How opiates and Hypercapnia affect the control of breathing

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Breathing is gas exchange....
Hypercapnic acidosis (HA) is the primary mechanism that drives breathing.

\[ \text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{H}^+ + \text{HCO}_3^- \]
The control of breathing is integrated neurophysiological behavior.
Neuronal basis of the breathing rhythm
The preBötzinger complex: A central rhythm generator
Clinical Topic: How opiates affect the central control of breathing
The hallmark of opiate overdose: Respiratory depression

Rx opioid related death in the U.S. is on the rise

Source: National Center for Health Statistics, CDC Wonder

http://www.drugabuse.gov/related-topics/trends-statistics/infographics/prescription-
Opiate-mediated Respiratory depression is defined by

1. Suppressed respiratory frequency
2. Elevated CO$_2$
3. Reduced O$_2$
How does hypercapnia influence opioid neuromodulation in the preBotzinger Complex?
Effects of DAMGO and HA on rhythmogenesis
Opiates and hypercapnia depresses neural rhythm
We know...

Hypercapnia alone stimulates breathing
Hypercapnia may also enhance opiate neuromodulation breathing centers (e.g., the preBotzinger complex).
Respiratory depression caused by DAMGO is stronger with acidification.
Where did the injection sites of the drug hit?
Overall Conclusion:

Opiate and hypercapnia use depresses respiratory frequency through a pH dependent mechanism.
Thank you!

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