Critical Oxygen Tension of *Caenorhabditis elegans*[1]

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Regulators are able to maintain a stable oxygen consumption, despite variations in ambient tension, down to a characteristically low "critical" oxygen tension. Below this tension, oxygen consumption is a function of ambient oxygen tension. Free-living nematodes are generally reported to have low critical oxygen tensions (4); i.e., they generally behave as regulators with respect to oxygen consumption. *Caenorhabditis briggsae,* a commonly studied free-living nematode, behaves as a regulator with a reported critical oxygen tension of 38 mm Hg (3). A closely related species, *Caenorhabditis elegans,* is reported to have a much higher critical oxygen tension, approximately 122 mm Hg (1). *Caenorhabditis elegans* would, therefore, be an exception to the generalization that free-living nematodes are regulators. The current study was undertaken to re-evaluate the influence of oxygen tension upon oxygen consumption in this species. A more accurate estimate of its critical oxygen tension may be useful in view of the increas-

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ing use of the species as an experimental model.

Our estimates of the critical oxygen tension of *C. elegans* were based on polarographic measurements of oxygen consumption. The strain of *C. elegans* and method of culture on petri dishes were those of Brenner (2). Worms were rinsed from the agar surface and separated from bacteria in 15-ml centrifuge tubes with three washes of N-buffer (50 mM sodium chloride plus 25 mM potassium phosphate buffer pH 6.0). Washed worms, approximately 15 mg dry weight, were introduced into the reaction chamber. The suspension media was 2.7 ml of N-buffer maintained at 20 C and stirred continuously. The oxygen tension within the chamber was monitored with a Clark type electrode, Radiometer model E5046-0, which had a zero current of less than 10^{-10} amps. Measurements of oxygen consumption were made over a wide range of oxygen tensions which included the critical oxygen tension.

A plot of oxygen uptake versus oxygen tension was made for each of 12 experiments and the critical oxygen tension was estimated (Fig. 1). For this experiment, the critical oxygen tension was 27 mm Hg; on the basis of 12 experiments, the average critical oxygen tension was 27.4 $\pm$ 4.9 mm Hg. There was no evidence of conformity at higher oxygen tensions. A possible explanation for the discrepancy between these results and those of Bair (1) lies in the different methods of measuring oxygen consumption. Bair's technique could result in establishment of a large oxygen gradient within the closed respiration chamber. The average oxygen tension in the chamber need not be close to the oxygen tension in the immediate environment of the worms. This situation could result in an error on the high side for estimation of critical oxygen tension. On the basis of polarographic measurements, the critical oxygen tension of 27 mm Hg is consistent with the classification of *C. elegans* as a regulator. This species apparently fits the generalization that the free-living nematodes are regulators.

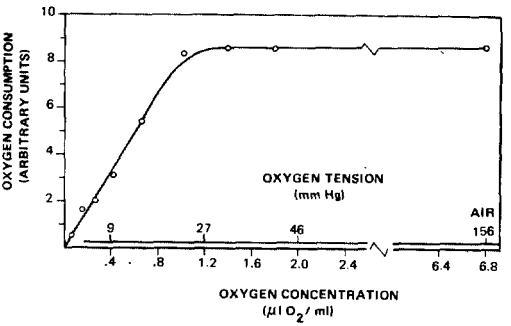

Fig. 1. Oxygen consumption versus ambient oxygen tension for *Caenorhabditis elegans*. (Consumption was measured polarographically on approximately 15 mg dry weight of tissue at 20 C).

LITERATURE CITED

1. BAIR, T. D. 1955. The oxygen consumption of Rhabditis strongyloides and other nematodes related to oxygen tension. J. Parasitol. 41: 513-623.
2. BRENNER, S. 1974, The genetics of Caenorhabditis elegans. Genetics 77:71-94.
3. BRYANT, C., W. L. NICHOLAS, and R. JANTUNEN. 1967. Some aspects of the respiratory metabolism of Caenorhabditis briggsae (Rhabditidae). Nematologica 13:197-209.
4. OVERBAARD NIELSON, C. 1949. Studies on the soil microfauna. II. The soil inhabiting nematodes. Natura Jutlandica 2:1-131.