presumably, into the ovary. This result was to be expected since the pollen of the self-sterile plants causes normal seed pods with viable seeds to be produced on plants which are not homozygous recessive for the gene for self-sterility involved. So also the pollen of plants which are not homozygous recessive for the self-sterility gene develops normally in styles of the self-sterile plants. Observations of styles made forty-eight hours after they had been pollinated showed that from 75 to 95 per cent. of the pollen had germinated and had formed tubes of varying lengths, including many which extended all the way down the style.

Plants of the self-sterile strain of Golden Rose Petunia can be self-fertilized by either of two methods described below. If flower buds which are beginning to develop anthocyanin in the petals are opened and pollinated with pollen from fully opened flowers from the same plant, seed capsules containing viable seeds are produced. Similar results were found in *Petunia violacea* by Yasuda,[1] who refers to this method of self-fertilization as homo-pollination. In a more recent study Yasuda[2] found that the placenta in the overy of *Petunia violacea* secretes a "special substance" which diffuses into the style and retards or completely inhibits the germination of the pollen and the development of pollen tubes. Preliminary studies with the self-sterile Golden Rose strain of Petunia in my laboratory indicate that when the sap expressed from the ovary of self-sterile plants is placed on the stigma and style of strains which are not homozygous recessive for the self-sterility gene, the latter strains are rendered cross-sterile with the self-sterile plants. This result tends to show that the ovarian secretion which renders the plant self-sterile can be transferred to other plants and renders them cross-sterile with pollen from self-sterile plants.

The self-sterile plants can also be made self-fertile in a more simple and more remarkable manner. This may be accomplished by spraying the flowering plants with a solution composed of ten parts of alpha naphthalene acetamide dissolved in one million parts of water.[3] Flowers which are sprayed with this solution immediately before or shortly after they have been self-pollinated produce seed capsules filled with viable seeds in exactly the same way that normal self-fertile plants of other strains produce seeds. Obviously alpha naphthalene acetamide neutralizes the effects of the ovarian secretion which diffuses into the style and inhibits or greatly retards the growth of the pollen tubes. Seeds from such self-fertilized self-sterile plants were found, when planted, to grow into normal seedlings and the per cent. of germination in all trials was unusually high.

Preliminary experiments indicate that the alpha naphthalene acetamide greatly increases the self-fertility or self-compatability of highly inbred and highly sterile strains of *Tagetes erecta* (African marigolds), *Brassica oleracea* (cabbage) and *Trifolium pratense* (red clover). These results suggest that a great variety of economically important plants which are normally partly or completely self-sterile or self-incompatible may be made self-fertile by the use of a suitable solution of alpha naphthalene acetamide as indicated in the preliminary report given in this paper.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW PROCEDURE FOR ADSORPTION ANALYSIS

IF a liquid containing one or more dissolved substances is allowed to pass slowly through a layer of a finely divided adsorbent, the different solutes, dependent upon the degree of adsorption, will become more or less retarded as compared to the liquid. If the solution flows upwards through the adsorbent and emerges into a vessel suitable for optical observation (for example, by the Toepler Schlieren method, as used in observations of electrophoretic migration[1]) a number of boundaries will be observed, corresponding to the number of differently adsorbable components present, and the volume of liquid between each boundary and the meniscus ("the retardation volume") will equal the ratio between the amount adsorbed and the concentration of the corresponding component.

If the mutual adsorption displacement effects are negligible the concentrations of the components in the observation tube should have the same value as in the original solution. A new method for qualitative and quantitative analysis, with a very wide field of application, may be based upon the principle described. A theoretical treatment and a description of the experimental arrangement has been given in two recent communications.[2] The method has been tried on mixtures

[1] Sadawo Yasuda, *Proc. Crop. Sci. Soc. Japan*, 2 (2): 122–126, 1930.

[2] Sadawo Yasuda, *Bot. Mag.* (Tokyo), 46 (548): 510–517, 1932.

[1] A. Tiselius, *Trans. Farad. Soc.*, 33: 524, 1937. See also The Harvey Lectures, 35: 37, 1939–40.

[3] The alpha naphthalene acetamide was used in the form of the commercial preparation known as Fruitone.

[2] A. Tiselius, *Arkiv för Kemi* (Royal Swedish Academy of Sciences), 14 B, No. 22 and No. 32. A detailed description of the method and some of its applications is to appear this year in "Advances in Colloid Science," edited

of various substances; for example, saccharides, organic acids in water or organic solvents, and some

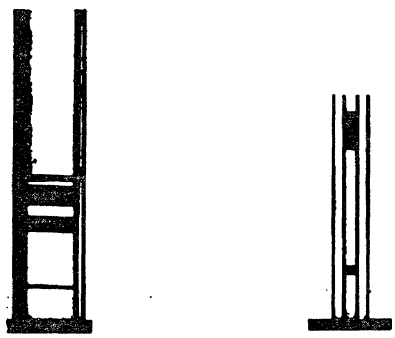

FIG. 1. Schlieren photographs of adsorption analysis. *Left:* 1 per cent. NaCl, 1 per cent. glucose, 1 per cent. lactose. Cross-section of cuvette 100×20 mm. *Right:* 1 per cent. NaCl, 1 per cent. glucose (the meniscus has passed out of the field of vision). Cross-section of cuvette 50×5 mm.

stereoismeric compounds. Fig. 1 shows a photograph obtained by the Schlieren method on a mixture of 1 per cent. sodium chloride, 1 per cent. glucose and 1 per cent. lactose, and Fig. 2 a gradient curve (photographed by the Philpot-Svensson modification of the Schlieren method) from an experiment on (left to

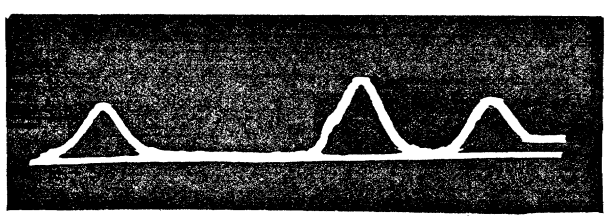

FIG. 2. Gradient curve photographs of adsorption analysis. *Left to right:* 0.5 per cent. leucine, 0.5 per cent. valin, 0.5 per cent. alanin.

right) 0.5 per cent. leucin, 0.5 per cent. valin and 0.5 per cent. alanin. The active carbon used in these experiments was packed into a cylindrical cell 20 mm in diameter and 10 mm in height between filter paper supported by perforated disks, and this cell is attached to the bottom of an optical cuvette with 50×5 mm cross-section area.

In Fig. 3 the retardation volumes per gram active carbon have been plotted for 0.5 per cent. solutions of a number of amino acids and peptides. The first two rows were obtained in neutral solutions with "Carbo Active Kahlbaum" the last row in alkaline and acid buffer solutions on "Eponit 3n" of the Lurgi G.m.b.H.

Adsorption displacement effects in mixtures tend to make the observed concentrations too large for the less adsorbable components. To avoid this one should try to choose the conditions such as to give relatively small occupation of the available adsorbing surface area. Thus, low concentrations, or extreme pH-values at which the adsorption is considerably diminished are to be preferred. Eventually one may extrapolate to zero from two determinations at different total con-

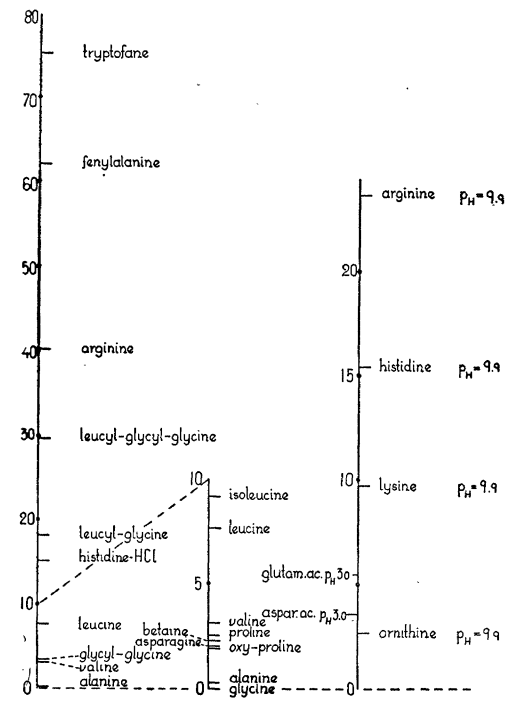

FIG. 3. Specific retardation volumes (cm^3 per gram adsorbent) for 0.5 per cent. solutions of some amino acids and peptides.

centrations. Concentration determinations on the successive layers are made on samples collected in a container on top of the observation cuvette, or may be obtained by integration of the gradient curves (Fig. 2).

The method described is obviously a modification of the Tswett chromatographic analysis, but it is not limited to colored substances and is easier to adapt for quantitative work.

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