

5. The facility of catalytic reduction of ethylenic compounds with reference to chemical structure is discussed.

CONVERSE MEMORIAL LABORATORY
CAMBRIDGE, MASSACHUSETTS

NOTES

Identity of Neonicotine and the Alkaloid Anabesine.—In a recent article¹ Orechhoff and Menschikoff reported the results of a study of the alkaloids of *Anabasis aphylla* L. (Fam. Chenopodiaceae). The alkaloids isolated and identified were lupinine and anabesine. Anabesine was shown to be β -pyridyl- α' -piperidine. They considered it to be different from nicotimine, an alkaloid associated with nicotine in the tobacco plant, to which Pictet had erroneously assigned this structure.

The writer obtained a sample of "anabesine sulfate" through the courtesy of the Amtorg Trading Corporation and made an examination of the alkaloids. Anabesine was separated and purified. It was found to be identical with neonicotine, the isolation of which the writer reported at the 79th meeting of the Society on April 8, 1930. The report was published on January 12, 1931.² Anabesine differs from neonicotine in being levorotatory, whereas synthetic neonicotine is inactive.

The writer isolated neonicotine from the reaction products of sodium, pyridine and oxygen, while he was attempting to separate the insecticidal substance (neonicotine) from the comparatively non-toxic dipyridyls. Although previous workers had reported the presence of isonicotine (γ -pyridyl- γ' -piperidine) in the products of the sodium-pyridine reaction, the writer has been unable to find that any pyridylpiperidine other than neonicotine or β -pyridyl- α' -piperidine² is produced in his modified procedure. It is interesting that out of nine compounds theoretically possible, the particular pyridylpiperidine which most closely resembles nicotine should be found in nature. It represents the first dipyridyl alkaloid. It is also interesting to note that this is a rare instance of the synthesis of an alkaloid preceding its isolation from a plant.

In addition to neonicotine the writer found considerable methylneonicotine (methylanabesine) in his sample of anabesine sulfate. Orechhoff and Menschikoff do not report this alkaloid as one of the constituents of the *Anabasis aphylla*. When the total mixed alkaloids are dissolved in water and extracted with ether, the anabesine remains in the water, and the methylanabesine is extracted. Its presence was immediately suspected because the ether fraction when evaporated was found to be more soluble in cold water than in hot water, which is generally true of all N-methylpyridylpiperidines.

¹ Orechhoff and Menschikoff, *Ber.*, **64**, 266 (1931).

² C. R. Smith, *THIS JOURNAL*, **53**, 277 (1931).

Owing to lack of information of the previous treatment of this sample of "anabasine sulfate" only a brief outline of the work done to establish the identity of neonicotine and anabasine and the presence of methylneonicotine is submitted. It is hoped that a separation of these substances into their optically active forms can be made later.

The total alkaloids were liberated by strong potash solution and extracted with ether. After the ether solution was dried over potash, the ether was removed by evaporation, and the alkaloids were distilled in a vacuum to remove residual tarry bases. The distilled bases were dissolved in water and extracted with ether to remove the methylanabasine fraction. The water solution was acidified with dilute hydrochloric acid, and sodium nitrite was added to form the nitrosoanabasine. This was extracted with ether and decomposed with dilute hydrochloric acid. The anabasine was freed with alkali and extracted with ether. After one or two distillations in a vacuum to remove traces of water and solvent, the anabasine distilled between 277.5 to 280° at 760 mm. The boiling point of neonicotine was given as 280–282° at 775 mm. The picrate was prepared first from alcoholic solutions of the base and picric acid. It was twice recrystallized from water, from which it separated in long needles which melted at 212–214° (Orechoff and Menschikoff report an indefinite melting point of 200–205°, presumably corrected). Neonicotine picrate melts at 213°. When it was mixed with the anabasine picrate it showed some softening at 208° but melted at 212°. Orechoff and Menschikoff proved the identity of anabasine through the formation of nicotinic acid by alkaline permanganate and the formation of α,β' -dipyridyl by dehydrogenation with zinc dust. Their description of the picrate of their dipyridyl exactly duplicates results previously observed by the author for pure α,β' -pyridyl and leaves no doubt as to the correctness of their conclusion.

The author has found that pure anabasine when hydrogenated takes up nearly the theoretical amount of hydrogen and forms a dipiperidyl boiling at 269°. The dipiperidyl was first separated from alcoholic solution as the crystalline dihydrochloride, from which the base was liberated by alkali. Since the anabasine dipiperidyl would also be optically active, the picrate and the dinitroso derivatives would be expected to be different from those of the synthetic α,β' -dipiperidyl. The picrate, however, was found to melt at 224° which was not appreciably lowered when the synthetic dipiperidyl picrate was added. The dinitrosodipiperidyl obtained from anabasine, however, melted at 111–112° while the synthetic melts at 88°; a mixture of the two softened below 75° but no definite melting point could be obtained. The author has not attempted the resolution of α,β' -dipiperidyl so that no exact comparison could be made.

In the writer's first study of the oxidation of neonicotine with permanganate, nicotinic acid was not obtained, but a repetition of the oxidation

using alkaline permanganate showed a smooth oxidation to nicotinic acid. As the chief impurity in the earlier preparations of neonicotine was β, γ -dipyridyl, which might also have produced nicotinic acid, little attention was paid to the oxidation.

The methylanabasine fraction was distilled several times, but only the fraction from 270 to 275° was collected. The picrate was formed in fine needles which softened at 215° and melted at 222–223° (corr.) with gas evolution. Some anabasine was methylated by treatment with potassium methyl sulfate, and a picrate was prepared which softened at 217° and melted at 222–223°. When the two were mixed the melting point was 219–220°. Because of the slight differences in the boiling point of the bases and the melting point of their picrates, an optical study was made by Mr. George L. Keenan.

Anabasine Picrate, Natural.—This material consists of yellow, plate-like rods, usually six-sided in outline. In parallel polarized light (crossed nicols), the extinction usually is straight and occasionally inclined. In convergent polarized light (crossed nicols), a biaxial interference figure with the optic axis up or slightly inclined is occasionally seen. The most significant refractive index determinable by the immersion method was the minimum value, n_{α} 1.585, frequently shown on irregular fragments and lengthwise on the elongated forms; n_{β} and n_{γ} were found to be considerably higher than the refractive index for methylene iodide.

Neonicotine Picrate.—The optical crystallographic data for this substance were found to be identical with those obtained for natural anabasine picrate.

Picrate of the Natural Anabasine, Methylated.—This substance crystallizes in small, yellow needles. In parallel polarized light (crossed nicols), the extinction is straight. Biaxial interference figures are rarely seen with convergent polarized light (crossed nicols). The minimum refractive index, n_{α} 1.616, is very common on irregular fragments and on the elongated forms lengthwise; n_{β} and n_{γ} are considerably higher than the refractive index for methylene iodide.

Picrate of the Natural Methyl Anabasine.—This was found to be identical with the previous picrate in so far as optical crystallographic data are concerned.

INSECTICIDE DIVISION
BUREAU OF CHEMISTRY AND SOILS
WASHINGTON, D. C.

C. R. SMITH

RECEIVED JULY 20, 1931
PUBLISHED JANUARY 7, 1932

Bromomethyl Normal Alkyl Ethers.—Although many investigators have utilized Henry's method¹ for the preparation of α -halogenated ethers to obtain the chloro compounds, the synthesis of the corresponding bromo derivatives has received but scant attention and the preparation and physical properties of only the methyl,^{2,3} ethyl³ and *n*-propyl-³ ethers

¹ L. Henry, *Bull. soc. chim.*, **44**, 458–459 (1885); *Compt. rend.*, **100**, 1007–1009 (1885).

² L. Henry, *Bull. acad. roy. Belgique*, [3] **25**, 439–440 (through *Ber.*, **26**, ref. 933–934 (1893).

³ A. Karvonen, *Ann. Acad. Sci. Fenn.*, (A) **5**, **6**, 109 (through Beilstein, "Handbuch der organischen Chemie," 4th ed., Vol. 1, Supplement 1, p. 305).

have been described in the literature. It is the purpose of this note to record the preparation of the *n*-butyl and *n*-amyl ethers and to correct the erroneous value reported for the index of refraction of the *n*-propyl ether.

Experimental.—A stream of hydrogen bromide gas⁴ was passed into a well-cooled mixture of 75 cc. of aqueous formaldehyde solution and one mole of the appropriate alcohol until saturation occurred with resulting separation of the mixture into two layers. The upper layer was then separated and dried over calcium chloride for at least two hours. Most of the excess hydrogen bromide was removed by placing the ether under a partial vacuum and drawing a small stream of dry air through it, but complete removal of the gas was accomplished only by treating the ether with anhydrous potassium carbonate. Distillation of the crude ether at atmospheric pressure resulted in profound decomposition. However, by maintaining a pressure below 20 mm. it was possible to purify the ethers by fractional distillation. Our experience in purifying these ethers indicates that as the molecular weight increases the stability of these compounds, as indicated by the ease of hydrolysis, markedly decreases. The properties of the ethers synthesized in this investigation are given in Tables I and II.

TABLE I
BROMOMETHYL *n*-ALKYL ETHERS, CH₂Br—O—R

R-	Yield, %	d_4^{20}	n_D^{20}	Molecular refraction		Analyses, Br %		Molecular wts.	
				Calcd.	Found	Calcd.	Found	Calcd.	Found
<i>n</i> -Propyl	80	1.3551	1.4515	29.89	30.32	52.22	52.38	153.0	155.1
<i>n</i> -Butyl	78	1.2702	1.4514	34.48	35.35	47.88	47.87	167.0	171.3
<i>n</i> -Amyl	99	1.2129	1.4512	39.07	40.11	44.14	43.49	181.0	185.5

TABLE II
BOILING POINTS

Bromomethyl <i>n</i> -Propyl Ether									
<i>T</i> , °C. (corr.)....	48	54.6	62.5	71.6	84.0	98.0	133.3		
<i>P</i> , mm.....	20	31	49	73	125	210	747.5		
Bromomethyl <i>n</i> -Butyl Ether									
<i>T</i> , °C. (corr.)	57.2	65.7	73.2	80.8	85.6	90.3	101.0	108.2	159.0
<i>P</i> , mm.....	20	30	45	62.5	76	97	137.5	170	749.5
Bromomethyl <i>n</i> -Amyl Ether									
<i>T</i> , °C. (corr.)	71.8	83	92.2	100.7	113	130.2	140.4	178-180 (dec.)	
<i>P</i> , mm.....	7	15	28	45	76	150	214	748.3	

From Karvonen's³ data for the density and index of refraction for the *n*-propyl ether, the molecular refractivity may be calculated to be 30.73.

⁴ J. H. Kastle and J. H. Bullock, *Am. Chem. J.*, **18**, 105-111 (1896).

A similar calculation using the data in Table I yields 30.32, which is in closer agreement with the calculated value.

CONTRIBUTION FROM THE
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF TEXAS
AUSTIN, TEXAS

RECEIVED AUGUST 31, 1931
PUBLISHED JANUARY 7, 1932

CHARLES M. BLAIR⁵
HENRY R. HENZE

COMMUNICATIONS TO THE EDITOR

THE 4-*n*-ALKYL-GUAIACOLS

Sir:

In a recent paper by Coulthard, Marshall and Pyman [*J. Chem. Soc.*, 280 (1931)] on the variation of phenol coefficients, a number of *n*-alkyl guaiacols were prepared and studied. In view of the fact that the latter compounds were under investigation in the authors' laboratory at a much earlier date [Master of Science Thesis submitted by Norine Hower Howells at the Oklahoma A. and M. College, 1929] and since the methods of synthesis were somewhat different, it appears worth while to report briefly the results of this earlier work.

The 4-*n*-alkyl guaiacols were prepared here by the reduction of the corresponding acyl guaiacols, which were obtained after the method of Howells, Little and Andersen [THIS JOURNAL, 52, 4077 (1930)] by the oxidation of the carbinols resulting through the reaction of the benzoate of vanillin with *n*-alkylmagnesium halides. Unlike the work of Coulthard, Marshall and Pyman, the readily formed solid benzoate ester and diphenyl urethan were selected as derivatives for characterizing the new phenols.

The 4-*n*-pentyl guaiacol (b. p. 156–158° at 20 mm.) which resulted in good yields when 4-*n*-valeryl guaiacol was reduced by the Clemmensen method, was found also to have the maximum phenol coefficient for the series, comparable to the findings of the above authors.

DEPARTMENT OF CHEMISTRY
OKLAHOMA A. AND M. COLLEGE
STILLWATER, OKLAHOMA

RECEIVED NOVEMBER 18, 1931
PUBLISHED JANUARY 7, 1932

NORINE HOWER HOWELLS
HENRY P. HOWELLS

INTERMEDIATE PRODUCTS IN THE THERMAL DECOMPOSITION OF AMMONIA

Sir:

An attempt has been made to identify the molecule NH as an intermediate product in the thermal decomposition of ammonia, through a study of the absorption spectrum of the decomposing gas. The emission band at $\lambda\lambda$ 3360–70, long known from photographs of the ammonia-oxygen

⁵ This note is taken from a portion of a thesis submitted by Charles M. Blair in partial fulfilment of the requirements for the degree of Master of Arts.