

Ventilatory Acclimatization to High Altitude in Birds

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Abstract. There have been conflicting reports about the effects of prolonged exposure to altitude on arterial O₂ tensions (Pa_{O₂}) in birds. To resolve this issue we measured ventilation and arterial blood-gases and pH in awake adult domestic ducks exposed for varying times to inspired P_{O₂}=90 Torr at 3,800 m (12,470 ft) at the Barcroft Facility at White Mountain Research Station and in hypobaric chambers at the University of Wisconsin Biotron facility. Effects of acute hypoxia were measured during 15 minutes of decreased inspired O₂ concentration at sea level. In six ducks at 3,800 m for six weeks, Pa_{CO₂} was significantly less than during acute hypoxia, but Pa_{O₂} was not significantly greater. Hypobaric chamber studies showed that time-dependent changes in arterial blood-gases with prolonged hypoxia were complete during the first 12 hours of

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exposure and were stable thereafter to 72 hours; 72-hour values were the same as those after six weeks at altitude. Arterial acid-base status showed no metabolic compensation for the acute respiratory alkalosis with acute hypoxia, but the alkalosis from the additional time-dependant decrease in Pa_{CO_2} was compensated. Ventilation in acute hypoxia was only slightly greater than in normoxia, and there were no further changes with chronic hypoxia, except a nonsignificant change in breathing pattern. However, the time-dependent decrease in Pa_{CO_2} indicates a time-dependent increase in parabronchial ventilation, so ducks show ventilatory acclimatization to hypoxia without large changes in inspired ventilation. Hence, the primary result of ventilatory acclimatization to hypoxia in birds appears to be hypocapnia and not increased Pa_{O_2} .

Editors' Note. The complete text of this study has been published under the title "Acclimatization to high altitude," by Frank L. Powell in *Hypoxia: the Adaptations*, edited by J. R. Sutton, G. Cortes, and J. E. Remmers, pp. 41-44, B. C. Decker, Toronto, 1990.