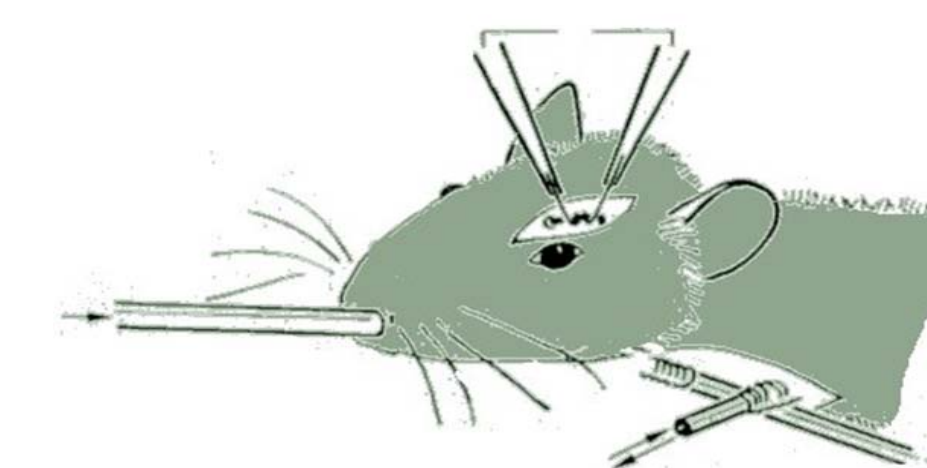
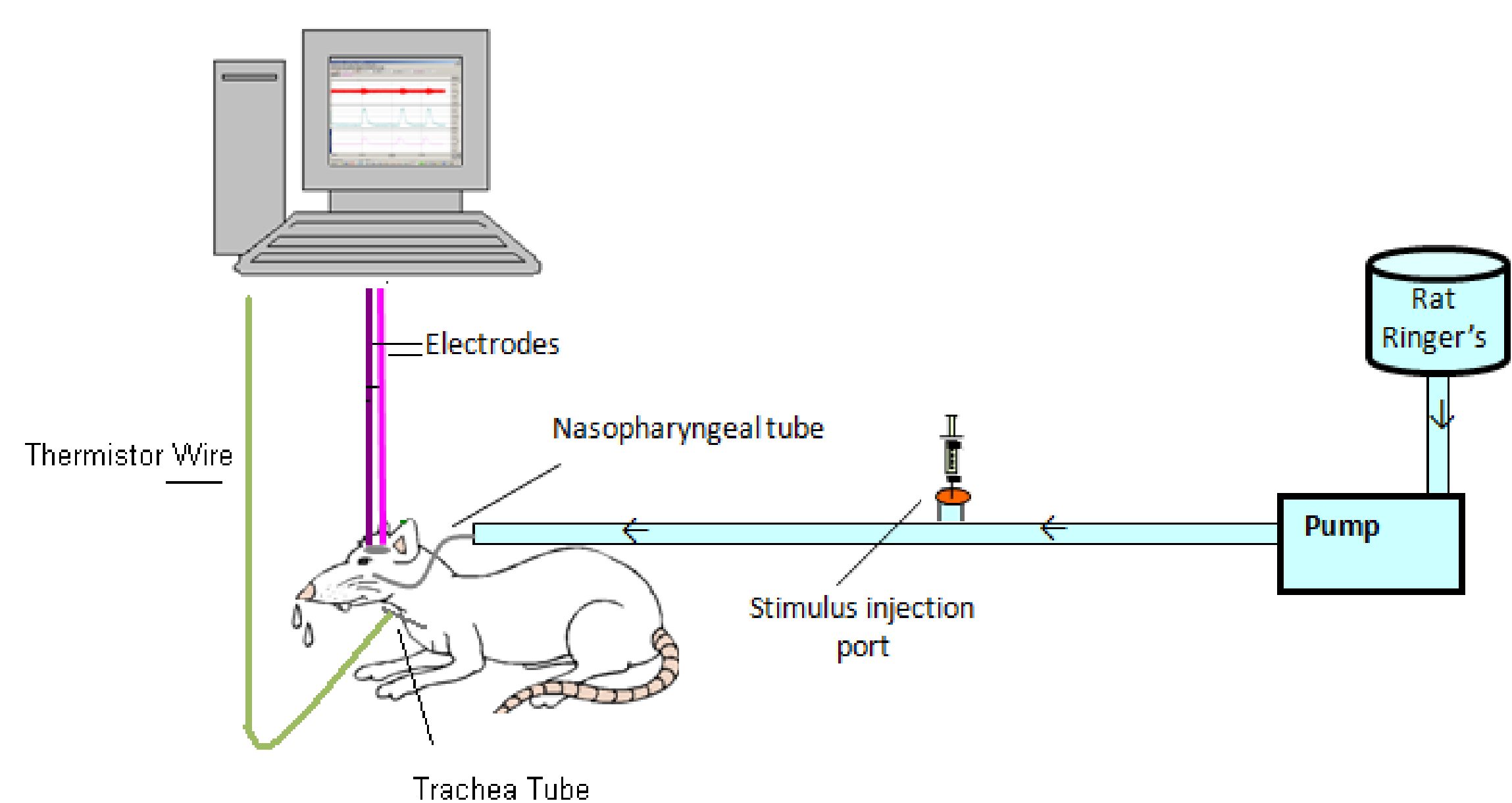




Introduction

Insects release a variety of compounds when trying to avoid predation or protect their territory. It was recently proposed that the particular chemicals used in these defensive mechanisms may have been selected to elicit vertebrate chemesthesis (stimulation of the somatosensory system by chemical irritants).¹ In the current study, we are testing a number of insect defense compounds to determine if these stimuli cause chemesthesis in rats. In mammals, nasal and facial chemesthesis is primarily mediated by the trigeminal nerve. We determined if the tested stimuli activated the trigeminal nerve by recording from the ethmoid nerve, a sub-branch of the trigeminal nerve, when stimuli were pumped through the rat's nose. As activation of the trigeminal nerve is known to decrease respiratory frequency², we also monitored respiration in the rats both before and after stimuli were introduced.

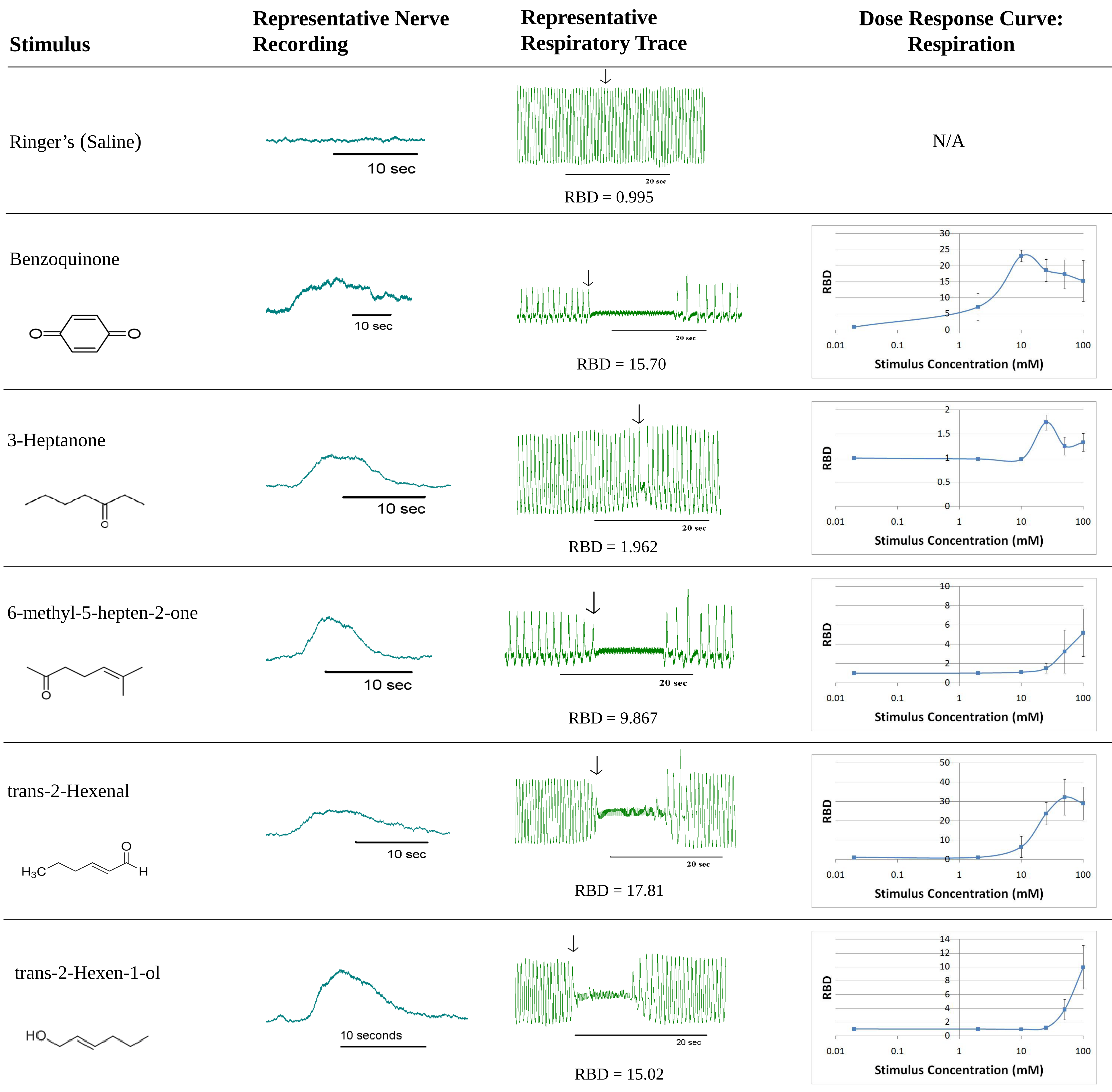
Methods



Experimental Setup for Delivering Fluids to the Rat's Nasal Cavity

1. Rats were anesthetized with urethane.
2. A polyethylene tube was inserted into each end of the cut trachea. One tube was inserted rostrally into the nasopharynx and the other into the trachea allowing the mouse to breathe room air.
3. The rat was secured in a head holder, and the ethmoid nerve was exposed in the orbit of the eye and placed on two platinum-iridium wire hook electrodes. Multiunit neural activity was amplified, integrated and monitored.
4. A thermistor wire was placed in the end one of the trachea tubes to monitor respiration.
5. Rat Ringer's (saline) solution was perfused continuously through the tube inserted into the nasopharynx.. Stimuli (~ 1 mL) were injected into this tube.
6. Data were analyzed using Acknowledge 3.7.3 software

Results



RBD³ (Relative Breath Duration) = $\frac{\text{Breath Duration Following Stimulus Exposure}}{\text{Mean Breath Duration Before Exposure (10 breaths)}}$

A breath duration is defined as the time it takes for one inhalation followed by one exhalation (or until the next inhalation if apnea ensues).

Conclusions

1. We have identified five insect allomones that activate the rat trigeminal nerve. We did test one allomone (tetradecane) that did not elicit trigeminal responses (data not shown).
2. In the future:
 - A. We will identify the receptors these chemicals stimulate by monitoring intracellular calcium levels in trigeminal neurons and transfected HEK cells.
 - B. We will evaluate whether these compounds activate avian chemoreceptors.
 - C. We will examine additional compounds released by insects.

References

1. Conner WE, Alley KM, Barry JR, and Harper AE. (2007). Has vertebrate chemesthesis been a selective agent in the evolution of arthropod chemical defenses? Biol Bull 213: 267-273.
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3. Tizzano M, Gulbransen BD, Vandenbeuch A, Clapp TR, Herman JP, Sibhatu HM, Churchill MEA, Silver WL, Kinnamon SC, and Finger TE. (2010). Nasal chemosensory cells use bitter taste signaling to detect irritants and bacterial signals. PNAS 107: 3210-3215.