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Characterization of Ventilatory Modes in Dragonfly Nymph CHRIS ROH[1], THERESA SAXTON-FOX, MORTEZA GHARIB, California Institute of Technology — A dragonfly nymph's highly modified hindgut has multiple ventilatory modes: hyperventilation (i.e. jet propulsion), gulping ventilation (extended expiratory phase) and normal ventilation. Each mode involves dynamic manipulation of the exit diameter and pressure. To study the different fluid dynamics associated with the three modes, Anisopteran larvae of the family Aeshnidae were tethered onto a rod for flow visualization. The result showed distinct flow structures. The hyperventilation showed a highly turbulent and powerful jet that occurred at high frequency. The gulping ventilation produced a single vortex at a moderate frequency. The normal ventilation showed two distinct vortices, a low-Reynolds number vortex, followed by a high-Reynolds number vortex. Furthermore, a correlation of the formation of the vortices with the movement of the sternum showed that the dragonfly is actively controlling the timing and the speed of the vortices to have them at equal distance from the jet exit at the onset of inspiration. This behavior prevents inspiration of the oxygen deficient expirated water, resulting in the maximization of the oxygen intake.

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