For many operations not requiring a finely pointed flame, even the compressed air may be eliminated. A small torch on the principle of the Bunsen burner is made commercially with which joints, bulbs, and constrictions can be readily made. This is very useful in work on apparatus already set up, as the torch is much smaller and more easily manoeuvered than a 2-pipe torch, and is fed by a single small tube from the tank, which may be placed in any convenient position, while the high pressure prevents the gas from being cut off suddenly by the kinking of the tube.

The only disadvantage of acetylene is that if the air supply is cut off even for a few seconds a very disagreeable flocculent smoke is produced. For this reason it is necessary always to turn on the air before lighting the gas, and to turn off the gas first when extinguishing the torch.

For soft glass acetylene is not suitable, as the flame is too hot, and it is not possible to produce a smoky flame for warming up and annealing without filling the room with soot.

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ESTERS OF AMINOBENZOIC ACIDS.

BY HARVEY C. BRILL.

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One of the simplest members of this class of compounds, namely, ethyl *p*-amino-benzoate[1] has been known for some time, possesses marked anesthetic properties and is used as a dusting powder on wounds.[1] A whole series of this class of pharmaceuticals has been prepared and their properties described by Einhorn and Heinz.[2] These investigators found all the compounds studied by them to have anesthetic properties to various degrees.

Apothesin and procaine,[3] two of the most powerful local anesthetics on the market, have structures related to this series.

To learn more of the series, the *n*-butyl esters of *p*-aminobenzoic acid,[4] *m*-aminobenzoic acid, *o*-aminobenzoic acid, 2,4-diaminobenzoic acid, and 3,5-diaminobenzoic acid; the allyl ester of *p*-aminobenzoic acid;[5] the *iso*-propyl ester of *p*-aminobenzoic acid; the ethyl ester of 3,5-diaminobenzoic

[1] D. R. P. 147,580 and 147,790.

[2] Einhorn and Heinz, *Münch. med. Wochschr.*, **44**, 931 (1897).

[3] Wildman and Thorp, U. S. pat. 1,193,649; Kamm, THIS JOURNAL, **42**, 1030 (1920).

[4] Brit. pat. 148,743. Announcement in C. A., **15**, 240 (1921).

[5] Adams and Volwiler, U. S. pat. 1,360,994. Announcement in *C.A.*, **15**, 575 (1921). The notice of Brit. pat. 148,743 appeared after this article was in the hands of the typist, while notice of U. S. pat. 1,360,994 appeared after it was sent to the Editor.

acid[1] and the hydrochlorides of these were prepared and their properties studied.

The ethyl ester of 3,5-diaminobenzoic acid was included with the *n*-butyl ester in the study for the sake of a comparison of their properties. In general the effect of substituting a higher for a lower alkyl group is to increase the physiological activity of the compound. Obviously this effect is limited by the decreasing solubility of the higher alkyl derivatives. A comparison of the anesthetic properties of ethyl-3,5-diaminobenzoate with the properties of *n*-butyl-3,5-diaminobenzoate showed these compounds to be in harmony with the above statement, *i. e.*, *n*-butyl-3,5-diaminobenzoate is a much more powerful anesthetic than is the ethyl ester. Indeed, this compound is one of the most powerful of those prepared.

The properties of the allyl ester and of the *iso*-propyl ester would seem to discredit this statement but in the former we have unsaturation which generally increases the physiological properties of a compound while in the latter we have a group with a secondary carbon, which likewise usually enhances the physiological activity of a compound. Consequently these two compounds should theoretically show anesthetic activity as great or greater than the butyl ester, and this was found to be true.

Relative Anesthetic Power.

The order of activity, which was roughly judged by placing a small amount of the free base on the tongue is as follows: most active: *n*-butyl-*p*-aminobenzoate, allyl-*p*-aminobenzoate, *iso*-propyl-*p*-aminobenzoate, and *n*-butyl-3,5-diaminobenzoate; intermediate: *n*-butyl-*o*-aminobenzoate, *n*-butyl-*m*-aminobenzoate and ethyl-3,5-diaminobenzoate; least active: *n*-butyl-2,4-diaminobenzoate. Why the 2,4 compound should be the least active is not understood, as it would seem that it should be as active as the *ortho* compound, which falls in the intermediate group. With a more refined method for differentiating the activity of these esters a distinction could be made among the members of the same class. For example, *n*-butyl-3,5-diaminobenzoate appeared to be the most active but this is partly due to its being more soluble than the mono-amino esters and it is therefore placed in class one. The *n*-butyl ester of *o*-aminobenzoic acid, of *m*-aminobenzoic acid and of 3,5-diaminobenzoic acid are liquids at room temperature; the other esters are solids.

General Methods of Preparation of the Amino Compounds and the Hydrochlorides.

The general method used for the preparation of the amino compounds was to prepare the specific ester of the nitrobenzoic acid and reduce this

[1] *J. prakt. Chem.*, [2] 51, 526 (1884).

with tin and hydrochloric acid at a temperature below 35°. *Normal*-butyl-*o*-aminobenzoate was prepared from *o*-aminobenzoic acid. These methods are described in more detail under the preparation of *n*-butyl-*p*-aminobenzoate. *Iso*-propyl-*p*-aminobenzoate was prepared by the method used by Adams and Volwiler.[1]

The hydrochlorides were usually prepared either by passing dry hydrogen chloride into the alcoholic solution of the base or by adding alcohol saturated with dry hydrogen chloride to the alcoholic solution of the base. The *n*-butyl- 2,4-diaminobenzoate hydrochloride was prepared by passing dry hydrogen chloride into the ether solution of the base.

Preparation of *N*-Butyl-*p*-Aminobenzoate.

Three methods were used in the preparation of this ester. *Method 1* was essentially the method used by Einhorn[2] in the preparation of members of this series. Yields of 60 to 75% were obtained by this procedure. In order that the precipitation of tin sulfide by means of hydrogen sulfide might be avoided two other methods were tried.

Method 2.—*p*-Acetyl-aminobenzoic acid is placed in *n*-butyl alcohol and warmed on the steam-bath for 4 hours during treatment with dry hydrogen chloride. The hydrochloride of *n*-butyl- *p*-aminobenzoate results, and the free base is obtained by neutralization with bases. 40% yields were obtained. The low yields are due to the slight solubility of the acetyl-aminobenzoic acid in the butyl alcohol.

Method 3.—Methyl alcohol, in which *p*-acetyl-aminobenzoic acid is more soluble, was substituted for the *n*-butyl alcohol. The *n*-butyl ester is prepared from the hydrochloride of methyl-*p*-aminobenzoate by suspending the latter in *n*-butyl alcohol and warming in the presence of hydrogen chloride.

TABLE I.—THE PROPERTIES OF THE BASES AND HYDROCHLORIDE.

Alcohol and ether used as solvents in all instances.

Compound.	M.P. °C.	B.P. °C.	Class of anesthetic power.	Method of preparation.	Properties of the hydrochloride salts.
Allyl- *p*-aminobenzoate.....	52	...	1	1	plates m. p. 180°
iso-Propyl- *p*-aminobenzoate..	79	...	1	Adams and Volwiler	coarse needles, m. p. 184°
n-Butyl -*p*-aminobenzoate....	58	...	1	1, 2, and 3	coarse needles, m. p. 198°
n-Butyl- *m*-aminobenzoate...	below 0	245	2	1	plates, m. p. 128°
n-Butyl- *o*-aminobenzoate....	below 0	182	2	3	needles, m. p. 178°
Ethyl- 3,5-diaminobenzoate..	84	...	2	1	plates, m. p. 248°
n-Butyl- 3,5-diaminobenzoate.	below 0	255	1	1	needles, m. p. 253°
n-Butyl- 2,4-diaminobenzoate.	90	...	3	1	needles, blacken at 270°

[1] *Loc. cit.*

[2] *Loc. cit.*

The yields were not superior to those of Method 1.

The free base is very slightly soluble. One-half g. dissolves in 100 cc. of boiling water.

In the preparation of the amino esters the nitro esters were synthesized in all but one case. These are described in Table II.

TABLE II.—THE PROPERTIES OF THE ESTERS OF THE NITROBENZOIC ACIDS.

Compound.	M.P. °C.	Solvent.
Allyl-*p*-nitrobenzoate	liquid	
iso-Propyl-*p*-nitrobenzoate	95	glacial acetic acid
n-Butyl-*p*-nitrobenzoate	35	glacial acetic acid
n-Butyl-*m*-nitrobenzoate	liquid	
n-Butyl-*o*-nitrobenzoate	not prepared	
Ethyl-3,5-dinitrobenzoate	91	glacial acetic acid
n-Buty-1,3,5-dinitrobenzoate	61	glacial acetic acid
n-Butyl-2,4-dinitrobenzoate	70	glacial acetic acid

Summary.

The *n*-butyl esters of (1) *p*-aminobenzoic acid; (2) *o*-aminobenzoic acid, (2) *m*-aminobenzoic acid, (1) 3,5-diaminobenzoic acid; (3) 2,4-diaminobenzoic acid; the allyl ester of (1) *p*-aminobenzoic acid; and the ethyl ester of (2) 3,5-diaminobenzoic acid, their hydrochloride salts and the intermediate nitro compounds, except the ester of *o*-nitrobenzoic acid, were prepared and their properties studied. Their anesthetic activities are indicated by the numerals in parenthesis preceding the names, (1) referring to high; (2) to intermediate, and (3) to slight anesthetic activity.

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THE QUANTITATIVE SEPARATION OF THE LEAD SALTS OF THE SATURATED FROM THE LESS UNSATURATED FATTY ACIDS.

BY ARMIN SEIDENBERG.

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The differences in solubility existing between the fatty acids are accentuated in their salts. Attempts to separate the various fatty acids into groups are usually based upon these differences in solubility. The lead salts of the fatty acids have been most studied with this end in view, and on the whole have given the most nearly satisfactory results. Gusserow[1] and Varrentrap[2] were the first to attempt the separation of the saturated or "solid" fatty acids from the unsaturated or "liquid" fatty

[1] Gusserow, *Ann.*, **27**, 153 (1828).

[2] Varrentrap, *ibid.*, **35**, 197 (1840).