Association, the American Folk-Lore Society and Section H. One of these will be on "The Archeology and Ethnology of the Southeastern United States" and the other on "Ethnological Field Methods."

Section I (Psychology) has practically completed arrangements for a symposium on "The Psychological Significance of Birth Lesions." Interesting motion pictures will be shown at this session.

Section K (Economics, Sociology and Statistics) and Section M (Engineering) and the Econometric Society have completed the program for a timely symposium on the "Stabilization of Employment." Complete success has been met in securing outstanding scientific men to speak on matters which they have been seriously studying for considerable time. Monetary, credit and capital aspects of the stabilization of employment problem will be discussed by Dr. Irving Fisher, Dr. James W. Angell and Dr. Alvin Hansen. Science and machinery aspects will be considered by Dr. C. F. Kettering, Dr. Dugald C. Jackson and Dr. Walter Rautenstrauch. The problems of agricultural stabilization will be discussed by Dr. Elmer Working. The stabilization of employment by means of public works will be treated by Dr. Leo Wolman and Dr. W. N. Loucks. Employment insurance will be discussed by Mr. Gerard Swope and Dr. H. L. Rietz. Legislative aspects will be considered by Dr. K. T. Compton and Dr. Royal Meeker.

Section K and the Econometric Society are also organizing a symposium on "Central Bank Policy," led by Dr. Carl Snyder, of the Federal Reserve Bank of New York. A third symposium on "Sociological Statistics" is being organized by Dr. W. F. Ogburn, chairman of the Section.

Section L and the History of Science Society are completing arrangements for four sessions devoted to symposia. These are: (1) "History of Oriental Science," with Dr. Berthold Laufer, Dr. Cyrus H. Peake, Dr. C. A. Browne and others; (2) "History of Medical Science," with addresses by Dr. Howard T. Karsner, Dr. H. E. Sigerist, discussion led by Dr. Harvey Cushing and Dr. Wm. H. Welch as presiding officer; (3) "Biography," with a series of invitation papers considering the subject from the points of view of the historian, by Dr. C. O. Paullin, the anthropologist, by Dr. Alfred Tozzer, the biologist, by Dr. W. M. Wheeler, and the psychologist, probably by Dr. Knight Dunlap; (4) "Primitive Linguistics," with Dr. H. F. Nedall, Dr. Truman Michelson, Dr. George Herzog and Mr. Gerhardt Laves. It is expected that speakers in the symposium on linguistics will give demonstrations which will make the program of popular interest. In particular, Dr. Herzog will demonstrate the drum language of West Africa.

A description of the symposium on the Stabilizaiton of Employment organized by Section M (Engineering) and Section K is given above. In addition to this session, in which Dr. Dugald C. Jackson, Dr. C. F. Kettering, Dr. Walter Rautenstrauch, Dr. K. T. Compton and others will take part, an invited program on "Radio Problems" is planned for a joint meeting with the Institute of Radio Engineers. Speakers on this program will be Mr. C. N. Weyl, Mr. A. V. Loughren, Dr. Richard Kovacs, Mr. C. B. P. Aiken, Mr. H. F. Olsen and Mr. F. Massa.

Section O (Agriculture) will hold a symposium on "Nitrogen in Relation to Crop Growth and the Use of Nitrogen Fertilizers." Among the speakers will be Dr. J. G. Lipman, Dr. B. E. Gilbert, Dr. A. B. Beaumont, Dr. S. A. Waksman, Professor J. W. White, Professor A. W. Blair, Professor G. L. Schuster, Dr. R. P. Thomas and others. Further details of the Section O program will be given in a later issue of SCIENCE.

CHARLES F. ROOS,
Permanent Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A GLASS ELECTRODE FOR TESTING THE pH OF BLOOD

A RATHER novel form of glass electrode and containing vessel for the measurement of the pH of blood has been developed for a study of blood that is now being made in the Department of Physiology, School of Medicine, Yale University. The electrode differs from the usual MacInnes type of electrode in that the glass tube is tapered near the end like a sharpened pencil and the glass film that is welded on the tip is very small in diameter, usually about ¼ mm.

This form of electrode is obviously much stronger, for an equal thickness of glass film, than one of large diameter and is not very hard to make. The electrode when lowered into the containing vessel plugs the top of the central capillary tube. The fit, however, must not be so tight as to prevent a flow of blood up the capillary tube and past the electrode when the sample of blood is taken in.

The blood, taken by the method described by Himwich and Castle,[1] enters the containing vessel without exposure to air at A. The blood is let in slowly and at first stop-cocks B and C are turned to divert the flow of blood towards the vent D. As soon, however, as stop-cock C is full of blood it is turned to

[1] *Amer. Jour. Physiol.*, 83: 92–114, 1927.

shut off the flow in that direction and stop-cock B is given a quarter turn, allowing fresh blood to rise up and around the tip of the electrode. The blood should stand from ½ cm to 1 cm above the electrode tip. Stop-cock B is then given a final quarter turn, to the position illustrated, and the tonometer is then disconnected.

Only about ¼ cc of blood is required for a filling, and, by using smaller and shorter capillary tubes, this amount could be reduced. The apparatus is water-jacketed, and water at 38° C. circulates through the jacket while the sample is being taken in. For pH measurements the apparatus is disconnected and transferred, with full water-jacket, into a 38° C. constant-air-temperature potentiometer-box.

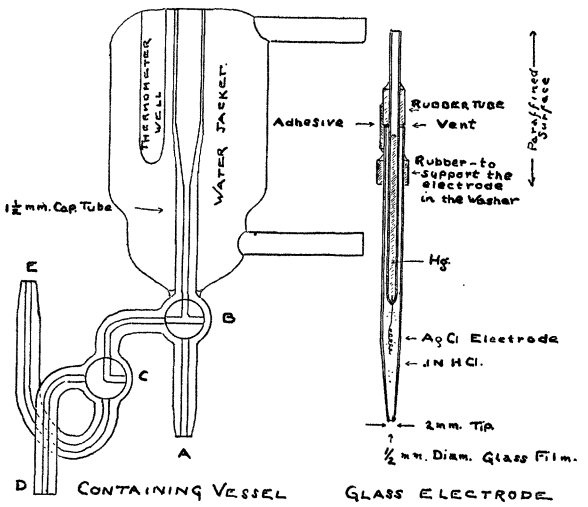

FIG. 1

The calomel half-cell and K Cl reservoir are kept in the constant-temperature box and, after the K Cl connection is made at E, stop-cock C is rotated, first to wash the blood out of the stop-cock bore and then, by an additional half turn, to make a junction between the K Cl in the bore and the blood in the capillary tube. This is the position of this stop-cock in the illustration. Stop-cock C is not greased, except a little at each end, and enough K Cl wets the glass to make an electrical connection between the K Cl in the stop-cock bore and the K Cl supply. It may be necessary slightly to roughen this stop-cock, but it must not be grooved or scratched to such an extent as to cause an actual leak.

The constant-temperature box and the vacuum-tube potentiometer used have been described in a former paper.[2]

[2] *Jour. Biol. Chem.*, 88: 729, 1930. Note that in Fig. 4 of this paper one switch is omitted through error. Add a single pole switch to short-circuit the lower contracts of switch E. This switch is closed when switch E is in its up position.

This electrode was designed primarily to eliminate drifting potentials, which can be a very serious source of trouble in the measurement of the pH of blood by glass electrode. It was found that this drifting is linked with the settling of the blood corpuscles around the electrode, or possibly with the flow of corpuscles past the electrode as they settle. With an electrode plugging the top of a capillary tube containing blood there can be no settling of corpuscles around the electrode, and such few corpuscles as drift down from above the electrode are negligible in effect. Not every electrode of this type is successful, but the majority are, and drift during measurement is no longer a serious obstacle.

A glass electrode may be considered electrically as a condenser and, as such, subject to charge and also to di-electric absorption. In other words, it can pick up and persistently hold electrical charges which at ordinary temperatures dissipate only very slowly. (The thicker the glass the worse the electrode in this respect.) Any liquid flow past the glass will charge the glass electrically and it follows that due to washings and blood fillings a slight charge can not be avoided. This being the case, it is obvious that a very definite and uniform procedure or cycle of washings, fillings and readings will give the most consistent results. Washings after a blood reading are always made first in isotonic saline and then in distilled water and, for these washings, there are two glass washing tubes a little larger in diameter than the electrode. These washing tubes are fixed in a rack and the water in them very slowly wells up from the bottom. The electrode is carefully lowered and hung suspended first in the washing tube containing saline and then in that containing distilled water; thus the washing is the same after each blood filling. Drying the electrode with alcohol followed by ether was tried but finally abandoned as tending to disturb stability, but alcohol, followed by vacuum, is useful for rapidly drying the containing vessel.

The testing technique includes, as part of each cycle, a test with a standard buffer (standard acetate) between each blood determination, and unless the voltage reading of the standard buffer tests, before and after a blood determination, are nearly the same, the blood determination is repeated. If a new electrode does not soon settle down to a sufficiently constant condition of charge, it should be discarded. Sometimes an electrode will work well for a number of days and then show too great a change of charge between blood samples. It should, of course, be discarded.

In making an electrode, the glass wall of the tube should be carried down fairly thick when pulling out the tip, and the tip end, about 2 mm in diameter at

first, is then fire-polished until almost closed before it is brought up against the bubble of special electrode glass. If the electrode proves water tight when dipped in water, a little 0.1 N HCl is run into the electrode tube and the tube is stood in a beaker of water which is brought to a boil. This removes the air trapped in the tip of the electrode and at the same time relieves its electrical stresses, so that the electrode can be used as soon as finished. A silver chloride electrode (equilibriated to .1 N HCl) is then fastened in place with a bit of adhesive tape, leaving however a vent for air expansion, and a coat of paraffin is applied to the top of the electrode. It is then ready for use.

In work on the pH of the blood a difference of .01 is not considered a very significant change. This corresponds to an accuracy of voltage measurement of .6 millivolts. Any given filling can be measured with an accuracy of about .2 millivolts, but at times the variations, between fillings, of the charge held by the electrode may considerably reduce this accuracy. However, sufficient accuracy can be maintained without great difficulty.

Below is given a protocol of the tests made with this equipment on August 8, 1932. All readings are at 38° C. Three blood samples were tested for comparison, A_1, A_2 and A_3. The standards buffer was standard acetate with a pH of 4.64 at 38° C.

Blood	Voltage readings		pH of blood
	Standard buffer	Blood	
	.1060 .1059		
A_1		.2721 .2720	
	.1068		
A_1		.2722	7.32
	.1067		
A_2		.2722	7.32
	.1065		
A_3		.2679	7.25+
	.1067		
A_3		.2682	7.26−
	.1067		

Note that the electrode reached sufficient stability before the first blood reading was taken.

DELAFIELD DUBOIS

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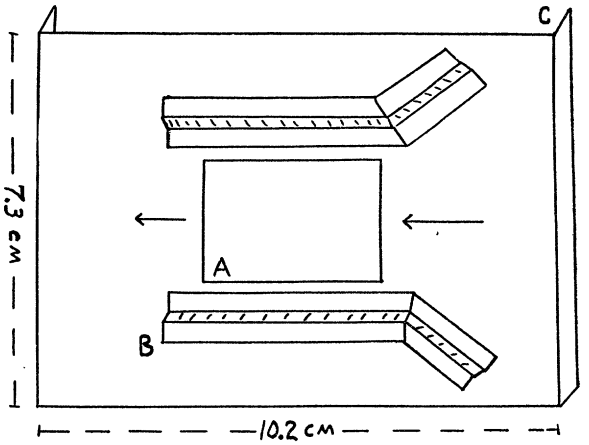
MOVING PICTURE FILM ADAPTER FOR ROLL FILM CAMERAS

IN work requiring a series of pictures, such as progressive development of symptoms of vitamine deprivation, neuro-surgical symptoms, complicated apparatus set-ups, operative steps in difficult experiments, duplicating for future reference pages from loaned references or for obtaining serial photos of any material, the following adapter will enable one to use the ordinary moving picture film in a regular roll film camera. The size adapter described here was used successfully in a camera designed for No. 120 roll film, although by a simple modification of measurements it could be used in larger or in smaller cameras.

The material used in construction was light sheet tin, painted a dull black to avoid reflection. The aperture A was cut 35 by 24 mm, although it could be made longer or shorter or even made to handle the narrow 16 mm film instead of the larger size. B indicates the guiding channels; these are shaped strips flared as shown and extended beyond the open window about a quarter of an inch to aid in giving the film flatness. These strips are easily soldered in place. C are the flanges to hold the adapter plate in place in the camera; these insert below the usual small metal rollers found in cameras. When in place the adapter does not interfere in changing film cartridges in daylight.



In preparing the film for use in the camera, old rolls of backing paper and film spools are obtained from the photographic supply house or from a developer of films. This is laid flat, black side down on a table and new numbers are placed about 26 mm apart in line with the old film numbers. These numbers should be spaced about 2 mm more apart than the length of the aperture A, to prevent possible fogging of adjacent film. Such spacing also marks off the exposures more clearly.

In the darkroom the film is cut as long as the regular film or about 80 cm. Gummed stickers are used to hold the film in position, and the film cartridge is then rolled and sealed with a sticker so as to be available for daylight loading of the camera.

Positives may be made from the negatives and these