pattern for celluloid. For a large microscope piecing may be necessary. Use celloidin, or better, Dupont Duco Cement, permitting the first application to partly dry, apply a second layer of cement, hold in place with weights or pressures for ten minutes and the job is done. (I have such a cone fitted over a Leitz research microscope standing on a Chambers micro-dissection apparatus, all beautifully visible yet dust-proof.) A cone frustum would be better looking but slightly more difficult to make, though it is merely a matter of fitting in the top. It also would eliminate the piecing necessary for the cone.

By folding the celluloid over a wire frame to give better rigidity I have made a celluloid case to cover a Thoma-Jung microtome. Dr. E. P. Bartlett, seeing this, conceived the idea of making dust-proof cases for beam balances. These are folded and cemented like paper boxes.

F. A. VARRELMAN

AMERICAN UNIVERSITY

DEVELOPMENT OF A PERMANENT BLUE COLOR FOR COLORIMETRIC PHOSPHORUS DETERMINATION

THE blue color used as a standard for Dénigés colorimetric method for the determination of phosphorus is very unstable. The color fades rapidly and a new color standard must be prepared rather frequently. By reducing a solution containing 2.5 grams of ammonium molybdate in 100 cc of 10 n. sulfuric acid a permanent blue color can be developed. The solution is reduced by stannous chloride. A dense blue color is formed which can be diluted to the desired intensity by adding 10 n. sulfuric acid. With proper dilutions a series of standards can be prepared which represent definite readings of phosphorus in parts per million.

The blue color developed under the latter condition is of a slightly different hue from the color of the reduced standard phosphorus solution but this slight difference in color is not enough to be objectionable. As a matter of fact, this permanent blue color compares as well to the unknown blue color as to the blue standard phosphate color.

The shades of blue color vary with the higher concentration of both ammonium molybdate and sulfuric acid. With the mentioned amount of ammonium molybdate in a slightly lower concentration than of 10 n. sulfuric acid a bright yellow color is produced upon reduction.

A. H. MEYER

LOUISIANA STATE UNIVERSITY

SPECIAL ARTICLES

AN EFFECT OF SHORT ELECTRIC WAVES ON DIPHTHERIA TOXIN INDEPENDENT OF THE HEAT FACTOR

ABOUT thirty-five years ago D'Arsonval and Charrin found that high frequency currents of 200,000 cycles per second diminished the strength of diphtheria toxin. This effect was obtained without elevation of temperature to a level which would by itself affect the toxin. Since that time little has been done to develop this finding. Recent advances in short wave technique have given new impetus to the study of the biological action of these waves. It is readily accepted from many recent papers that such electrical waves may produce tremendous changes through the indirect medium of temperature elevation. Before any result is ascribed to the specific action of short electric waves, heat effect through conductivity and eddy currents must be ruled out. The chief import of this paper is to show that radiation of the type used here is capable of producing changes in biological substances independent of a heat effect.

Throughout, the wave-length was 1.9 meters and the substances to be radiated were placed between two condenser plates of a resonating circuit. The amperage in the resonating circuit was .95 to 1.2, and the frequency was 158,000,000 cycles per second.

From the beginning, and so far in this work—eliminating heat effect—completely negative results were obtained in attempts to sterilize milk and to destroy bacteria both *in vivo* and *in vitro*. Radiation *in vivo*, both as general radiation of the whole animal and local radiation to the site of injection, produced no changes in the course of streptococcus infections in guinea-pigs. In addition, no effects of the radiation could be detected on the precipitin titer of the pneumococcus antisera from rabbits.

The study of diphtheria toxin was made in two series of experiments. First series: One sample of toxin was chilled in ice water to 7° C., then exposed to radiation until the temperature had risen to 38°–40°C. (about four minutes). When such a temperature was attained the sample was taken out of the high frequency field and chilled again in the ice water. This process was repeated until the total time of radiation was fifteen to sixty minutes. A control sample was kept at the identical temperatures with the same rate of heating and cooling by alternate chilling in ice water and immersion in a small heated water bath. The temperature attained did not affect