preparations showed particles whose lengths were predominantly in the neighborhood of 140 and 190 millimicrons. In keeping with their decision that the length of the virus protein molecule is 280 millimicrons, Stanley and Anderson[3] concluded that Melcher and coworkers must have been dealing with some different strains of the virus. These same particle lengths occur in the electron microscope photographs published by Stanley and Anderson[3] and by Anderson and Stanley.[4]

A further consideration of equal interest is that the size of the suggested basic unit from which the other particles seem to be built is in good agreement with the "diameter" of some 38 millimicrons arrived at by Thornberry[6] from ultrafiltration experiments. One might wonder just what the electron microscope photographs of these ultrafiltrates would show.

VERNON L. FRAMPTON
DEPARTMENT OF PLANT PATHOLOGY,
CORNELL UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

CHROMATOGRAPHIC SEPARATION OF MIXTURES OF AMINO ACIDS

THE recent report by Tiselius[1] of the adsorption analysis of certain mixtures of amino acids by a modification of the Tswett chromatographic method has led us to publish at this time results of our own work.

We have been able to separate mixtures of *l*-tyrosine and *dl*-leucine, and of *dl*-phenylalanine and *dl*-leucine, in a quantitative, or nearly quantitative manner. Other separations, such as that of *l*-tyrosine from *dl*-phenylalanine or of glycine from *dl*-alanine, have been obtained but are not yet quantitative. A representative experiment is given below. We hope shortly to publish our findings in full.

Materials. A variety of *adsorbents* have been investigated. The experiment described below employed a commercial carbon, Darco G–60.[2] *l*-Tyrosine, partially racemized, analyzed 7.69 and 7.75 per cent. nitrogen and gave no nitroprusside test for cystine. *dl*-Leucine analyzed 10.71 and 10.74 per cent. nitrogen.

Experiment. Two grams of Darco G–60 carbon were mixed with filter paper pulp (a convenient, non-adsorbing bulking agent) and packed in a tube 2.2 cm in diameter to give a column of adsorbent 12 cm long. To this was applied a solution containing 0.5006 g *dl*-leucine and 0.1008 g *l*-tyrosine in 100 cc of water. The column was developed with water in the usual manner and without pressure. The liquid which passed through the column was collected in fractions and analyzed for amino acid. All the leucine was obtained in the first 600 cc of liquid which passed through the column (0.5016 g in 15 fractions), and in no fraction was there any evidence of tyrosine (Folin-Marenzi test). At this point all the tyrosine remained on the column and the percolating liquid gave a negative ninhydrin test and a negative Folin-Marenzi test.

The strongly adsorbed tyrosine could be desorbed by elution with aqueous ethyl acetate: 550 cc of 5 per cent. aqueous ethyl acetate removed about 90 per cent. of the tyrosine (by colorimetric estimation, checked gravimetrically).

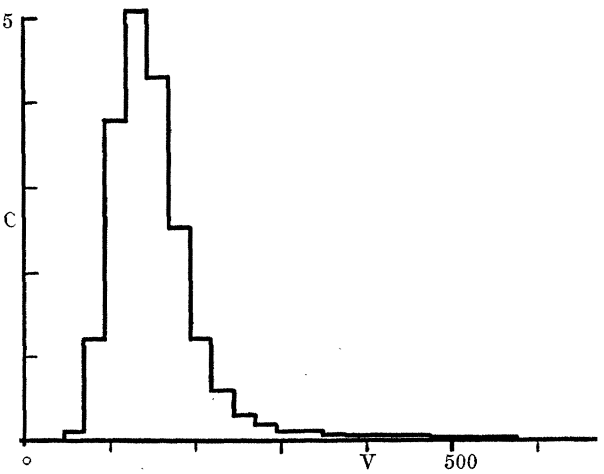

FIG. 1
"Zone" of *dl*-leucine.
V Volume of percolate, in cc.
C Concentration of fractions shown, in mg. per cc.

The concentrations of leucine in the fractions of percolate are plotted (Fig. 1) against the volume of percolate to show how the "zone" passed completely from the column. This method of plotting is useful in dealing with the separation of colorless materials.[3]

This problem is being developed further in this laboratory.

At this time we would like to express our thanks to Dr. Hubert B. Vickery and Dr. Werner Bergmann for many kindnesses, and to the International Silk Guild for funds in support of this work.

JACQUES WACHTEL
HAROLD G. CASSIDY
YALE UNIVERSITY

[1] A. Tiselius, SCIENCE, 94: 145, 1941.
[2] The Darco Corporation, 60 East 42nd Street, New York, N. Y.
[3] H. G. Cassidy, Dissertation, Yale University, 1939; E. Caliri, Thèse, University of Fribourg, 1939; H. G. Cassidy, *Jour. Am. Chem. Soc.*, in press.
[6] *Phytopathology*, 25: 601, 1935.