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NOTES ON SOME OF THE CHEMICAL PROPERTIES OF THE MYDRIATIC ALKALOIDS.

By Theodore G. Wormley, M.D.

Several different alkaloidal substances or principles have been discovered as existing in the mydriatic plants; but it is now generally conceded, especially through the researches of Ladenburg, that these consist of three distinct isomeric bodies, having in common the formula $C_{17}H_{23}NO_3$, and named respectively *Atropine*, *Hyoscyamine* and *Hyoscine*, the last named being found only in hyoscyamus niger, associated with hyoscyamine. The substances formerly described as Daturine, from Datura stramonium, and Duboisine, from Duboisia myoporoides, are now considered to be identical with hyoscyamine.

Atropine, hyoscyamine and hyoscine are closely allied not only in their chemical composition, but also in their physiological effects and their general chemical properties, yielding much the same results with the ordinary reagents. According to Ladenburg, atropine fuses at 114° C., hyoscyamine at 108° C. In the free state, hyoscine forms a syrupy liquid, which, with acids, forms crystallizable salts. Other differences have been pointed out in regard to these principles, but these would rarely serve for discrimination in ordinary toxicological investigations.

In the following comparative examination of some of the tests for these substances, recent samples of the three alkaloids as prepared by Merck, Trommsdorff, and by Kahlbaum, were employed. Only one preparation, however, of hyoscine (Kahlbaum's) was examined, this being in the crystalline state, as hydrochloride.

(1) *Vitalis' Test.*—This test, as is well known, consists in treating the solid alkaloid or one of its salts with a drop or two of nitric acid, evaporating to dryness on a water-bath, and treating the cooled residue with a drop of a strong alcoholic solution of potassium hydroxide, when a deep violet coloration is produced.

On comparing the above samples of the three alkaloids, in equal but varying quantities, side by side, under this test, no appreciable difference was observed in the results. It has been stated by some writers that under this test atropine yields a yellow coloration, whereas hyoscyamine yields a purple color; but this difference did not exist in the preparations examined.

(2) *Auric Chloride.*—This reagent throws down from aqueous solutions of salts of the alkaloids, even when quite dilute, a bright yellow precipitate of the aurochloride of the alkaloid. The precipitate from *hyoscine*, being the least soluble of these gold salts, is notably greater in quantity, and it more promptly assumes the crystalline form than the precipitate from like solutions of either of the other two alkaloids.

If a drop of a 1–100th solution of the alkaloids be treated with a drop of the reagent, the hyoscine solution yields a very copious precipitate and soon the mixture becomes a solid, confused crystalline mass. The precipitate from atropine stands next in quantity, that from hyoscyamine being least. No marked difference was observed in the color of the precipitates, even on spontaneous evaporation to dryness.

A drop of a 1–1000th solution of the alkaloids gave with the reagent, very uniformly in the case of hyoscine, a precipitate which quickly formed crystalline lamina or leaves; whilst that from atropine formed minute granules, and that from hyoscyamine crystalline blocks or masses.

(3) *Bromine Test.*—As we have pointed out elsewhere, a solution of bromine in bromohydric acid throws down from solutions of atropine and of hyoscyamine, even when highly dilute, a yellow amorphous precipitate which is soon converted into characteristic crystals, no marked difference being observed between the reaction of the two alkaloids. With an aqueous solution of *hyoscine*, the reagent produces a voluminous yellow precipitate which soon becomes converted into minute globules; these change to large yellow drops, which slowly dissolve to a colorless solution. In no instance

were crystals obtained by the reagent from a 1–100th or more dilute solution of this alkaloid.

This reaction, therefore, serves to discriminate atropine and hyoscyamine from hyoscine, at least from the preparation under examination.

The Bromine reagent may be very satisfactorily applied to atropine and hyoscyamine, and their salts, in the *solid* state. If a minute portion of either alkaloid be touched with a small drop of the reagent, it is *immediately* converted into a mass of crystals, consisting of rough needles, twig-like masses and bright yellow plates.

The residue from one drop of a 1–1000th solution of the alkaloids yields with the reagent, a mass of crystals of the usual forms; and the residue from a drop of a 1–10000th solution, gives a very satisfactory deposit of crystalline needles and granules.

This reaction, as in the case of solutions of the alkaloid, will manifest itself in the presence of comparatively large proportions of foreign matter. Thus, if a drop of a 1–1000th solution of the alkaloid be treated with a drop of ordinary urine, and the mixture evaporated to dryness, the residue will yield, under the reagent, a very satisfactory crystalline reaction, although the proportion of urine solids to the alkaloid present is about 50 : 1. Crystals may be obtained from even a much less quantity of the alkaloid mixed with this amount of urine solids.

If the Bromine reagent be applied to a minute drop of a syrupy solution of *hyoscine*, it is immediately converted into a mass of reddish-yellow globules, which soon change to bold groups of faintly yellow crystals, these being quite different in form from the crystals obtained from the other two alkaloids.

The *residue* from a drop of a 1–100th solution of hyoscine yields, under the reagent, a mass of yellow globules, which soon become converted into groups of bold crystals. From the residue from a 1–1000th solution of this alkaloid no crystals were obtained, the precipitate consisting alone of oily drops.

(4) *Picric Acid.*—A drop of a 1–100th solution of *atropine*, when treated with a drop of an alcoholic solution of this reagent yields a voluminous yellow precipitate, which slowly becomes converted into minute yellow drops. If, however, the mixture be stirred with a glass rod, it quickly yields beautiful groups of yellow crystals, as figured in *Micro-Chemistry of Poisons.* Pl. xiii, Fig. 1.

A drop of a similar solution of *hyoscyamine* yields, with the reagent, results not to be distinguished from those from atropine.

A like solution of *hyoscine* gives, with the reagent, a yellow precipitate, which remains amorphous; but on stirring the mixture it slowly becomes, on standing, a dense mass of fine, feathery or plumose crystals, markedly different in form from the crystals of the preceding alkaloids. These crystals are less readily formed than those from either atropine or hyoscyamine.

(5) *Platinic Chloride.*—Under the action of this reagent, when applied to somewhat strong solutions, no marked difference was observed between the three alkaloids.

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