

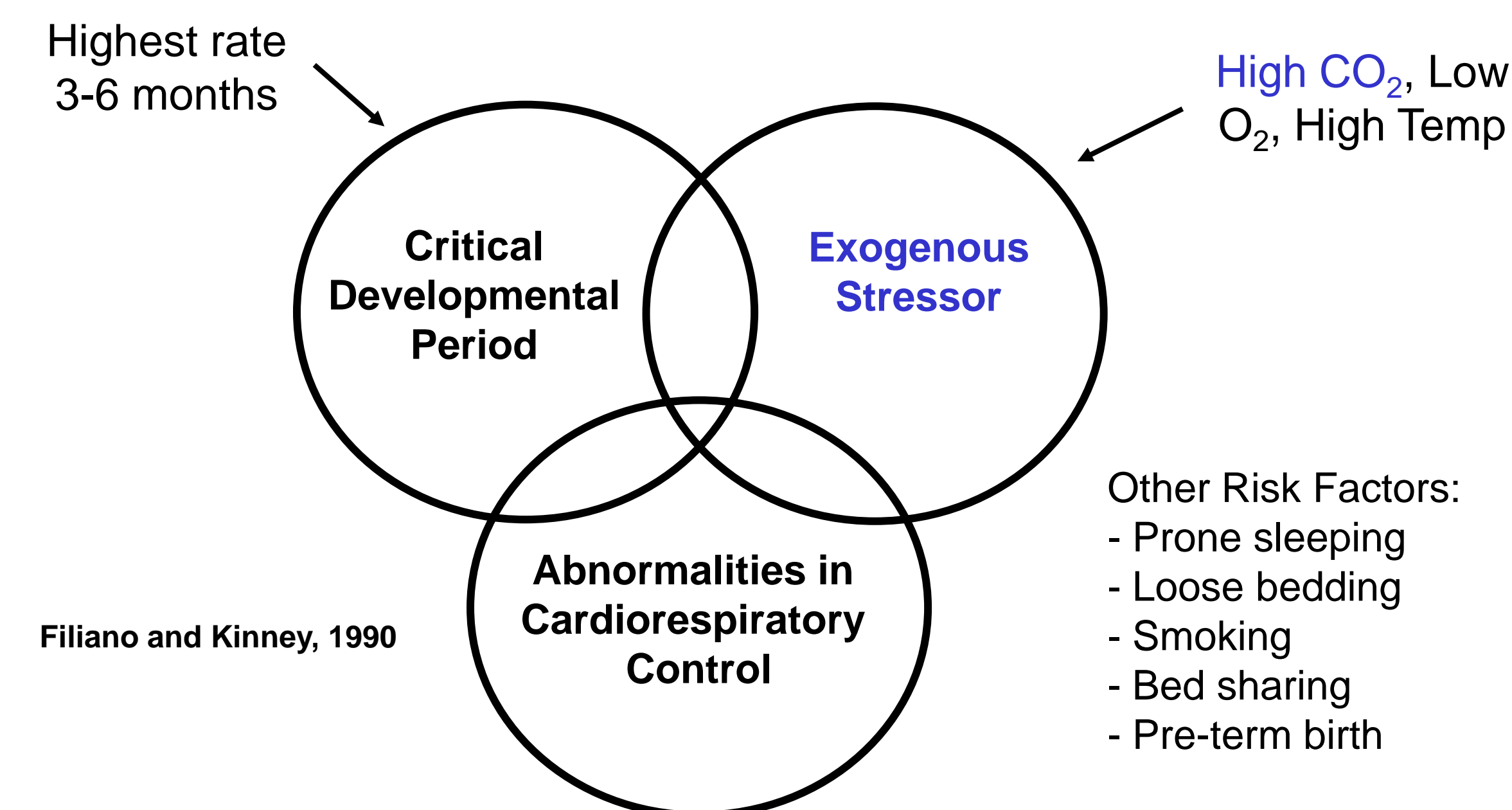
## Introduction

"Sudden Infant Death Syndrome (SIDS) is the unexpected, sudden death of a child under age 12 months in which an autopsy does not show an explainable cause of death" (NIH, 2008).

The "Triple Risk Model" proposes that SIDS is due to the intersection of a critical developmental period, an exogenous stressor, and an abnormality in cardiorespiratory control (Filano and Kinney, 1990).

### Breathing Study

The objective of this study was to determine if neonatal mice could be used to investigate portions of the "Triple Risk Model"

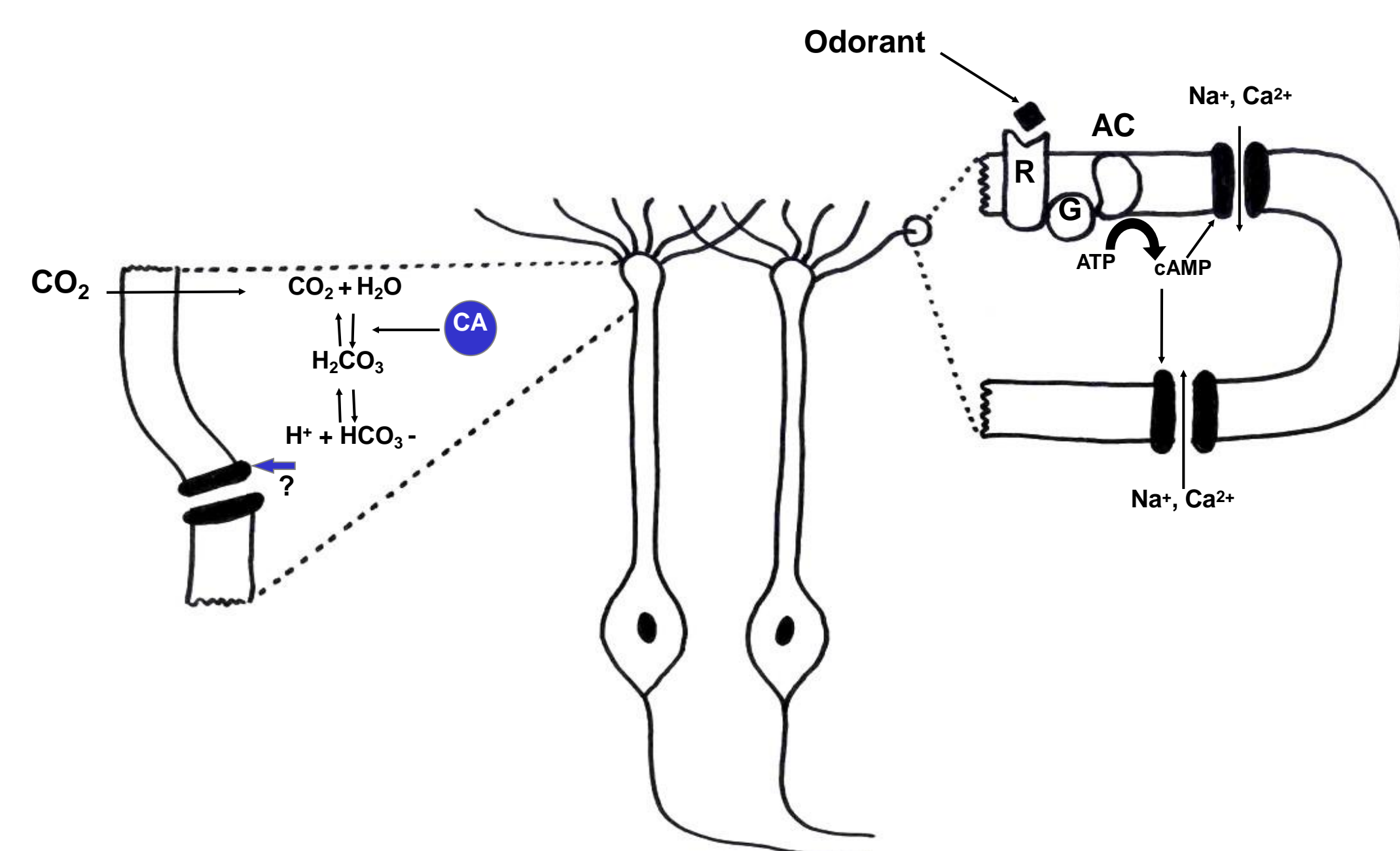


"Back to Sleep" campaign reduced SIDS from 1.2 cases/1000 live births in 1993 to 0.5 cases/1000 live birth in 2003

### Electrophysiology Study

The objective of this part of the study was to record from CO<sub>2</sub> olfactory receptors in the mouse to determine the transduction mechanisms used to detect CO<sub>2</sub>.

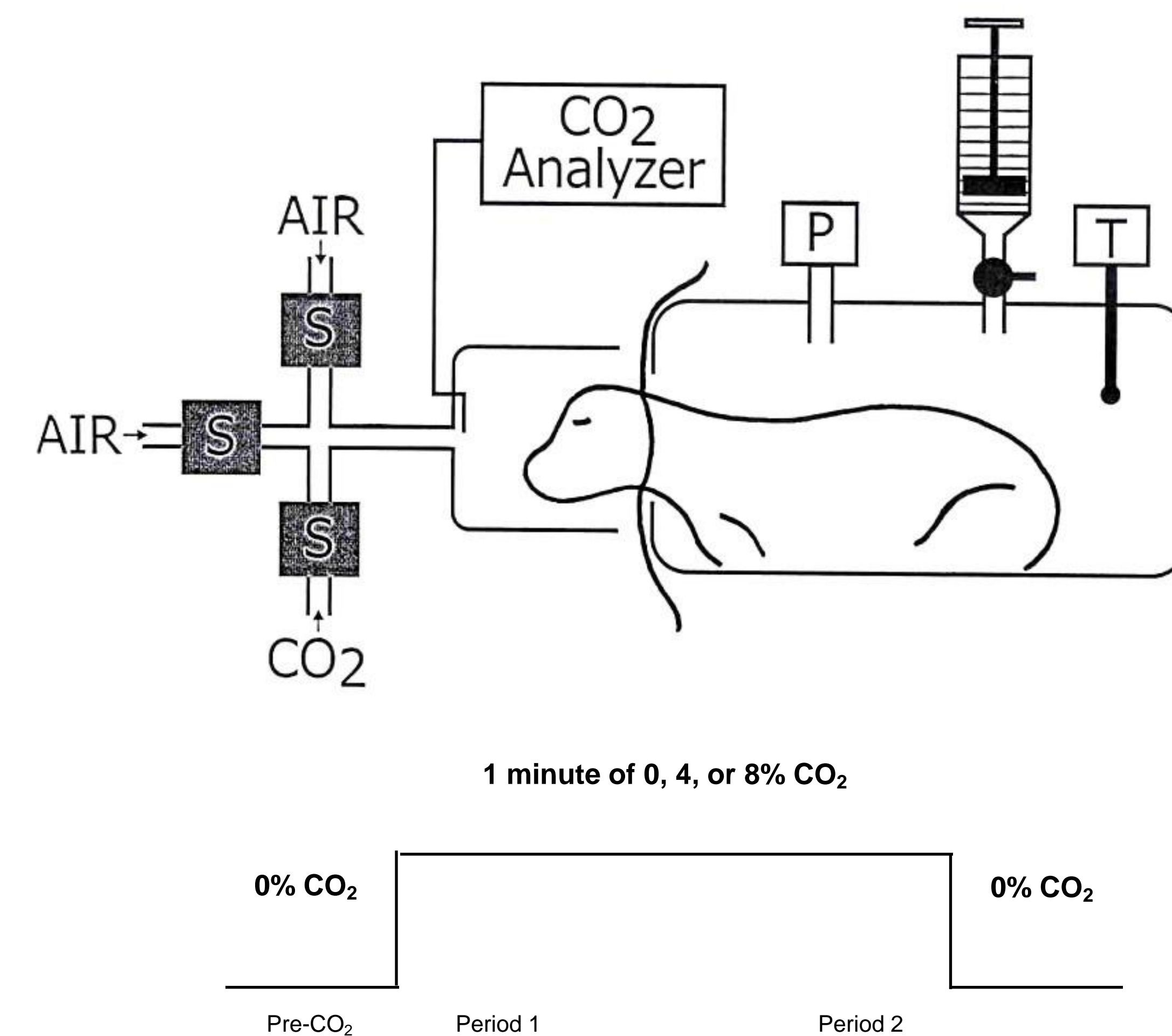
Specifically, we sought to determine the role of intracellular and extracellular carbonic anhydrase (CA)



## Methods

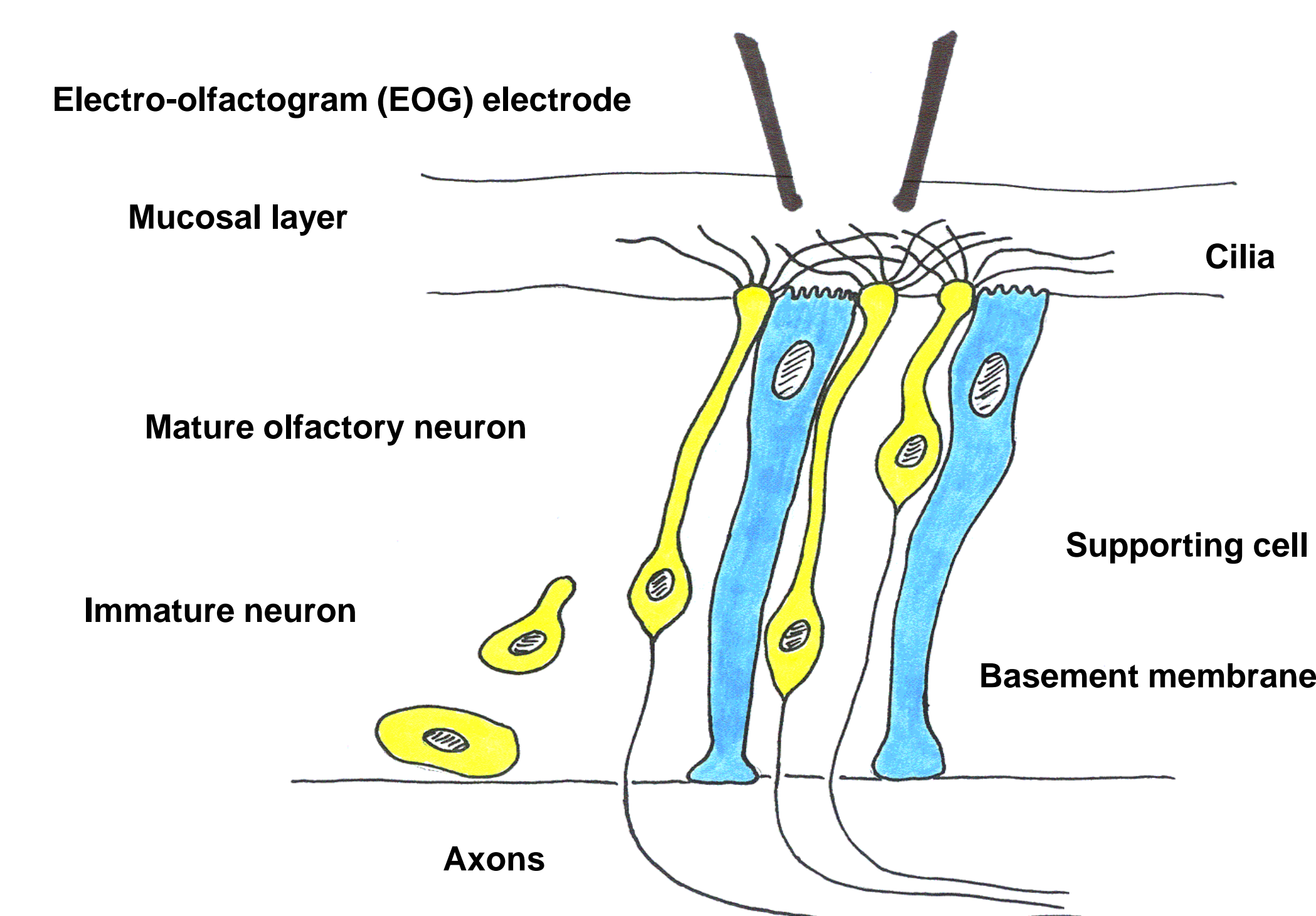
### Breathing Study

- Breathing was measured in neonatal mice in response to 0, 4, 8% CO<sub>2</sub>
- Mice were placed in a plethysmograph chamber (see Figure below)
- Breathing responses were measured on days 1,2,3,5, and 8 after birth



### Electrophysiology Study

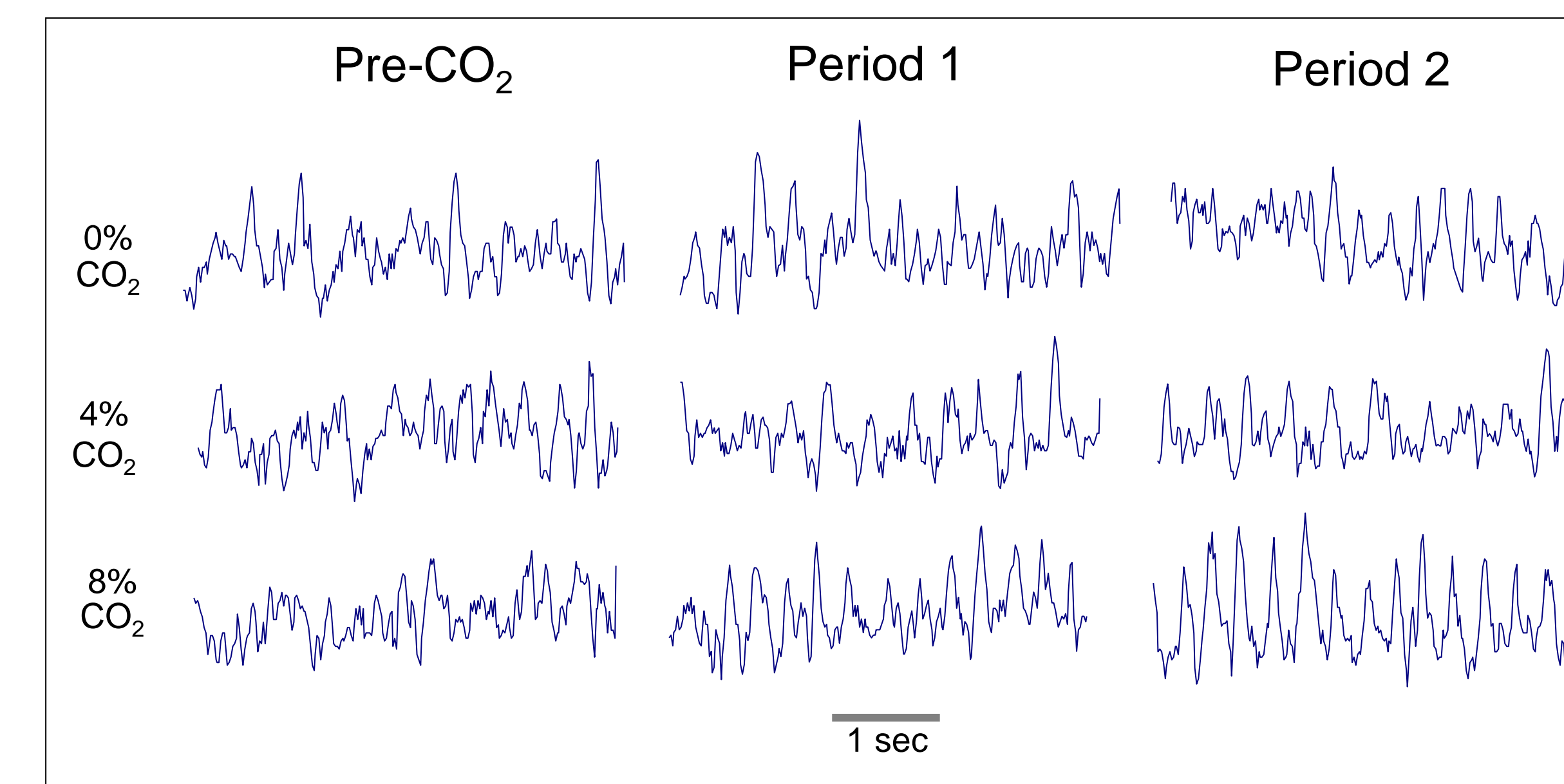
- Receptor responses to CO<sub>2</sub> were recorded from the olfactory epithelium
- Membrane permeable (acetazolamide) or membrane impermeable (QAS) carbonic anhydrase inhibitors were applied to the olfactory epithelium.



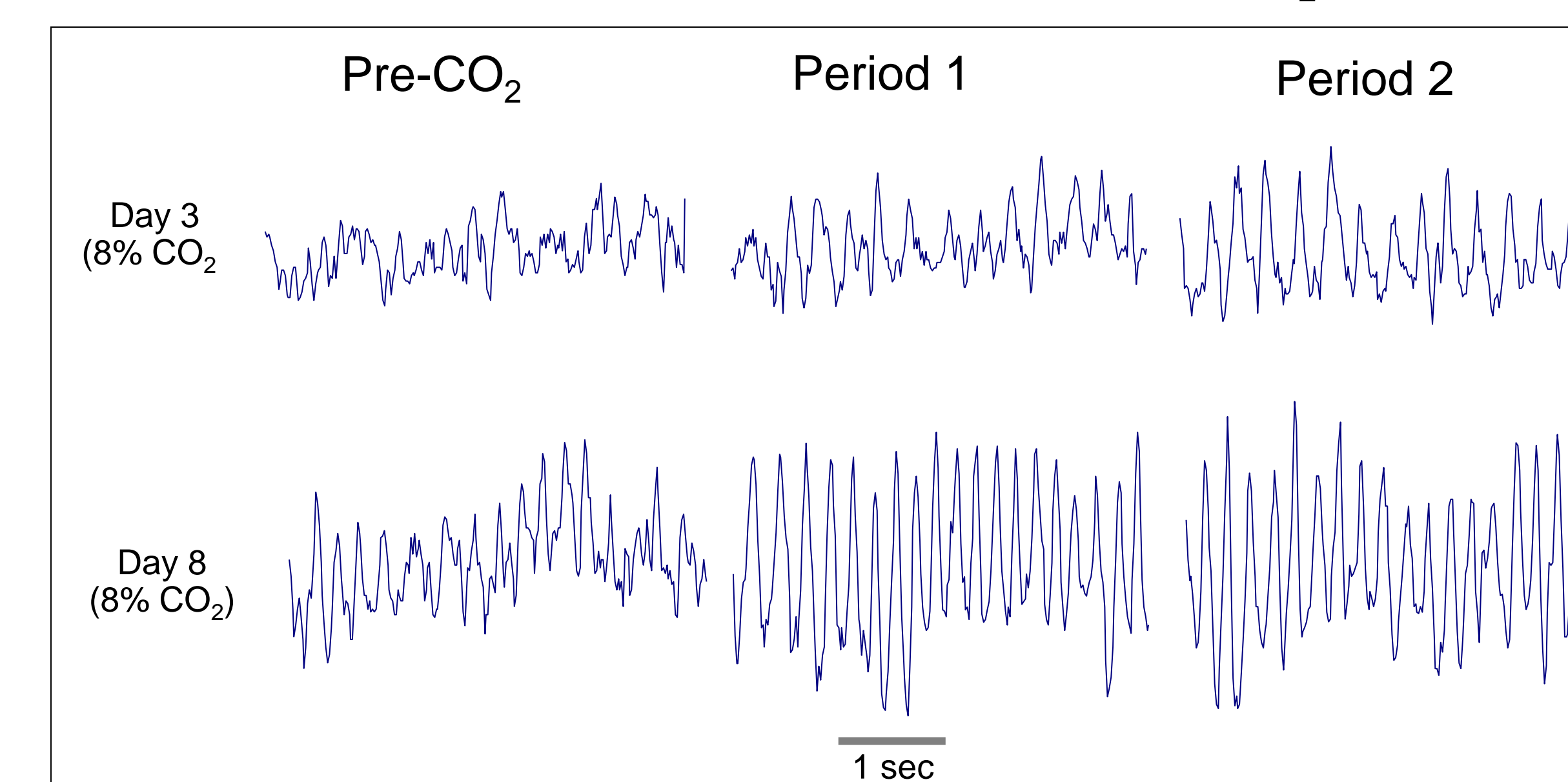
## Results

### Breathing Study

#### Ventilatory Response to CO<sub>2</sub> - Day 3

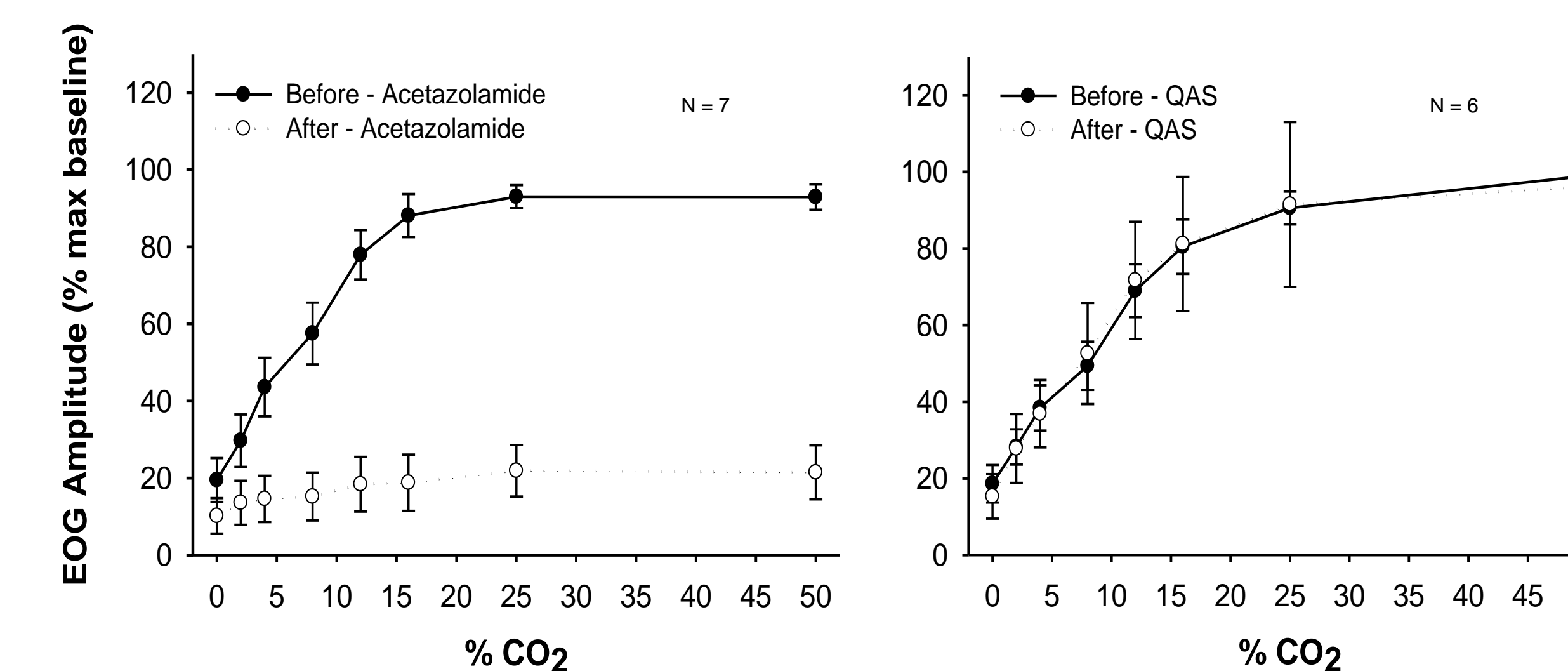


#### Age-Related Ventilatory Response to CO<sub>2</sub>



### Electrophysiology Study

#### Olfactory receptor response to CO<sub>2</sub> (Before and after inhibition with Acetazolamide or QAS)



## Conclusions

### Breathing Study

- Ventilation was successfully measured in neonatal mice.
- Mice exhibited an age-related increase in ventilation with increasing CO<sub>2</sub> concentrations.
- Ventilation became more regular with age, indicating that central chemoreceptors are not fully developed at birth.

### Electrophysiology Study

- Application of Acetazolamide inhibited the receptor responses to CO<sub>2</sub>
- Application of QAS did not affect receptor responses to CO<sub>2</sub>.
- We conclude that intracellular CA is necessary for the detection of CO<sub>2</sub> by olfactory CO<sub>2</sub> receptors.
- Extracellular CA does not seem to play a role in the detection of CO<sub>2</sub> by olfactory CO<sub>2</sub> receptors.

## References

- Coates EL, Silvis ML. (1999) Age-related changes in the ventilatory response to inspired CO<sub>2</sub> in neonatal rats. *Respiration Physiology* 118: 173-179.
- Coates EL. (2001) Olfactory CO<sub>2</sub> chemoreceptors. *Respiration Physiology* 129: 219-229.
- Filano JJ, Kinney HC. (1994) A perspective on neuropathologic findings in victims of the sudden infant death syndrome: The triple risk model. *Biology of the Neonate* 65: 194-197.
- Hunt CE, Hauck FR. (2006) Sudden infant death syndrome. *Canadian Medical Association Journal* 174: 1861-1869.
- National Institute of Health (2008) www.NIH.gov

## Acknowledgements

We thank Dr. and Mrs. Edward Shanbrom for generously funding this project.