

## 5 Hierarchy of orofacial rhythms revealed through whisking and breathing.

Moore JD, Deschênes M, Furuta T, Huber D, Smear MC, Demers M, Kleinfeld D.  
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### Interesting Hypothesis, New Finding

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In this magnificent paper, Moore and colleagues identify the core medullary cell group that generates rhythmic whisking movements (the vibrissa zone of the intermediate reticular formation [vIRt]) and dissect the larger circuit within which it is embedded. This larger circuit also generates sniffing and perhaps other orofacial movements (e.g. licking).

The identification of the vIRt is, in itself, a master class in functional circuit analysis – the authors use recordings from this region (spikes phase lock to whisking movements), lesions (elimination of whisking), stimulation (kainic acid induces whisking) and anatomy (neurons in vIRt project to the facial motor neurons that drive whisking) to produce unassailable evidence for their conclusion.

Clever behavioral experiments demonstrate that the whisking pacemaker (vIRt) and the sniffing/inspiratory pacemaker (pre-Bötzing complex) can operate independently. The authors conclude, however, that under normal conditions the 'inspiratory pattern generator' in the pre-Bötzing complex drives the whisking oscillator so that sniffing and whisking are nicely synchronized. This paper has opened up a vast field for rigorous study. I imagine that many slice experiments are already planned or underway to elucidate, at a biophysical level, how the inspiratory and whisking generators are linked in a manner sufficiently flexible to drive the diversity of sniffing/whisking patterns. For me, the most prescient idea is in the last sentence of the article in which the authors speculate that the inspiratory pacemaker might provide a signal that binds olfactory (sniffing) and vibrissae sense inputs. Such putative binding is likely to occur in the cortex, and hunting down a site that is in receipt of olfactory, vibrissae and inspiratory clock (pre-Bötzing complex) input should be a difficult but not impossible task.

### Disclosures

None declared

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### Interesting Hypothesis, New Finding

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Moore et al. show that inspiratory pattern generators synchronize various patterning circuits. The authors provide precise anatomical and functional description of a circuit that generates coordination, which leads to optimal perception and binding of olfactory and tactile information. The coordination of sniffing and whisking with breathing ensures that actions and sensations of different elements (modalities) do not confound each other. Their suggestion that a breathing clock serves as a phase-locking signature to bind olfactory and tactile sensations is attractive; it follows the line of thought that phase locking provides an efficient mechanism, with distinct computable relations between action and sensation, which are possibly the basis of perception. The significance of the findings goes beyond the elegant, specific oscillatory circuit. It is reasonable to consider more complex (yet specific) patterns carry internal information of our actions, and serve as important elements in predicting sensory inputs. This may be a general principle of commutation in our brain.

### Disclosures

None declared