

Target Talk for New Zealand Satellite Symposium, 1983

Section 2a

ONTOGENY AND PHYLOGENY OF THE OXYGEN RESPONSE.

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Breathing is adjusted to meet changes in oxygen supply and demand in virtually all vertebrates while the role of CO₂ and [H⁺] in control of breathing is less clear. From a phylogenetic perspective Rahn (1967) argued that blood oxygen tension determines the gross ventilatory pattern while P_{CO2} engenders fine ventilatory adjustments to control the [OH⁻]/[H⁺] ratio of arterial blood. Dejours (1981) also concluded, from a literature review, that CO₂ clearance and acid-base regulation are subordinate to appropriate oxygenation of the organism. Respiratory sensitivity to CO₂ only occurs when air and water breathers are normoxic; in hyperoxic water breathers and strongly hypoxic air breathers breathing is independent of CO₂. Furthermore, even the CO₂ response in some normoxic water breathers is apparent rather than real and is actually a response to a reduction in tissue oxygen supply since mild hypercapnia reduces blood oxygen capacity (Smith and Jones, 1982).

The primacy of the oxygen response in vertebrates indicates that some phylogenetic continuity in control mechanisms exists. From amphibians to mammals, associations of glomus, sustentacular and nerve cells occur in the area of the primary carotid bifurcation. The glomus cells are assumed to be the key chemoreceptive elements and, as members of the APUD series of the

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Physiology of diving birds: A Film produced by David R. Jones & William K. Milsom, Dept. of Zoology, U.B.C., Vancouver, CANADA. (1980).

The techniques used to study the physiology of diving birds in the laboratory are shown i.e. recording heart rate, arterial blood pressure and breathing. In dives, the animal holds its breath and heart rate falls while blood pressure remains unchanged. Experiments are shown which prove that, in ducks, the fall in heart rate is due to the stimulation of arterial chemoreceptors with hypoxic blood. An animation sequence is used to summarize these experiments. In deep divers (i.e. cormorants), blood oxygen tensions increase as they dive and chemoreceptors are not involved in causing diving bradycardia. Experiments and an animation sequence are used to explain the diving response in cormorants. The relation between body mass and underwater endurance is used to introduce the diving response seen in a one day-old duckling. Radioactive tracers are used in a visualisation of the reduction in peripheral circulation during diving. Finally, diving responses of ducks diving voluntarily are compared with those obtained from forced dives in the laboratory.

Duration 25 minutes
In colour
With optical sound
16 mm.

I have published over 20 abstracts which are not included in this list and made two films and two major television appearances (ABC, London; CBC, Toronto).

In the past ten years I have attended the following international meetings:

1. 1973 "Control of Breathing in Birds", Gottingen, W. Germany. Invited Speaker.
2. 1974 "Breathing and its Control", Albany, N.Y., U.S.A. Invited Speaker.
3. 1977 I.U.P.S. Meeting, Paris, France. Session Chairman.
4. 1977 "Control of Breathing - Adult and Embryonic", Gottingen, W. Germany. Invited Speaker.
5. 1980 I.U.P.S. Meeting, Budapest, Hungary. Symposium Speaker.
6. 1981 "George Holeyton Memorial Symposium", Waterloo, Ontario. Invited Speaker.
7. 1982 "Control and Co-ordination of Circulation and Respiration", Audrieu, Normandy, France. S.E.B. Symposium. Invited Speaker.
8. 1982 XVIII Congressus Internationalis Oinithologicus, Moscow, U.S.S.R. Invited Speaker.
9. 1982 "Adaptations to Extreme Environments", C.S.Z. Symposium, Vancouver, Canada. Organizer.
10. 1982 "Control of Breathing and Acid Base Balance in Ectotherms", Gottingen, W. Germany. Invited Speaker and Chairman.
11. 1983 "Breath-hold Diving and Asphyxia", I.U.P.S. Satellite Symposium, Port Stephens, Australia. Invited Speaker.
12. 1983 "Oxygen: physiological adjustments to changes in its supply and demand". I.U.P.S. Satellite Symposium, Queenstown, New Zealand. Co-organizer and Speaker.
13. 1986 XXX I.U.P.S. Congress, Vancouver. Plenary Lecture.
14. 1986 "Diving and Hypometabolism" I.U.P.S. Satellite Symposium, Cowichan Bay, Vancouver Island. Co-organizer and Speaker.

This list does not include my participation at biannual and annual meetings of the C.S.Z., C.P.S., S.E.B. and A.P.S.