5-HT$_{2A}$ Neuromodulation in the Pre-Bötzingher Complex

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Different breathing patterns are triggered by changes in oxygen

- Normoxia
  - Eupnea

- Hypoxia
  - Gasping
Breathing is a neurobiological behavior

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

Eupnea

95% O₂

0% O₂ (hypoxia)

95% O₂ (recovery)

Gasp
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 serotonin 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?
Experiments

**PIP present during steady state hypoxia**
- 95% O₂
- 20 uM PIP
- 0% O₂ (hypoxia)
- 95% O₂ (recovery)

**PIP present during transition phase**
- 95% O₂
- 20 uM PIP
- Wash
- 0% O₂ (hypoxia)
- 95% O₂ (recovery)
Results

Gasping Activity when PIP is added to Steady State

- Events without Gasping
- Events with Gasping

Gasping Activity when PIP is added to Transition

- Events without Gasping
- Events with Gasping

PIP present during steady state hypoxia

- 95% O₂
- 20 µM PIP
- 0% O₂
- n=5

PIP present during transition phase

- 95% O₂
- 20 µM PIP
- Wash
- 0% O₂
- 95% O₂
- 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
  - Serotonin needed to reconfigure network, not to maintain gasps
- Future work
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