The origin of yawning behavior in vertebrates and inspiratory activity in mammals

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Yawning is a common behavioral event that is observed in almost all vertebrates. This study investigated yawning in the amniotes and the out-group of amniotes, using video camera. We could record the yawning in the turtles that branched later than mammals, and in the more primitive vertebrates than mammals, amphibians, dipnoan, actinopterygii and sharks. Yawning in these vertebrates consisted of maximal opening of the mouth and lowering of the oropharyngeal (buccal) floor. Interestingly, aquatic turtles, amphibians, and lunged fishes (dipnoan, gar and polypterus) did not open their glottis during the yawning, differently from mammals. These observations recognized us that yawning is a common behavior in jawed vertebrates and more primitive than lung ventilation furthermore the opening of glottis is not essential for the yawning behavior in most of the vertebrates except mammals. The reason why mammals open their glottis during the yawning may originate from that the ancestral mammalian had utilized a part of the nerve activity lowering the buccal floor for driving the diaphragm in the evolutional process. This idea also leads us to a hypothesis that the inspitaroy activity in mammals may originate from a sternohyoid muscle branch of the hypoglossal nerve.