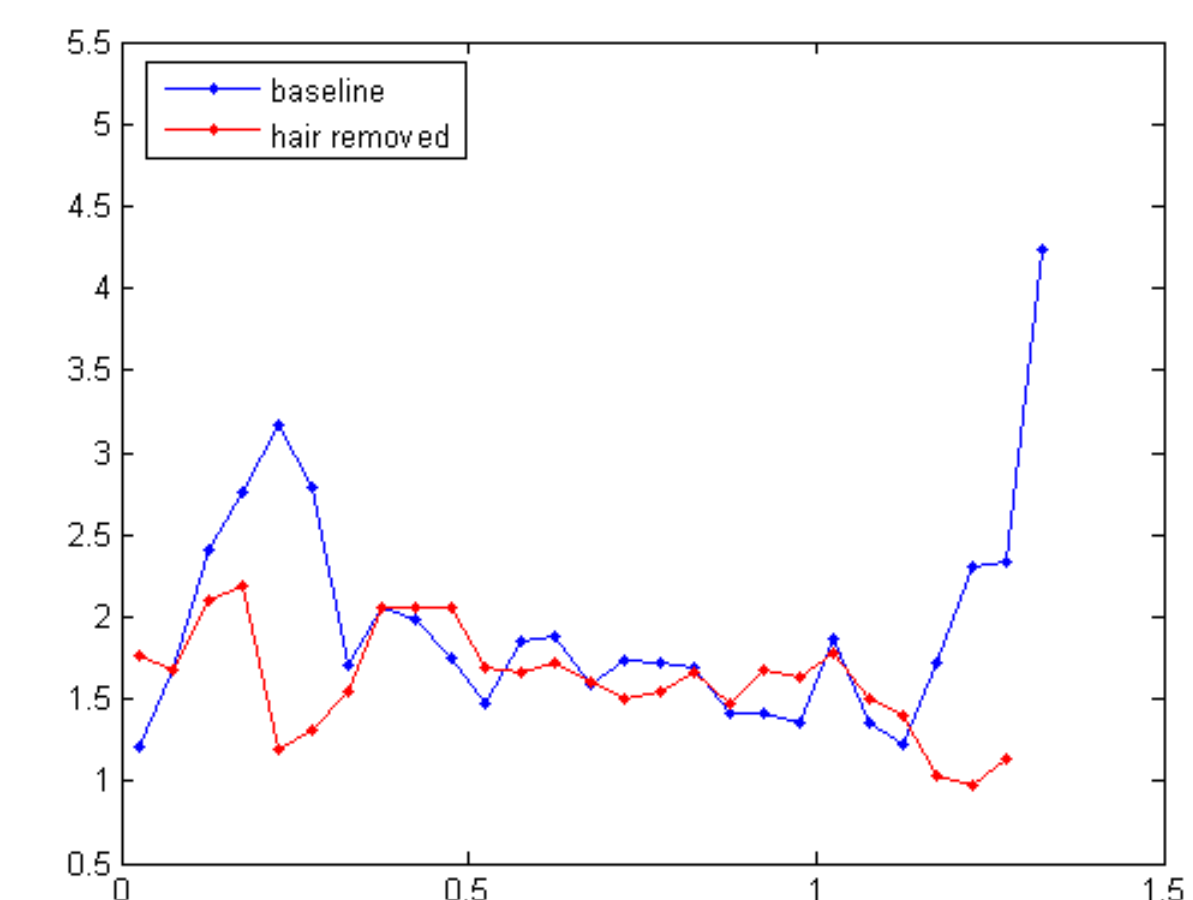
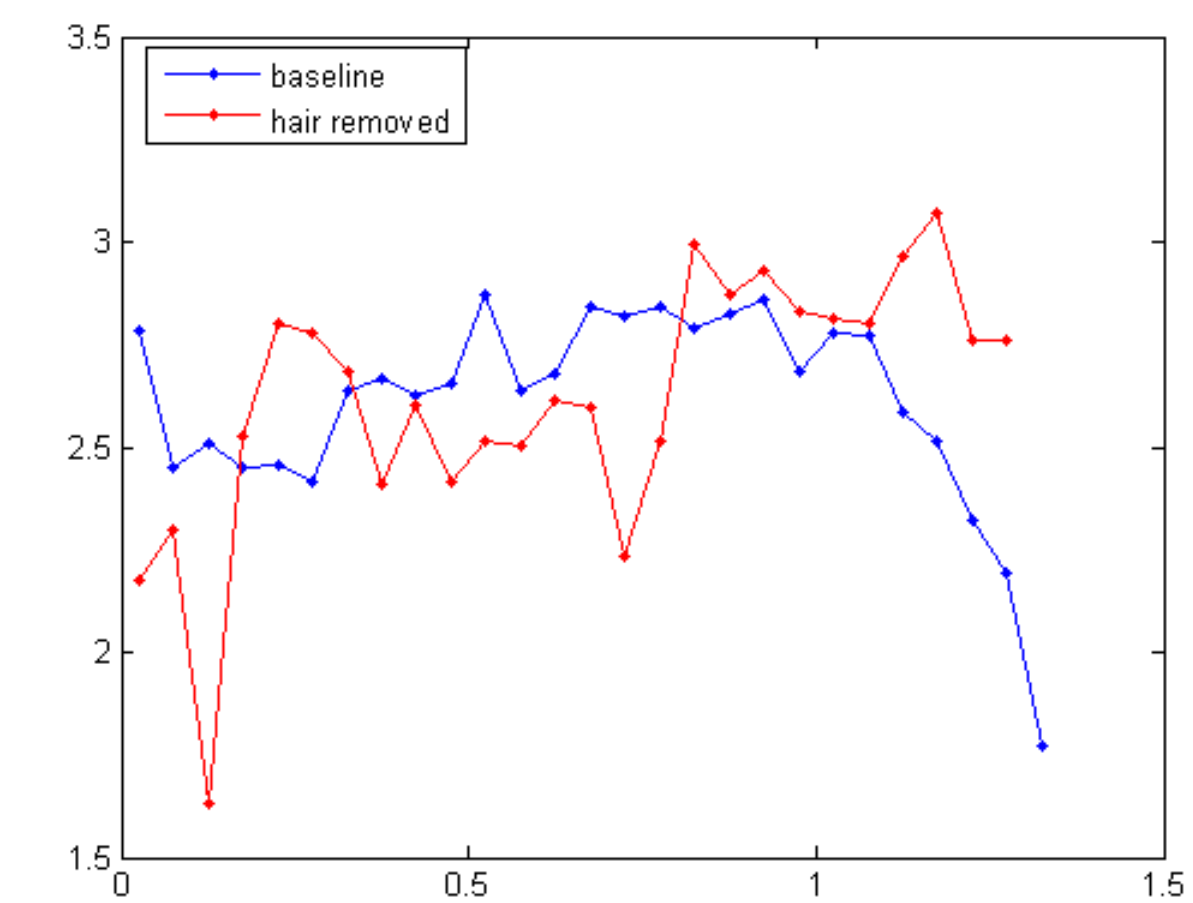
#### Average Turn Rate (deg/sec)



#### Distance to closest tree (m)

Treatment: ventral and dorsal trailing edge wing hairs removed, ventral tail membrane hairs removed  
Treated: 8 trials, 10 segments, 10 trees  
Baseline : 10 trials, 10 segments, 10 trees

### BAT 2



Treatment: ventral and dorsal trailing edge wing hairs removed  
Treated: 6 trials, 9 segments, 10 trees  
Baseline: 6 trials, 9 segments, 10 trees

## Future Work

- Train bats to catch catapulted mealworms - record time to capture, misses, speed and turn rate
- Increase number of obstacles - record collisions
- Analyze differences in vocalization production
- Determine the length of time for hairs to grow back
- Remove hairs from additional areas of the wing and conduct additional behavior tests

## Acknowledgments

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