single throw key is used, the wiring can be simplified by the use of a commutator attached to the kymograph. For example, in the fundamental experiment of determining the phases of a single muscle twitch, the use of the commutator obviates the necessity of the signal magnet to mark the point of occurrence of the stimulus. After the twitch has been recorded on the revolving drum the point where the stimulus entered can be shown quite easily on the same record by turning the drum around to a point just preceding that of entry of the stimulus. Now if the drum is run at its slowest speed until the contact is made, the muscle will again contract and thus mark the point of entry of the make or break shock. Also the arc of the muscle lever will be recorded so that errors due to it can be compensated for on the original record. Thus the commutator simplifies the above experiment by reducing the electrical wiring, eliminating the signal magnet and its additional "scratch marks," and giving a single tracing for the muscle twitch and the occurrence of the impulse, besides picturing the arc of the muscle lever. In many other experiments simplification of wiring and more positive electrical contacts can be produced.

The construction of the commutator is as follows. A brass collar (1, Fig. 1) of slightly greater diameter

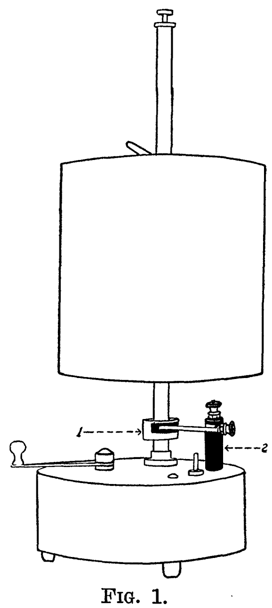

FIG. 1.

than the base of the upright stand is fastened to the shaft of the drum by a countersunk set screw. One half of the circumference of this collar is insulated by an inset piece of bakelite. Then the collar is turned and polished to insure good edges since these are necessary for perfect contacts. All metal parts can be plated to give a more pleasing effect, if so desired. A bakelite binding post (2, Fig. 1) is then mounted in place of one of the three machine screws found on the top of the base of the kymograph. A long machine screw passes into this base and affords the "ground" contact. The upper end of this machine screw is fitted with nuts which hold the post in position and serve as a binding post.

The second contact consists of a strap of brass bound around the bakelite post and making a sliding contact with the collar (1). A slight tension of the brass strip affords a good contact and in no way impedes the turning of the drum. If the commutator is not to be used the bakelite post (2) can be turned slightly to disengage the strap from the rotor. For the sake of simplicity in the accompanying diagram the stop lever and fan have been omitted from the sketch, although they do not interfere with the apparatus in any way.

By varying the position of the secondary coil of the inductorium, threshold make and break shocks can be obtained, and thus one or two stimuli per rotation of the drum can be had at will.

The author acknowledges the assistance of the university technician, W. E. Fish, in the designing and constructing of the commutator.

WM. A. HIESTAND

MENINGOCOCCUS PRECIPITATING ANTIGEN FOR ROUTINE TESTING OF THERAPEUTIC SERUMS[1]

ONE of the generally used methods of standardizing the potency of anti-meningococcus therapeutic serums is the determination of their precipitating titers. It is therefore necessary to have a highly specific antigen and one that could be kept for a long time without appreciable deterioration. After considerable experimentation with different preparations, the following preparation gave us the desired results.

Meningococcus cultures of standard types are grown on 0.5 per cent. glucose beef-heart agar, pH 7.2 to 7.4. Several successive transplants are made at 24-hour intervals. Then a 24-hour growth is scraped into sterile physiological saline, the suspension is shaken by hand and filtered through a thin layer of sterile absorbent cotton to eliminate particles of agar that may have been carried over. The filtered saline suspension of the cocci is centrifuged at high speed until the cocci are precipitated. The supernatant fluid is discarded and the cocci are suspended in sterile distilled water, using ten times the volume of water to each volume of packed cocci. To this 10 per cent. of commercial antiformin is added and the mixture is placed in boiling water until the cocci are

[1] From the Bureau of Laboratories, New York City Department of Health; Director, Dr. Wm. H. Park.

dissolved—usually 10 minutes. The solution is centrifuged for 30 minutes at high speed, and the clear supernatant fluid is added drop by drop to 95 per cent. alcohol in 50 cc centrifuge tubes using 1 cc of the supernatant fluid to each 20 cc of alcohol; a precipitate forms immediately. The tubes are centrifuged for 5 minutes at low speed, the alcohol is poured off and the tubes are filled with 95 per cent. alcohol which contains 0.2 per cent. HCl. The sediment usually adheres to the sides and bottom of tubes. This should be scraped by means of a pipette and thoroughly mixed with the acid alcohol; care should be taken to break up large clumps. This is centrifuged for 5 minutes, the acid alcohol poured off and the sediment washed twice in 95 per cent. alcohol, using the same procedure as above. After the final washing, the alcohol is drained off and the sediment dissolved in saline, using 10 times the amount of the original packed cocci. The sediment dissolves readily in the saline, and in order not to lose any of the sediment, the necessary amount of saline is added to the centrifuge tubes. The solution is then collected and placed in sterile centrifuge tubes and heated in boiling water for 20 minutes. It is then centrifuged for 30 minutes at high speed and the clear supernatant fluid collected aseptically into small sterile vials and stored in the ice box.

The antigen is standardized by testing with known homologous and heterologous serums, using various dilutions of the antigen and the optimum dilution of the antigen is determined by repeated tests. This dilution is then used as the standard dilution for the routine testing of the antimeningococcic serums.

The antigen can be kept almost indefinitely when stored at 8 to 10° C. Care should be taken not to contaminate it. We have been using antigens prepared according to this method for the past several years in testing our therapeutic serums, also to follow the response of the horses during the process of immunization, and found the antigens stable and highly specific.

LUCY MISHULOW

SPECIAL ARTICLES

INVESTIGATION OF OVERTHRUST FAULTS BY SEISMIC METHODS[1]

IN the great mountain belts the earth's crust has been severely buckled and fractured, apparently mainly by horizontal compressive forces. Of the various types of folds and faults that developed in the course of this deformation the enormous overthrust faults are among the most important and interesting. Along these horizontal or gently sloping fractures huge slabs of the crust ranging from thousands of feet to miles in thickness have been thrust forward for distances of miles and sometimes for many tens of miles. The length of these faults, traced along the surface, is from tens to hundreds of miles. Their extension backward and downward into the crust is presumably of comparable dimensions, but in view of the limited thickness of that part of the crust which has suffered mountain-making deformation, it is unlikely that the depth to which they reach exceeds a few tens of miles. On our own continent the Rocky Mountains of the northern United States and of Canada have been thrust many miles eastward over the margin of the Great Plains along such overthrust faults. In the southern Appalachians each of the several slabs shown in any cross section has ridden westward over its neighbor. In the Alps and in the Highlands of Scotland overthrusts on a tremendous scale have been recognized.

Until the shape of the fault surfaces is known it will be very difficult to gain an understanding of the mechanics of the overthrusting process. Suppositions regarding their form have ranged from convex upward to concave; Longwell has suggested that the presumable convexity of the portion near the trace may change to concavity farther back under the plate. It has been difficult, however, to ascertain the three-dimensional form of these remarkable structures, since observation of them is limited to the trace—the intersection of the fault surface with the land surface—and to occasional fensters or windows where a stream has cut through the overriding plate to expose the undermass. Clearly it is desirable to gain any information possible regarding the shape of the fault surface, or of any part of it back of the trace. So far as known, no previous attempt has been made to secure such data for great overthrusts by utilizing seismic reflections. The experiment was tried only after several years' experience with the method and after considerable success through its use had been attained in determining folded structures in stratified formations.

Elastic waves in the crust of the earth are reflected when they encounter a surface between two layers or bodies in which the waves are propagated at different

[1] Contribution 164 of the Balch Graduate School of the Geological Sciences, California Institute of Technology, Pasadena.