of weight, diarrhea, and lethargy at an average dose of 400 mgm. per kg. on single oral administration. In natural *Balantidium coli* infestations in guinea pigs, it seems to be curative at a total of 200-225 mgm. per kg. on continued administration at daily or two daily intervals of 75 to 100 mgm. per kg. Toxicity may be encountered, however, at a total dosage only slightly higher than this indicated curative range on continued administration of the sublethal doses proposed.

5227

Ammonium Metavanadate as a Reagent for Reducing Carbohydrates.

VICTOR E. LEVINE AND ANNA MAY HUBBELL.

From the Department of Biological Chemistry and Nutrition, School of Medicine, Creighton University, Omaha, Nebraska.

A reagent consisting of 2% ammonium metavanadate in 10% sodium carbonate solution has proved effective in the detection of reducing carbohydrates or of non-reducing carbohydrates after hydrolysis. To make a test we heat on the water-bath 2 cc. of a 0.25% or 0.50% solution of the compound under consideration with 5 cc. of the reagent. A brownish to yellow color develops with a slight precipitate. On the addition of 1% hydrochloric acid, the mixture becomes clear and assumes a characteristic green color, due to the reduction of the metavanadate to a compound in which vanadium holds a lower valence. The acid must be added in quantities just sufficient to neutralize the reaction mixture, the point of neutralization being determined with litmus paper.

The following compounds reduced with the formation of the characteristic color: pentoses (xylose, arabinose, rhamnose); hexoses (glucose, glucosamine, levulose, galactose, mannose); disaccharides (lactose, maltose, cellobiose). The following compounds reduced only after preliminary subjection to hydrolysis followed by neutralization: disaccharides (sucrose, trehalose); trisaccharides (raffinose, melizitose); polysaccharides (dextrin, starch, inulin, glycogen, cellulose); glucosides (aesculin, amygdalin, arbutin, phloridzin, strophantin, picrotoxin, salicin, saponin); gums (arabic, acacia, tragacanth); glycoproteins (mucin, ovomucoid); glycolipins (phrenosin); nucleic acid.

Compounds other than carbohydrates also reduced. Cysteine gave

a green color; lactic acid, a royal blue; oxalic acid, a green; mucic acid and citric acid, dark blue; tartaric acid, a royal blue with a purplish tinge; and pyruvic acid, green.

The reagent, however, is more sensitive to the sugars than to the organic acids. The limit of sensitivity for glucose is 0.03%. Citric acid reduces in a 3% solution, but not in a 2% solution. Tartaric acid reduces in a 2% solution, but not in a 1% solution. Lactic acid does not react in a 0.9% solution. Oxalic acid gives a faint reaction in a 4% solution, but no reaction in a 3% solution. Pyruvic acid gives a green color in a 5% solution, but not in a 4% solution. Mucic acid proves positive in a 3% solution, but not in a 2.5% solution. Cysteine hydrochloride gives a green color in a 0.5% solution, but no color in a 0.25% solution.

Chloroform, uric acid and allantoin, creatinine, formaldehyde, acetaldehyde, acetone and β-hydroxybutyric acid do not respond. Ethyl acetoacetate reacts in the negative, but after hydrolysis with dilute hydrochloric acid it gives a faint green color. Proteins do not interfere with the reaction.

5228

Oxygen Consumption of the Cardiac Ganglion of Limulus Polyphemus.*

MARGARET DANN AND EDITH M. GARDNER.
(Introduced by W. H. Chambers.)
From the Marine Biological Laboratory, Woods Hole, Mass.

The CO_2 production of the cardiac ganglion of Limulus has been studied by Garrey,[1] who found a direct quantitative relation between the rate of the heart beat and the rate of CO_2 formation in the ganglion. Both of these rates were augmented when the ganglion was stimulated chemically, mechanically, or electrically, and diminished when the inhibitory nerves were stimulated.

The object of our experiments was to study the oxygen consumption of the ganglion during rest and during electrical stimulation.

* This work was performed under the direction of Dr. W. E. Garrey and Dr. R. W. Gerard as a part of the Physiology Course of 1930 at the Marine Biological Laboratory, Woods Hole, Mass. We wish to acknowledge our indebtedness to them for their advice and help and for permission to publish our results.

[1] Garrey, W. E., *J. Gen. Physiol.*, 1920, **3**, 163; 1921, **4**, 149.