

Industrial Chemistry, and Dr. H. S. McKee, Plant Physiology Unit, for helpful advice. [See also Hulme, A. C., *Nature*, December 4, p. 1055 (1954).]

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¹ McKee, H. S., and Urbach, G. E., *Aust. J. Biol. Sci.*, **6**, 369 (1953).

² Jepson, J. B., and Smith, I., *Nature*, **172**, 1100 (1953).

³ Feigl, F., "Qualitative Analysis by Spot Tests", 371 (3rd English edit., Elsevier Pub. Co., Inc., New York, 1947).

Infra-red Spectra of the New Proline Derivative from the Apple

IN the work of McKee¹ and of Hulme² on apple, two substances have been isolated. One of these, from apple peel³, has been referred to as proline substituted, probably on the same carbon, with methyl and hydroxyl groups. The other, from apple twigs, has been referred to by McKee¹ and described above by Urbach as 4-hydroxy-methyl proline, that is, the hydroxyl group is on the methyl side-chain.

Samples of the original materials isolated by these authors became available in this laboratory. They were therefore subjected to infra-red analysis using the potassium bromide disk method. The resulting spectrograms are shown in Fig. 1. This evidence clearly establishes the identity of the two substances.

The isomeric hydroxy-piperidine carboxylic acid was also available in this laboratory and was submitted to infra-red analysis at the same time. The resulting spectra were quite different. This evidence confirms the pyrrolidine, rather than the piperidine, structure for the new amino-acid from apple.

The following interpretations of the infra-red spectra can be made, and we have confirmed these in consultation with workers familiar with the analysis of infra-red spectra: (1) The band at 5.9 microns (frequency 1,600–1,560 cm^{-1}) is characteristic of the ionized carboxyl group of amino-acids (ref. 3, p. 206). (2) The band at 6.1 microns (fre-

quency 3,400–3,200 cm^{-1}) occurs in proline (ref. 3, p. 208). (3) The band at 3.1 microns (frequency 3,400–3,200 cm^{-1}) is characteristic of an imine (ref. 3, p. 213).

To this point the evidence, though consistent with the substance being a proline substituted with both methyl and hydroxyl groups, does not distinguish between the alternative structures suggested by Hulme and by Urbach. While the analysis of these curves, following Bellamy³, may seem to favour the tentative conclusion of a hydroxyl linked directly to carbon in the ring, it is obvious that a decision awaits other evidence, such as that of synthesis and comparison of infra-red curves for other model compounds.

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¹ McKee, H. S., Comm. and Proc. 8th Int. Cong. Botany, Paris, 1954, Sections 11–12, p. 401.

² Hulme, A. C., Comm. and Proc. 8th Int. Cong. Botany, Paris, 1954, Sections 11–12, p. 398; *Nature*, **175**, 1055 (1954).

³ Bellamy, L. J., "The Infra-red Spectra of Complex Molecules" (London, 1954).

Consideration of the Vi-phage Types of *Salmonella typhi* on a Structural Basis

RECENTLY published work^{a,b,c} has indicated that many of the Vi-types of the typhoid bacillus owe their characteristic reactions with the adapted preparations of Vi-phage II^a to the carriage of temperate non-Vi phages which have been called type-determining phages. The symbols assigned to these type-determining phages are small letters corresponding to the capitals by which the related Vi-types are designated, or a number with a superscript prime sign when the corresponding Vi-type has a numerical symbol. Thus, Type D_1 carries phage d_1 and Type D_6 , phage d_6 ; Type 25 carries phage 25'; and so on. Some types carry phages indistinguishable from those carried by other types, in which case the phages are designated by the same symbol. For example, Type 33

carries a phage apparently identical with that carried by Type D_6 , and the determining phage of both types is therefore called phage d_6 . A complete list of the lysogenically determined types identified hitherto is given in Table 1.

All the Vi-typing phages are derived from Vi-phage II, and the great majority have been prepared by propagation of phage A on the respective Vi-types of *Salmonella typhi*. According to the convention originated by Craigie and Yen², the various Vi-types and the homologous adapted typing preparations of Vi-phage II are designated by identical symbols. It has been shown³ that the specific adaptations of Vi-phage II

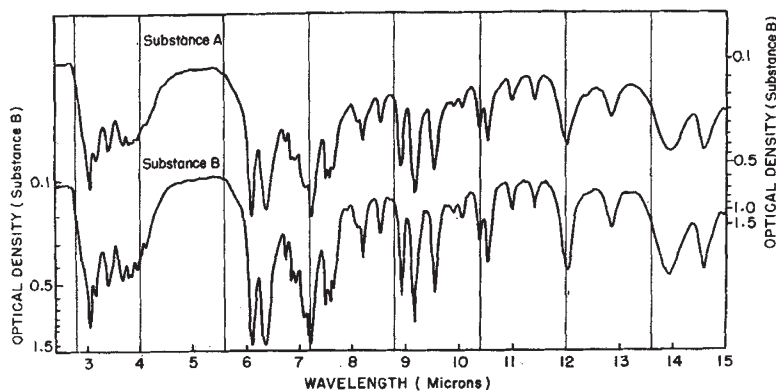


Fig. 1. The infra-red spectra of samples of an amino-acid obtained from the peel of apples by Hulme (substance A) and from apple twigs by Urbach (substance B)