have had to be re-determined and do not correspond to the previously reported series. A description of the present membranes will be reported elsewhere.

In the present experiments the test material used was a 20 per cent brain suspension in normal saline freshly prepared from guinea-pigs which had been killed at the height of the disease. The suspension was centrifuged at low speed to remove coarse tissue particles and was then filtered under low negative pressures through sterile membranes of various pore sizes. The filtrates were tested for the presence of the virus by inoculating 0.3 cc. intracerebrally into guinea-pigs.

The table appended shows that the virus traverses a 3 per cent. membrane but is retained by a 3.5 per cent. membrane. The usual bacteriological tests for the detection of microorganisms were applied to the filtrates with negative results. Our data would indicate an approximate particle size of 500 μμ for the virus as it exists in brain suspensions. Under like conditions of preparation and filtration it is of the same order of magnitude as the causal agent of poliomyelitis[6] an analagous disease of man and is apparently ten times the size of the hoof and mouth disease virus particle.[7] Dilution does not appear to render the virus more finely dispersed, as by elution from carrier particles for example, nor to affect the filter pore surfaces so that the particles pass more readily.

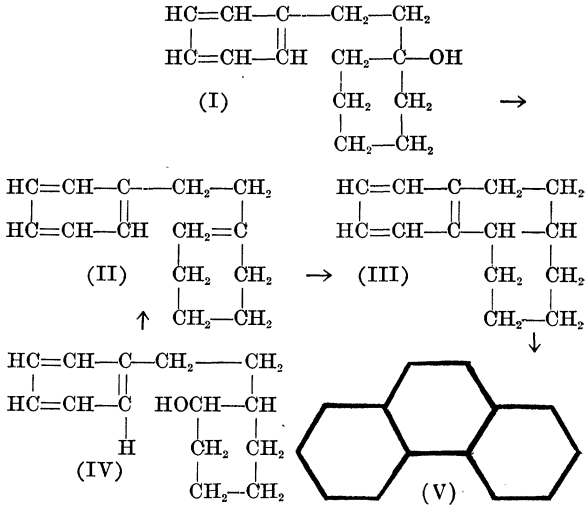
A. P. KRUEGER
B. HOWITT
VIRGINIA ZEILOR

A NEW PROCESS FOR THE SYNTHESIS OF PHENANTHRENE AND OF PHENANTHRENE DERIVATIVES

FOLLOWING up the researches on ionene lately communicated,[1] Davidson and Perlman have now succeeded, in these laboratories, in applying the knowledge gained in the ionene field to the development of a new process for the synthesis of phenanthrene and of its derivatives.

By the well-known Grignard reaction, 1-phenethyl-cyclohexanol-1 (I) was prepared from phenethyl magnesium bromide and cyclohexanone. When this tertiary alcohol (I) was treated with concentrated sulfuric acid, it split out a molecule of water and condensed to the same octahydrophenanthrene (III) as Bardhan and Sengupta[2] obtained from 1-phenethyl-cyclohexanol-2 (IV), and like it gave a good yield of phenanthrene (V) when dehydrogenated by heating with selenium.

Bardhan and Sengupta appear to assume a direct cyclodehydration between the OH of the alcohol and an H of the benzene nucleus. But, as we have shown in the ionene group (see the above reference), such condensations may proceed rather through the formation of the olefin first, which then rearranges by cyclization. That this is the case here also, Davidson and Perlman have now proven by heating the alcohol (I) for one minute with 50 per cent. sulfuric acid, when the olefin (II) was obtained. The same olefin was prepared by distilling the alcohol with a crystal of iodine. Treatment of this olefin with concentrated sulfuric acid rearranged it to the octahydrophenanthrene (III). These reactions indicate that the structure of the olefin is that shown in the formula (II), and that such an olefin could be formed by dehydration of either our alcohol (I) or that of Bardhan and Sengupta (IV). If this is really the mechanism of the condensation, as we believe it to be, it is clear why the same octahydrophenanthrene results whether the OH on the cyclohexane nucleus is in Position 1 (I) or 2 (IV).



We believe that this synthesis has certain advantages over that of Bardhan and Sengupta, in that it starts with a simpler initial material, cyclohexanone instead of the potassium derivative of its ethyl carboxylate, and involves fewer steps. The investigation therefore is being extended in various directions, by using other carbonyl compounds in place of cyclohexanone and and other Grignard reagents instead of phenethyl magnesium halides.

MARSTON TAYLOR BOGERT
LABORATORIES OF ORGANIC CHEMISTRY
COLUMBIA UNIVERSITY

[6] A. P. Krueger and E. W. Schultz, "Ultrafiltration Studies on the Virus of Poliomyelitis," *Proc.* Soc. Exp. Biol. and Med., 26: 600, 1929.

[7] P. K. Olitsky and L. Boez, *Jour. Exp. Med.*, 45: 673, 1927.

[1] Bogert, SCIENCE, n. s., 76: 1977, 475, November 18, 1932.

[2] *Jour. Chem. Soc.*, 1932, 2520.