

analysis to be at least 99.0%. The metals were melted in small iron crucibles 0.75 inch in diameter and 2.25 inches high, which were turned from a low carbon steel rod. Tests have shown that very little iron is dissolved by either of these metals in the liquid state if the duration of contact is kept at a minimum. The crucibles containing the alloys were heated in a Pyrex glass tube in an atmosphere of argon by means of a high frequency furnace. Thorough mixing was assured by use of a pure iron wire stirrer which was oscillated with a solenoid at the top of the tube. After cooling the iron crucible was removed from the alloy by turning it off on a lathe. During this process the alloy was bathed in a stream of dry oil to protect it from the action of the atmosphere. The samples for analysis were prepared by rolling the alloys, under oil, into thin sheets from which were cut narrow strips for the X-ray examination.

All alloys of the series crystallized with a face-centered cubic type of lattice.

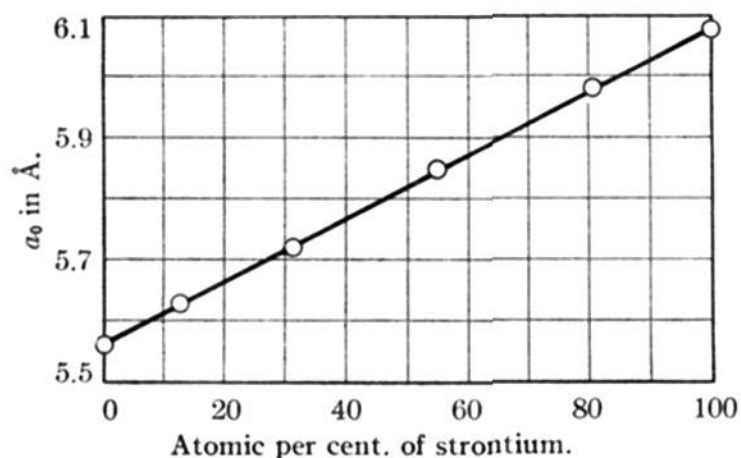


Fig. 1.

The results of the X-ray analysis are summarized in the table and shown graphically in the figure.

At. % Sr	0	10.26	31.37	54.60	80.60	100
a_0 in Å.	5.560	5.627	5.720	5.847	5.980	6.076
Density	1.539	1.666	1.939	2.180	2.416	2.578

It is obvious that the values of a_0 vary directly with the strontium content. Although no thermal analysis has been reported for this system, it is quite apparent from the above results that calcium and strontium form a continuous series of solid solutions at room temperature.

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Dimorphism of Amylcaine Hydrochloride

BY HENRY R. KREIDER AND AMEL R. MENOTTI

During the investigation¹ of the chemical and physical properties of amylocaine hydrochloride (mono-*n*-amylaminoethyl-*p*-aminobenzoate hydrochloride), a local anesthetic used for dental and medical purposes,² two crystalline forms (rectangular plates, melting at 153.5°, and rods, melting at 176°) were obtained. The absence of alcohol of crystallization and water of hydration was demonstrated by a negative Zeisel ethoxyl determination and by the fact that no loss in weight was observed when the crystals were heated above the melting point, although the lower melting form was transformed into the higher melting form under these conditions. Therefore, a dimorphic habit was indicated.

Experimental

Rectangular Plate Form (Fig. 1).—Two grams of commercially available amylocaine hydrochloride was dissolved in 25 cc. of hot water, the solution cooled to room temperature and the resultant crystals were filtered, washed with cold ethanol and dried in vacuum over sulfuric acid; melting point 153.5° (cor.). When kept at the melting point, the liquid solidified spontaneously or upon scratching the microscope slide, yielding the higher melting form. *Anal.* Calcd. for $C_{14}H_{22}O_2N_2 \cdot HCl$: N, 9.77; Cl, 12.36. Found: N, 9.5; Cl, 12.4.

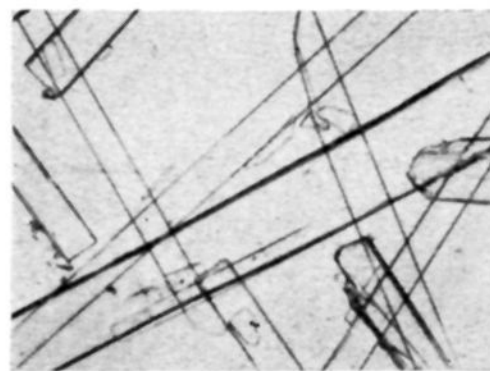


Fig. 1.—Amylocaine hydrochloride, rectangular plate form, m. p. 153.5° ($\times 100$).

Between crossed nicols the crystals appeared as elongated plates with a relatively high birefringence. They exhibited positive elongation and parallel extinction. In convergent polarized light biaxial figures were common, with the acute bisectrix and occasionally an optic axis in the field of view. *Refractive indices* (determined by immersion in organic liquids): $\alpha = 1.510$; $\beta = 1.582$; $\gamma > 1.655$ (all ± 0.002).

Rod Form (Fig. 2).—A saturated solution of amylocaine hydrochloride in boiling *n*-amyl alcohol was cooled slowly in a water-bath to 80°. Long, thick, hexagonal rods were

(1) *J. Am. Med. Assoc.*, **116**, 2020 (1941).

(2) S. D. Goldberg and W. F. Whitmore. *THIS JOURNAL*, **59**, 2280 (1937).

obtained; m. p. 176°. *Anal.* Calcd. for $C_{14}H_{23}O_2N_2 \cdot HCl$: N, 9.77; Cl, 12.36. Found: N, 9.9; Cl, 12.4.



Fig. 2.—Amylcaine hydrochloride, hexagonal rod form, m. p. 176° ($\times 100$).

Between crossed nicols the crystals appeared as long rods with hexagonal cross section exhibiting negative elongation, sharp, parallel extinction and relatively low birefringence. In convergent polarized light partial uniaxial figures were observed, indicating particles with faces parallel to the optic axis. When the crystals were crushed, irregular angular fragments were obtained. An occasional particle did not extinguish sharply when the stage was revolved and in convergent polarized light exhibited a partial uniaxial figure. The optical character was negative. *Refractive indices:* $\omega = 1.582$; $\epsilon = 1.573$ (± 0.002).

Pseudomorphic Habit (Fig. 3).—When the lower melting form was kept at temperatures just below the melting point, the crystals became opaque and showed no tendency to melt at the lower temperature but melted sharply at 176°. This transformation could be followed readily by the change to a lower birefringence during the heating.

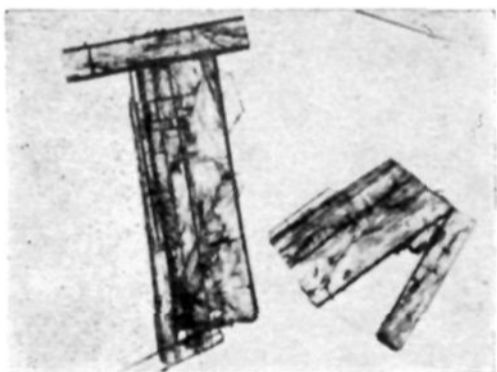


Fig. 3.—Amylcaine hydrochloride, pseudomorphic habit, m. p. 176° ($\times 100$).

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Sterols. CXLI. 3(α),11,12-Trihydroxycholanolic Acid¹

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We have repeated the work of Longwell and Wintersteiner² who attempted to prepare 3(α),11-

dihydroxycholanolic acid by the elimination of the keto group of 3(α),11-dihydroxy-12-ketocholanolic acid by the treatment with hydrazine hydrate and sodium ethylate at 200°. They obtained a compound having presumably two oxygen atoms less than the starting material.

We have obtained from this reaction a compound melting with decomposition at 136° with the empirical formula $C_{24}H_{40}O_5$ (II). The reduction of 3(α),11-dihydroxy-12-ketocholanolic acid (I) to 3(α),11,12-trihydroxycholanolic acid (II) is shown by the analysis and relative ease of its oxidation with chromic anhydride and subsequent Clemmensen reduction to neo-lithobilianic acid (III). Similarly neo-lithobilianic acid was obtained by the action of sodium ethylate and hydrazine hydrate on 11-hydroxy-12-ketocholanolic acid, followed by oxidation of the resulting dihydroxy compound. Reduction to the dihydroxy compound was the major product of both hydrazine reactions.

In addition we have oxidized directly 11-hydroxy-12-ketocholanolic acid to neo-lithobilianic acid. This product was not reported by Barnett and Reichstein³ who oxidized the methyl ester of 11-hydroxy-12-ketocholanolic acid under very mild conditions and obtained 11,12-diketocholanolic acid.

The reduction of a carbonyl to a carbinol group with hydrazine and alkoxide is not without analogy in the literature, for Marker and Lawson⁴ succeeded exclusively in converting pregnan-20(α)-ol-3-one to pregnanediol-3(α),20(α) by the Wolff-Kishner method. Later Dutcher and Wintersteiner⁵ in their investigation of this method of reduction of steroidal ketones showed in several cases that the conversion to a carbinol would take place in preference to the complete reduction to a methylene group.

We thank Parke, Davis and Company for their assistance.

Experimental Part

11,12-Dihydroxycholanolic Acid.—A mixture of 1 g. of 11-hydroxy-12-ketocholanolic acid, 5 cc. of 85% hydrazine hydrate, and 1.8 g. of sodium in 60 cc. of absolute ethanol was heated in a sealed tube for twelve hours at 200°. The product was diluted with water and extracted with ether. The aqueous layer was acidified and extracted with ether. The ether extract was washed with water, dried and evaporated. The product was crystallized from ether-

(3) Barnett and Reichstein, *Helv. Chim. Acta*, **XXI**, 926 (1938).

(4) Marker and Lawson, *THIS JOURNAL*, **61**, 852 (1939).

(5) Dutcher and Wintersteiner, *ibid.*, **61**, 1992 (1939).

(1) Original manuscript received June 27, 1941.

(2) Longwell and Wintersteiner, *THIS JOURNAL*, **62**, 200 (1940).