with butyric acid (*S*-benzylthiuronium salt) and leads to structure (2):

The formation of an adduct with maleic anhydride indicates a *trans-trans*-configuration for the 2:4-diene system. Unpublished reference data¹ obtained from a recent study of the four stereoisomeric *N*-isobutyldeca-2:4-dienamides show that the position of the C=C stretching frequencies in anacyclin, the possession of a band at 996 cm.⁻¹ and the absence of one at 960-965 cm.⁻¹, are characteristic of the above configuration. The ultra-violet extinction coefficient of anacyclin is also in agreement. Anacyclin is thus *N*-isobutyltetradeca-*trans*-2:4-diene-8:10-diyamide.

If methyl deca-2:4-dienoate is semi-hydrogenated in the presence of quinoline, using lead-poisoned palladium catalyst⁵, the main product is methyl deca-*cis*-2:4-dienoate¹. When anacyclin is allowed to absorb two molecules of hydrogen under these conditions a waxy crystalline product can be isolated which, on the basis of the above information and its ultra-violet absorption, is formulated as *N*-isobutyltetradeca-*trans*-2:4:8:10-tetraenamide. This unstable compound is very soluble in light petrol, is a strong sialogogue and has a high toxicity towards *T. molitor*. The last finding is of considerable interest because of the light it throws on the structure and stereochemical requirements for a potent polyene-amide insecticide.

The insecticidal testing was carried out by Dr. M. Elliott and Mr. P. Needham, Department of Insecticides and Fungicides, Rothamsted Experimental Station.

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¹ Crombie, L., *J. Chem. Soc.* (in the press).

² Gulland, J. M., and Hopton, G. U., *J. Chem. Soc.*, 6 (1930).

³ Crombie, L., *Chem. and Indust.*, 1034 (1952).

⁴ Crombie, L., *J. Chem. Soc.*, 4338 (1952).

⁵ Lindlar, H., *Helv. Chim. Acta*, 35, 446 (1952).

Isolation and Structure of Neo-Herculin from *Zanthoxylum clava-herculis* L.

SOUTHERN prickly ash bark (*Zanthoxylum clava-herculis* L.) contains a potent insecticidal substance, which was named herculin (m.p. 59-60°) by Jacobson¹ and claimed to have structure (I). This structure has been disproved^{2,3} by syntheses of the four possible stereoisomers of (I), which have different physical characteristics and negligible physiological activity.

A highly unstable but pure compound (m.p. 70°) named neo-herculin has now been isolated from the bark and shown to have structure (II). It is very toxic to *Tenebrio molitor* and houseflies and seems

to be the major crystalline insecticidal substance present. neo-Herculin has the empirical formula C₁₆H₂₅ON (found: C, 77.3; H, 10.2; N, 5.7. C₁₆H₂₅ON requires: C, 77.65; H, 10.2; N, 5.65 per cent) and on microhydrogenation absorbs 3.75 mol. of hydrogen. A mono-substituted amide linkage is present (infra-red absorptions: NH, 3,260, 3,070; amide A, C=O, 1,626; amide B, 1,559 cm.⁻¹). neo-Herculin gave isobutylamine (hydrochloride, chloroplatinate) on acidic hydrolysis: this demonstrates that unsaturation is contained only in the acid fragment. The carbon skeleton is revealed by the identity of octahydro neo-herculin (m.p. 53-54°) with lauric isobutylamide.

Ultra-violet light absorption data (λ_{max}. 259, 269, 280 mμ; ε_{max}. 31,500; 43,500; 36,200) demonstrate a conjugated triethenoid chromophore. Subtraction of the curve for α-elaeostearic acid leaves an absorption of λ 9,000 at ε 227 mμ, and this indicates that the fourth double bond is to be found α to the amide linkage. Its position is confirmed by the strength of the ethenoid stretching vibration at 1,670 cm.⁻¹ in the infra-red². Location of the triene system in the chain was effected by ozonolysis, which yielded acetaldehyde. neo-Herculin is therefore *N*-isobutyl-dodeca-2:6:8:10-tetraenamide (I).

Infra-red observations suggest that the αβ-double bond is *trans*-, but the stereochemistry of the triene system cannot be completely defined. neo-Herculin does not give a crystalline derivative with maleic anhydride, so two contiguous *trans*- linkages are likely to be absent. The relatively low extinction coefficients in the ultra-violet are consistent with this view⁴.

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¹ Jacobson, M., *J. Amer. Chem. Soc.*, 70, 4234 (1948).

² Crombie, L., *J. Chem. Soc.*, 2997 (1952).

³ Raphael, R., and Sondheimer, F., *J. Chem. Soc.*, 115 (1950); 2693 (1951).

⁴ cf. Crombie, L., and Tayler, A. J., *J. Chem. Soc.*, [2816 (1954)].

Cuscohygrine, a Normal Constituent Alkaloid of *Atropa belladonna*

IN an earlier communication on alkaloids in germinating seeds of *Atropa belladonna*¹, we mentioned that a new alkaloid was the first to appear on paper chromatograms using Dragendorff's reagent. As this alkaloid was always found on chromatograms of extracts of fresh root material and no information about its nature was available, it seemed worth while to make a further investigation.

Starting with 20 kgm. dried roots, about 100 mgm. of a picrate was obtained, which was analysed: melting point, 215° C.; molecular weight, 230; elementary analysis, C, 44.7, H, 4.5, N, 16.1 per cent.

Cuscohygrine