Chemoreceptor control of breathing in reptiles

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Animals respond to respiratory stimuli such as low oxygen and high CO_2 by adjusting cardiorespiratory variables to maintain blood gas homeostasis. Arterial chemoreceptors responsible for sensing these stimuli have been well studied in mammals, but very little is known about them in lower vertebrates. In particular, the mechanisms underlying O_2-sensing, the specific O_2 stimuli that trigger cardiorespiratory responses (arterial O_2 tension (PaO_2) or content (CaO_2)) and the reflex roles of different receptor groups remain unknown. The phylogenetic trend appears to be a reduction in the number of chemosensory areas from fish to reptiles to mammals. It has been hypothesised that multiple chemoreceptive sites may be advantageous for reptiles that regulate blood gases by changes in ventilation and/or the degree of cardiac shunt. Three functional chemosensory areas have now been identified in turtles and snakes. In snakes. stimulation of aortic and pulmonary chemoreceptors increase ventilation and reduce cardiac shunt, while carotid chemoreceptors are primarily involved in ventilatory control. Only aortic and pulmonary chemoreceptors respond to changes in CaO_2 by adjusting the degree of shunt. Our work confirms that reptiles have multiple chemosensory sites with different reflex roles, and suggest that the O_2-sensing structures are highly conserved among vertebrates.