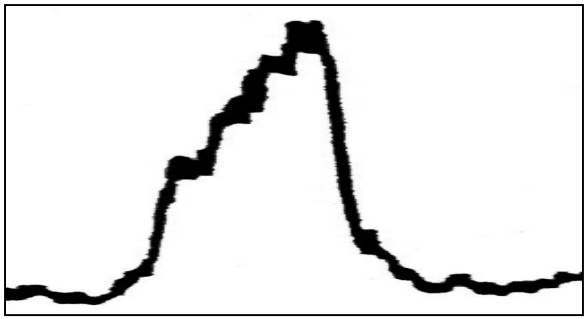
5-HT_{2A} Neuromodulation in the Pre-Bötzinger Complex

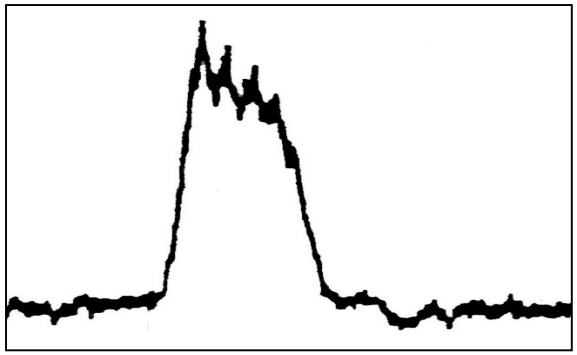
Smrithi Sukumar
UC Berkeley
Molecular/Cell Biology & Public Health
Ramirez Lab

Different breathing patterns are triggered by changes in oxygen

- Normoxia
  - Eupnea
- Hypoxia
  - Gasping



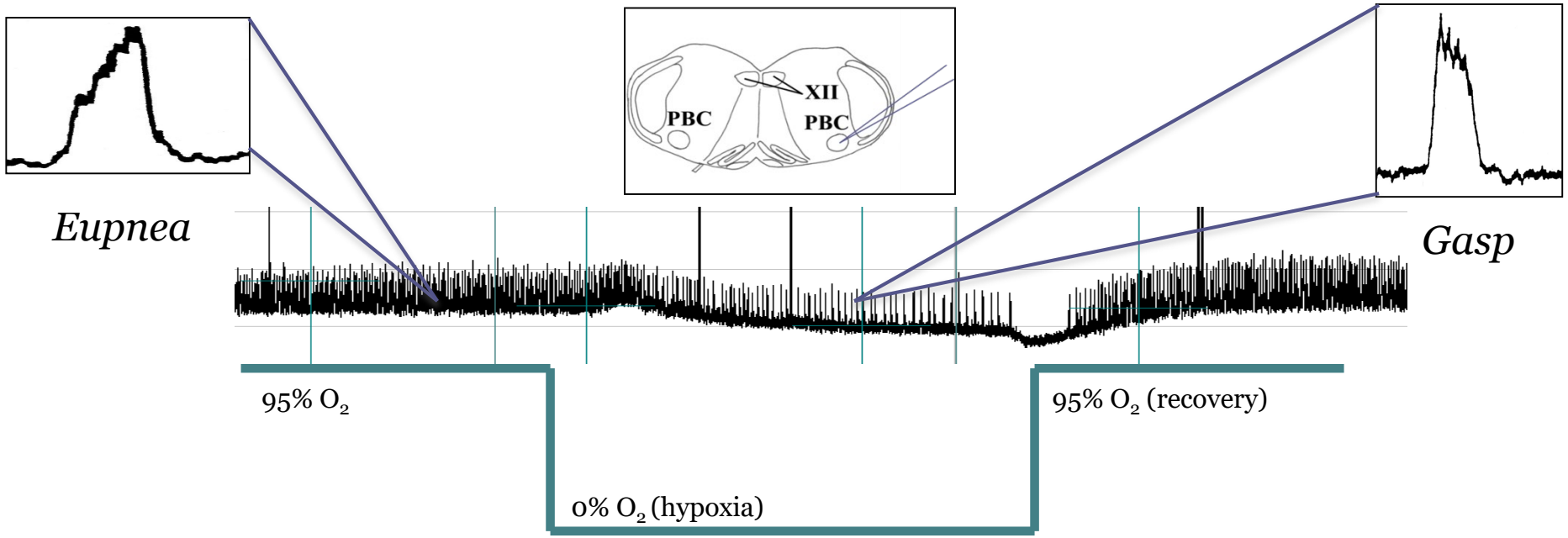
Eupnea



Gasp

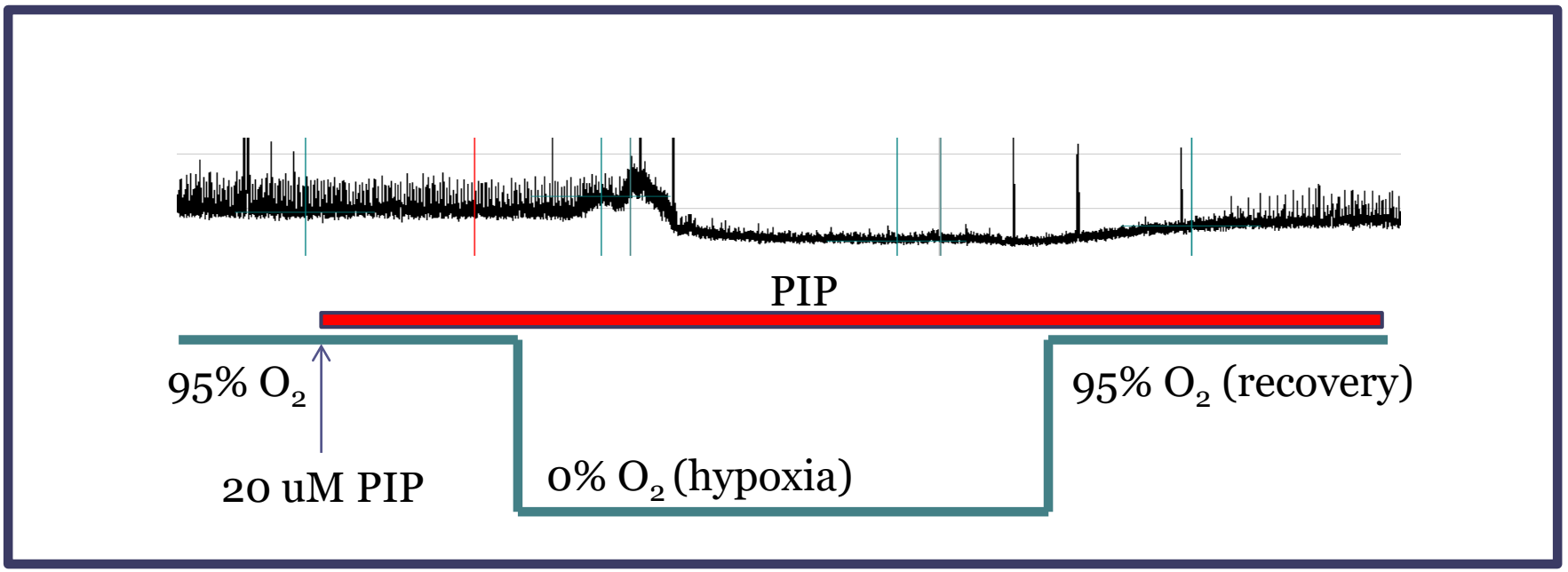
Breathing is a neurobiological behavior

- Transverse brain slice with Pre-Bötzinger Complex (PBC/Pre-Böt) generates eupneic and gasping neural rhythms



Gasping is dependent on 5-HT_{2A} receptors

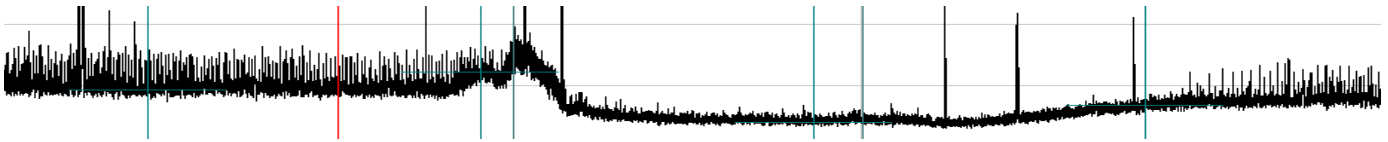
- Piperidine (PIP) is a 5-HT_{2A} receptor antagonist
- In presence of PIP, slices do not produce gasps



Clinical Significance

- Sudden Infant Death Syndrome (SIDS)
- Children with SIDS have low seratonin levels

- Is the 5-HT_{2A} neuromodulation of gasping essential to "reconfigure" the PBC network from eupneic rhythms to gasping rhythms, or is the neuromodulation necessary to maintain gasping?



Transition Phase

Steady State Hypoxia

95% O_2

20 uM PIP

0% O_2 (hypoxia)

95% O_2 (recovery)

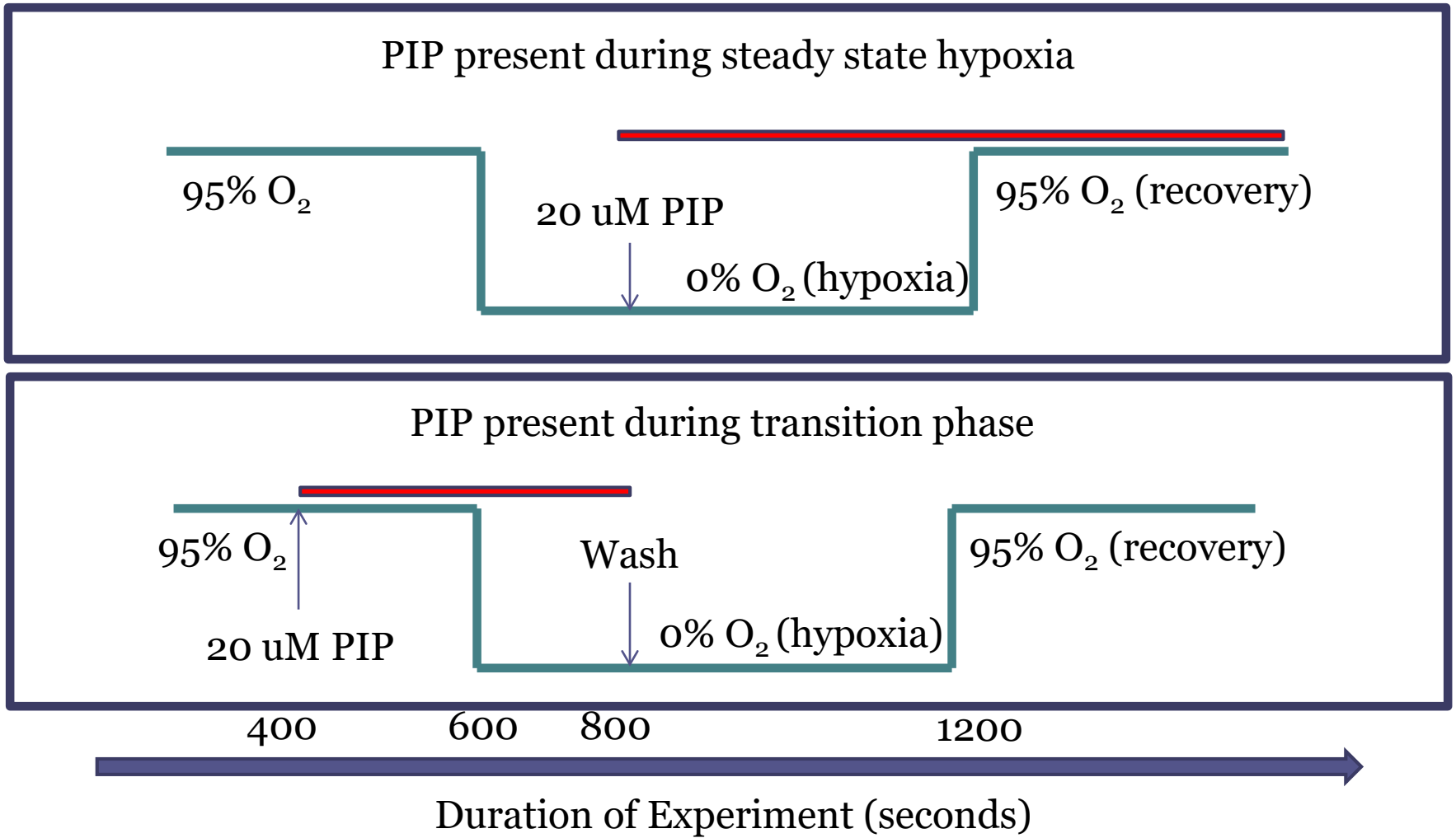
400

600

1200

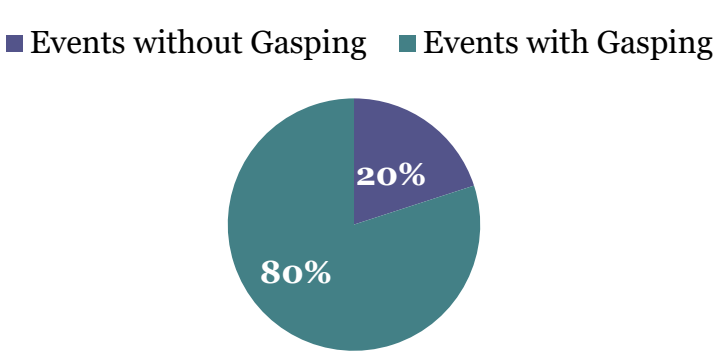
Duration of Experiment (seconds)

Experiments

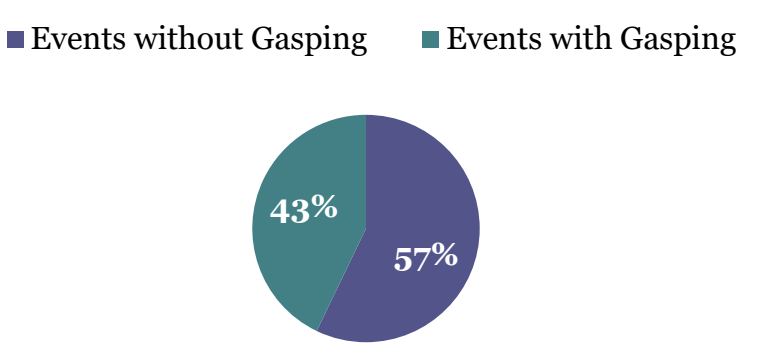


Results

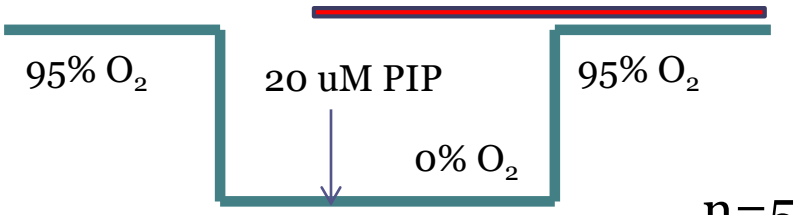
Gasping Activity when PIP is added to Steady State



Gasping Activity when PIP is added to Transition

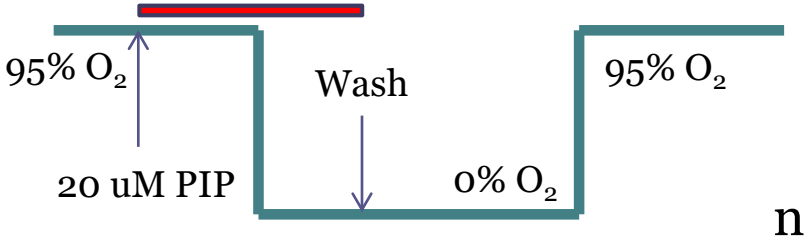


PIP present during steady state hypoxia



n=5

PIP present during transition phase



n=7

Conclusion

- For the slices that gasped, blocking 5-HT_{2A} receptors during the transition phase had similar effects to blocking the receptors during steady state hypoxia
- 5-HT_{2A} receptors are involved in "reconfiguring" neural network from eupnea to gasping
  - Seratonin needed to reconfigure network, not to maintain gasps
- Future work

Acknowledgements

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