unencysted brachylaemid metacercariae measuring 48 µ × 34 µ.

During the latter part of the summer a domestic rabbit was caged on the ground in a field of orchard grass and goldenrod where infected *V. ventricosa* form *elatior* were known to occur. This rabbit was returned to the rabbitry after 2 weeks; it began to pass eggs of *H. tricolor* 25 days after exposure. A second rabbit was maintained in the rabbitry and fed infected snails. Ten days after the last feeding of snails this rabbit was examined and found to contain a number of partially grown flukes measuring about 250 µ in length. This latter experiment was repeated, using two test and two control rabbits. These rabbits were maintained on a diet of prepared pellets, heat sterilized hay, and water. The test rabbits were fed infected snails for 4 consecutive days. Ten days after the last feeding the two test rabbits were found to be infected with numerous partially grown specimens of *H. tricolor*. The two control rabbits were negative.

The ecology of *V. ventricosa* form *elatior* has not been extensively studied. The snail is apparently capable of surviving in relatively arid habitats. In wet weather, at temperatures above 40° F, it becomes active and climbs to a height of a foot or more on vegetation. Since the snail is about 1/16 in. long it could readily be accidentally ingested by a feeding rabbit.

Further studies on the life cycle of *H. tricolor* are in progress and will be reported later.

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Polarograms of Oxygen in Lake Water

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The dropping mercury electrode was used to determine oxygen in lake water by Manning (*1*). The writer was introduced to the method by W. A. Spoor, of the University of Cincinnati and of this institute, with a view to determining the oxygen uptake of small aquatic insects. Although this objective was not attained, several aspects of the application were investigated.

Polarograms of oxygen at four levels of oxygen concentration are presented in Fig. 1, for Lake Erie water (90 ppm total alkalinity). The voltage-current relationship consists of two waves, one in the region up to about 0.6 v, and the second from about 0.8 to 2.0 v. These waves are indistinguishable at 1.4 ppm of oxygen because of the slight current flow. Above 2.1 v the relationship followed was essentially that of Ohm's law at all levels of oxygen. At zero potential applied, a negative current is generally expected, as indicated by the extrapolation of the 1.4 curve. However, the calomel half-cell and external anode system was such that it acquired the polarity of the applied emf and could be made to register in either direction. The three upper curves had a basis of − 0.16 v vs. the saturated calomel electrode.

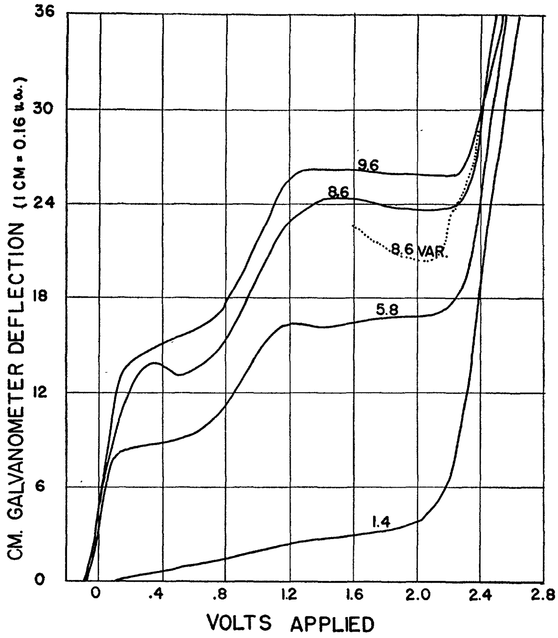

Fig. 1. Polarograms of Lake Erie water at 1.4, 5.8, 8.6, and 9.6 ppm concentrations of dissolved oxygen.

The existence of these oxygen reduction waves is well known. The points of interest here are (1) they were obtained with unmodified lake water in a flowing system, and (2) they indicate the best voltage at which to determine oxygen in such a system.

The flowing system was a plastic block drilled and fitted with 5 mm OD glass tubing. At right angles to this water line, holes were drilled in the plastic to receive the two electrodes: the cathode of marine barometer tubing; and the anode, a glass tube with a 5 mm diameter tip of Corning fine porosity, sintered glass filter. Mercury flowed through the capillary tubing, and saturated potassium chloride solution from a calomel half-cell seeped through the filter tip (0.16 ml flow/hr). Both these substances entered the water stream and were carried away in the effluent from the block. Voltages were applied across these electrodes and measured with a pH electrometer equipped with a voltage divider to increase its range. Electrical currents were measured with a moving coil, reflecting galvanometer. Water flow was controlled to within 1/10 ml/min by use of the Mariotte's flask principle in a constant-temperature room. The flow was 5 ml/min in the experiments presented in Fig. 1.

The usual procedure requires that the apparatus be calibrated at a single voltage. The 1-v Weston cell was used by Petering and Daniels (*2*), Manning (*1*), and Spoor (*3*). Although this is a convenient source of constant potential difference, it places the experiment at a region of the polarogram where the slope is steep (Fig. 1). Slight voltage changes in the system could thus cause considerable variations in the current at a constant level of oxygen. This hazard could be avoided by working at 1.6 v, where the current is relatively independent of the voltage over a wide range. Beckman (*4*) used the first oxygen reduction wave at 0.42 v, but the sensitivity to oxygen in this range is about half that at 1.6 v, and it is characterized by a very pronounced maximum (*5*).

The limiting currents (at 1.6 v applied) for each of the oxygen concentrations of Fig. 1 are shown in Table 1. There was a linear relationship between oxygen concentration and limiting current at 5.78–9.63 ppm with a slope of 0.44–0.46 μa/ppm. The ratio 0.32 at 1.43 ppm suggests a departure from linearity between low and high levels of oxygen. Variations in the residual current, however, could account for this discrepancy (*5*). A polarogram by Kolthoff and Lingane (*5*) indicated a sensitivity for oxygen of 0.67 μa/ppm, or about 45% greater than that obtained in the present experiments.

TABLE 1

LIMITING CURRENTS OF VARIOUS CONCENTRATIONS OF OXYGEN IN LAKE WATER

Oxygen (ppm)	Limiting current	
	μa	μa/ppm
1.43	0.46	0.32
5.78	2.63	0.46
8.62	3.89	0.45
9.63	4.20	0.44

The great sensitivity of the method is evident in the above data. However, troublesome variations made the present application unsuitable for critical determinations of respiration. A typical defection is shown in the dotted line of Fig. 1. At constant oxygen level (8.6 ppm) the galvanometer readings over the oxygen range were depressed as much as 3 cm from the usual values coincident with an observed increase in the mercury drop rate. This variation was associated with the diffusion of oxygen at the mercury surface, for it had its effect only below 2.2 v.

A supporting electrolyte was not used in the experiments; hence the wave height may have varied with the electrolyte content of the water at constant oxygen concentration. The seepage of potassium chloride from the calomel half-cell may be one source of trouble, although Spoor (*3*) recommended such a system to abolish variations in the limiting current at constant voltage.

Petering and Daniels (*2*) hoped to cancel out fluctuations in the readings that were due to temperature and accidental variations in the amounts of iron and other easily reducible substances by determining the current at 1.0 and 0.1 v. The oxygen concentration was then related to the difference between the currents flowing at these two voltages. However, in the present experiment (Fig. 1) there was a change of 12 cm in the galvanometer deflection at 0.1 v when the oxygen concentration was varied from 1.4 to 9.6 ppm. Also, the half-wave potential of the first oxygen wave may be expected at about − 0.05 v vs. the saturated calomel electrode (*5*). The 0.1 v reading is thus well above the decomposition potential for oxygen and should not be used to represent the residual current—that current which would flow in an oxygen-free solution at the working voltage.

The temperature coefficient of the process at 1.0 v was 1.3%/C degree at 4.3 ppm, and 1.6% at 8.0 ppm of oxygen. The latter value is equal to that applied by Manning (*1*), and both are within the range 1.3–1.6/degree quoted by Kolthoff and Lingane (*5*). Temperature and other variations that are a function of the total current obviously cannot be accounted for by the mere difference between the limiting and residual currents. A proportionality factor would have to be introduced. Frequent standardization against an air-saturated test solution (*5*) may yield more favorable results.

The dropping mercury electrode can be used to measure oxygen in flowing, unmodified lake water. However, the many variables which must be controlled or accounted for to obtain precise results render the method exceedingly difficult to apply in this manner.

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Relationship of Colloids to the Surface Tension of Urine

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The idea that colloids in the urine are of major importance in preventing precipitation, agglomeration, and conglomeration of crystalloids from a supersaturated solution has recently aroused renewed interest through the work of Butt and his associates. Ebstein in 1884 first suggested that the urinary crystalloids remain in the dissolved state through the protective action of the urine colloids (*1*).

Butt appears to have been the first to suggest that this protective action might be applied to the treatment of renal lithiasis (*2*). He found that the number of colloid particles visible in the urine when examined