

Respiration of So-Called Filterable Viruses.

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Some time ago one of us described a simple micro-respirometer which permits detection of very small amounts of CO_2 .¹

By the use of this method we were able to detect production of one cubic millimeter of CO_2 by 15 million staphylococci in less than ten minutes. However, this is not the limit of the sensitiveness of this method, since the time during which measurable amounts of CO_2 may be permitted to accumulate in the respirometer may be extended for days, so that the negative findings obtained by this method are significant.

Having failed to detect by this method evidence of respiration in filtrates of so-called bacteriophage,^{1, 2} we thought it of interest to inquire into the question of respiration (CO_2 production) by other so-called filterable viruses, particularly those of rabies and herpes. Since these viruses cannot be secured free from tissue cells, it was necessary, at the outset, to differentiate, on the one hand, between the oxygen uptake and the respiration proper with production of CO_2 , and, on the other hand, between the respiration of tissues as against that of the viruses themselves. The parallel use of Warburg's respirometer to determine oxygen uptake³ and of our closed cell respirometer¹ gave us the means of fulfilling the first requirement. In order to eliminate the effect of respiration of surviving tissue cells, fresh autopsy material was placed into 50 per cent glycerine and preserved in this condition for months. From time to time samples of these tissues were emulsified and subjected to test. In all, 6 experiments were made with fixed virus and 15 with virus of herpes. Emulsions, made from preserved tissues during the first 8 weeks of ageing in glycerin, showed oxygen uptake and production of CO_2 at approximately the same rate as did normal brain tissue preserved for the same length of time and under similar conditions.

After 3 months of ageing the fixed virus took up oxygen and transmitted rabies to fresh animals, but no longer produced CO_2 . When emulsified in Ringer's solution containing 1 per cent phenol, and kept at room temperature for 24 hours in the absence of oxygen, it continued taking up oxygen, when transferred to the respirometer, at approximately the same rate as before exposure to phenol, al-

though it had completely lost its infectivity by this treatment. It was evident, therefore, that oxygen uptake could not be attributable to the presence of the virus.

After a subsequent period of 3 months of ageing in glycerin, the samples of tissues yielded emulsions which were still infective but produced no detectable CO₂ during 48 hours sojourn in the respirometer, either under aerobic or anaerobic conditions.

The emulsions tested contained in each case 0.05 grams of tissue (by moist weight). This is twice the amount used for intracerebral injection in the test animals. Twenty-five thousandths of a gram of this material invariably produced typical symptoms, in a minimum number of days, and therefore, presumably contained a large amount of active virus.

These experiments suggest that either the viruses studied do not respire, or that the respiration proceeds at such a low rate that its detection is beyond the limits of the sensitiveness of the method.

¹ Bronfenbrenner, J. J., *Science*, 1926, lxiii, 51.

² Bronfenbrenner, J. J., *PROC. SOC. EXP. BIOL. AND MED.*, 1924, xxii, 81.

³ Warburg, O., *Biochem. Z.*, 1923, cxlii, 317.

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Photopharmacology. VII: Effect of Ultra-violet Rays on Germicidal Properties of Mercurochrome.

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The effect of Ultra-violet radiation on the potency of Mercurochrome Solution was studied on *B. coli*. The method used was as follows: 2 cc. of Mercurochrome Solution 1:500 was inoculated with one standard loopful of a twenty-four hour culture of *B. coli*. At the end of the exposure time, 0.1 cc. of the drug-and-organism mixture was removed by means of a sterile pipette and transferred to 5 cc. of sterile broth. Inasmuch as controls showed that in this transfer enough drug was carried over to prevent the growth, a second transfer of 1 cc. was made to 9 cc. of sterile broth. A control of this latter method of dilution showed that prompt and heavy growth of bacteria was obtained with these dilutions in the absence