

RESPIRATORY SYSTEMS IN MESOZOIC ARCHOSAURS

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The presence of large limb muscles (indicated by long ilia), high walking speeds (recorded by trackways) and powered flight suggest that pterosaurs, most dinosaurs and early birds had higher aerobic exercise capacity (AEC) than reptiles. Dead end, septate reptile lungs cannot oxygenate the high AEC sustained by air-sac ventilated, septate bird lungs and dead-end, diaphragm driven alveolar mammal lungs. Bats also use extra oxygen capacity blood to sustain the extremely high AECs of advanced flight, flying birds use a hyperenlarged sternal-air-sac complex. However, flying birds aerobically walk much faster than reptiles even when 70% of the air-sacs are disabled. Ratite air-sacs and sterna, especially kiwis', are less well developed than in flying birds.

Theropods must have had septate lungs as per their descendants, it is not possible to restore soft lung structure in other entirely extinct archosaur clades. Absence of a lumbar region precludes a crocodylian or mammalian type diaphragm in pterosaurs, theropods or sauropods. Increasingly pneumatic vertebrae, reduction of the dorsal series, shortening of the anterior ribs and/or elongation of the posterior ribs, and in some cases large sterna suggest that pterosaurs, theropods and sauropods developed increasingly well developed pulmonary air-sacs that approached or matched the ratite level. Pterosaur lungs may also have been alveolar, and/or had very high oxygen affinity blood. They same may have been true of ornithischians, which lack evidence of air-sacs. Perry suggested their retroverted pelves anchored an abdominal wall that acted as a diaphragm. Ornithopods had a mammal-like lumbar region and lack gastralia, strongly suggesting they had a vertical, mammal-like diaphragm.