ray. All five species, which lack retia, exhibit very low oxygen tensions at the retina, less than 30 mm. mercury. The observed correlation between the measured oxygen tension and the extent to which the choroid rete mirabile is developed suggests that the rete plays an essential part in establishing the large oxygen tension at the retina.

Two instances of transport of oxygen gas against a large concentration difference are now known. In each instance a rete mirabile is presumed to be the seat of transport, the gas gland or pigment epithelium playing an unknown but subsidiary part. The interesting question to be resolved is whether oxygen transport is a general property of cells magnified to easily measurable proportions by the rete mirabile acting as a counter-current multiplier¹⁶, or is some special property of the rete-gland complex.

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Effect of Concentration of Dissolved Oxygen on Survival of Trout and Roach in Lethal Temperatures

In the freshwater environment high temperature may be associated with low concentrations of dissolved oxygen, particularly in rivers receiving both heated and oxidizable effluents. Since the toxicity of some poisons is increased by lowering the dissolved oxygen concentration¹ and asphyxial levels of dissolved oxygen are increased by an increase in temperature², it is likely that lethal temperatures will be reduced by lowering the concentration of dissolved oxygen. Hitherto the lethal effects of high temperature on fish have been measured in the laboratory at concentrations of dissolved oxygen close to the air saturation value^{3,4}; the present work was undertaken to evaluate the effect of low concentrations on such measurements.

Rainbow trout (*Salmo gairdnerii*) (length 4.5 cm. $\pm$ 0.4 cm.) and roach (*Rutilus rutilus*) (length 12.3 cm. $\pm$ 1.8 cm.) were taken from water at 16° C. in May and acclimatized to 18° $\pm$ 0.5° C. for at least three

Fig. 1. Survival of trout and roach in lethal temperatures. A, Dissolved oxygen concentration, 7.4 p.p.m.; B, dissolved oxygen concentration, 3.8 p.p.m.

days before being tested. They were not acclimatized to low dissolved oxygen because a preliminary test showed that the survival-time of trout kept in a concentration of 4 p.p.m. and tested at 27° C. was similar (93 min.) to that (102 min.) of fish acclimatized to double this concentration.

Tests were carried out in 40-l. aquaria supplied with 1 litre/min. of water at either 7.4 or 3.8 p.p.m. dissolved oxygen, which was obtained by mixing appropriate proportions of air-saturated and nitrogen-saturated water. Trout in batches of ten and roach in batches of five were transferred to the aquaria and the concentration of dissolved oxygen fell by as much as 0.5 p.p.m. and tended to rise again as the fish died. Test temperatures were controlled within 0.1° C. The times of survival of the fish were observed until they had all died or until the tests ended after 24 hr. The individual periods of survival were distributed approximately log normally, and since there was an incomplete kill in some tests the median period of survival was estimated graphically⁵.

The relation between these medians and test temperature is shown for both levels of dissolved oxygen in Fig. 1. The survival time of trout and roach is lower at the low concentrations of dissolved oxygen than in the high ones, and though the difference is greater for roach than for trout the amount by which the temperature corresponding to a given period of survival is reduced by lowering the dissolved oxygen is similar for both species, amounting to 0.5° C. at 1,000 min. A fuller account of this and similar work being carried out will be given elsewhere.

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