bonate-Ringer's solution and that this carbohydrate synthesis is associated. with respiratory quotients below 0.7. Since lactic acid was not present in sufficient quantity, they assumed that the newly formed carbohydrate originated from fat.

It was noted in this laboratory that the inorganic phosphate content increases and the phosphate fraction difficult to hydrolyze in N HCl decreases when liver slices of rats are shaken for 3 hours in oxygenated bicarbonate-Ringer's solution. This suggested that glycerophosphate might be a source of carbohydrate in the liver.

Of 3 equal portions of liver slices from fasted rats, one was analyzed after 15 minutes for its total (fermentable) carbohydrate content, while the other 2 portions were incubated for 3 hours, one without and one with added substrate and then analyzed in the same manner as the first portion. Addition of α- or β-glycerophosphate or of glycerol caused in each case a greater increase in fermentable carbohydrate content than incubation of the liver without added substrate. The phosphorylized products were more active than glycerol. Under anaerobic conditions an increase of the carbohydrate content of the liver did not take place.

It was ascertained that during incubation of liver slices with α-glycerophosphate more inorganic phosphate was liberated than during incubation without added substrate. In muscle α-glycerophosphate interacts with pyruvic acid to form dihydroxyacetonephosphate and lactic acid. The mechanism of carbohydrate synthesis in the liver may be different, because addition of pyruvic acid or alanine (which would be deaminized to pyruvic acid) either alone or with α-glycerophosphate has so far not given clear-cut results.

The present experiments emphasize the importance of the glycerol part of the lipid molecule as a source of carbohydrate in the body and they do not lend support to the idea that fatty acids are converted to carbohydrate in the mammalian liver.

CARL F. CORI
WILLIAM M. SHINE

WASHINGTON UNIVERSITY
SCHOOL OF MEDICINE
ST. LOUIS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

BACTERIOLOGICAL EXAMINATION OF THE CONTENTS OF THE CLOSED ARM IN THE SMITH FERMENTATION TUBE

How often has the curiosity of the bacteriologist been directed to the chemical or biological conditions induced by bacterial flora under anaerobic environment in the closed arm of the Smith fermentation tube, and how often has he been foiled in securing an uncontaminated sample! Attempts to solve this problem have been made in the past, first, by substituting the so-called fish-hook tube with open ends, the longer of which was stoppered; and next, by the introduction by Hill[1] of a modified Smith tube, where the upper end was left opened and into which a glass thimble was made to fit snugly by ground glass surfaces.

In the first case, practical difficulties were encountered, owing to the frequent unexpected loosening of the stopper in the upper end of the fish-hook tube; to inability to readily handle such tubes in racks or other types of holders; and also to the impossibility of utilizing large quantities of inoculum. In the case of Hill's modification of the Smith tube, it was found that by repeated sterilization procedures the upper end of the tube or the thimble would crack and so render the tube useless, and annoyances were encountered in fitting the proper thimble into the end of a tube, where a series of such tubes were being cleaned up after use.

To obviate all these difficulties, and in fact to make the object of the removal of the contents of the closed arm easily carried out, the writer suggests the procedure which follows:

The usual footless type of the Smith fermentation tube (A.P.H.A. model) is taken, and with the thumb held firmly over the opening of the bowl, the end of the tube is brought in contact with a small-sized jet of flaming gas of a blast burner, being careful that the point of the flame impinges centrally on the closed end of the tube. As the glass begins to melt the enclosed air within the tube expands and blows out a small opening in the end of the tube. Everted edges of the opening are now to be held in the flame for a period sufficiently long to produce retraction of the everted lip of the opening to a level with the remaining surface of the glass. It should be the object of the operator to form an opening somewhere close to 3 mm; such an opening will readily accommodate either the passage of a fair-sized hypodermic needle or the drawn-out end of a glass pipette.

The next step involves the use of a method to effectually seal the opening made in the closed arm of the tube, and at the same time to offer later on the minimum of resistance to the passage of the hypodermic

[1] *Jour. Boston Soc. Med. Sci.*, January, 1899.

needle or glass pipette. This is accomplished by carefully fitting on a "Viscose cap" of a diameter of 16 mm and a length of 19 mm, such as is made by the Dupont Cellophane Company of New York. The tube, or tubes, should then be set aside at room temperature to permit the caps to shrink down slowly and snugly on the tube and to become perfectly dry. Attempts to hasten this by drying in a hot-air oven is not recommended, as the viscose caps tend to wrinkle and lead to the production of air channels which would defeat the purpose of the whole process, as leakage of the contents outwards during sterilization and suction of air within the tube upon cooling would result, not to mention subsequent contamination of the sterile contents of the tube.

When the viscose cap is found to be thoroughly dry and closely adherent, without any imperfections such as described, the tubes may then be filled with dextrose or other broths and sterilized in the usual way in the autoclave at 15 pounds for fifteen minutes. It will be found after sterilization that the adhesive properties of the viscose caps have in no wise undergone any deterioration and the seal, in consequence, remains intact.

Following upon subsequent inoculation and incubation, removal of samples from the contents of the closed arm is carried out by piercing through the cellulose cap directly over the hole in the upper end of the closed arm of the tube by simple pressure of the point of the needle of the hypodermic syringe, or by a drilling motion with pressure applied to the broken-off end of the capillary shank of a glass pipette, to which one has previously affixed at the proper end a small rubber bulb for suction purposes. Of course, before using the hypodermic needle or glass pipette, one must observe to remove the cotton plug and substitute a cork or a rubber stopper; otherwise, upon breaking open the sealed end, air pressure would cause the contents of the closed arm to immediately flow into the bowl.

The writer has found upon repeated tests that this method of the examination of the contents of the closed arm of a Smith fermentation tube may be regarded as easy, adequate and trustworthy.

NORMAN MACL. HARRIS
LABORATORY OF HYGIENE
DEPARTMENT OF PENSIONS AND
NATIONAL HEALTH
OTTAWA, CANADA

A DEVICE FOR AERATING AND CIRCULATING AQUARIUM WATER

A COMPACT, efficient air-water pump for aerating and circulating the water in an aquarium or water bath is illustrated in Fig. 1. In use, no parts of the apparatus other than the air inlet tube remain outside of the water container.

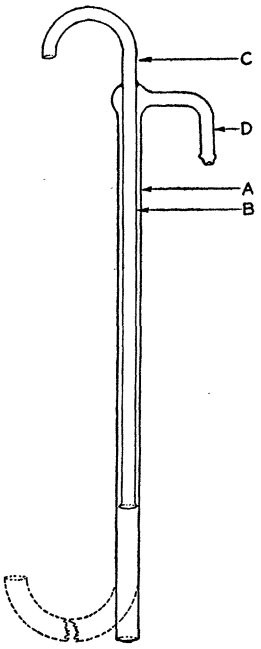

FIG. 1. A device for aerating and circulating aquarium water.

The apparatus consists of a Pyrex tube A of suitable length, with an inside diameter of 0.8–1.0 cm, inside of which is sealed a shorter glass tube B which connects to an outlet tube C of any desired shape or size. An air inlet tube D is sealed to the upper end of tube A.

The length of the submerged portion of tube A should be at least twice that of the unsubmerged portion of the apparatus. Air under low pressure is forced in at D and escapes into tube B. Due to hydrostatic pressure a column of water forms ahead of each bubble of escaping air and is forced through the outlet tube into the aquarium or other container.

The rate of air-water flow is controlled either by varying the air pressure or by changing the diameter of tube B. A maximum flow of about 150 cc of water per minute can be obtained by the use of glass tubing of 5 mm inside diameter, whereas a maximum flow of about 500 cc of water per minute can be obtained by the use of 8 mm tubing.

PHILIP L. VARNEY
WASHINGTON UNIVERSITY
SCHOOL OF MEDICINE

BOOKS RECEIVED

DOLE, MALCOLM. *The Principles of Experimental and Theoretical Electrochemistry.* Pp. xiii + 549. Illustrated. McGraw-Hill. $5.00.

FENTON, CARROLL LANE. *Along the Hill.* Pp. viii + 96. Illustrated. Reynal and Hitchcock. $1.25.

FULTON, JOHN F. *A Bibliography of Two Oxford Physiologists, Richard Lower, 1631–1691, and John Mayow, 1643–1679.* Oxford University Press, England.

Internationale Tabellen zur Bestimmung von Kristallstrukturen. Vol. I, Table on the Theory of Groups. Pp. xii + 452. 464 figures. Vol. II, Mathematical and Physical Tables. Pp. viii + 453–692. Gebruder Borntraeger, Berlin. 33.—RM geh. 40.—RM gebd.

KEEP, JOSIAH. *West Coast Shells.* Pp. xi + 350. 334 figures. Stanford University Press. $3.75.

MIDDLETON, L. R. *A Textbook of Light.* Pp. viii + 228. 189 figures. G. Bell, London. 6/–.

MILLER, DAYTON C. *Anecdotal History of the Science of Sound to the Beginning of the Twentieth Century.* Pp. xii + 114. Illustrated. Macmillan. $2.50.

ROBSON, WILLIAM A. *Civilization and the Growth of Law.* Pp. 354. Macmillan. $2.50.

SNODGRASS, R. E. *Principles of Insect Morphology.* Pp. ix + 667. 319 figures. McGraw-Hill. $6.00.