XXXIV.—*Presence of Choline in Hops.*

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CHOLINE, which is also known under the names of sincaline, neurine, and amanitine, the rational formula of which is $\left\{ \begin{array}{c} (\text{CH}_3)_3 \\ \text{C}_2\text{H}_4.\text{OH} \end{array} \right\} \text{N.OH}$, is not only a constantly occurring constituent of several organs of the animal body, for instance the brain, but it has also been proved to exist in some plants. As is well known, it was prepared synthetically by Wurtz, by the action of ethylene oxide on trimethylamine. We have found that it is also present in hops. In order to isolate it from the latter, the following method was adopted. To a concentrated aqueous extract of hops, acidified with hydrochloric acid, a sufficient quantity of a solution of iodine in hydriodic acid was added. In this way a blackish semi-solid precipitate was obtained, which occasionally crystallised in slender shining needles, and no doubt consisted of a choline periodide. Separated from the mother-liquors, and boiled with water, it is converted into the very easily soluble choline iodide, vapour of iodine being at the same time evolved and a tarry mass deposited. The free base is obtained, although at first in a very impure state, by treating the choline iodide with silver oxide, and evaporating the filtered solution on the water-bath. We have found it advisable to purify this crude choline by converting it into the aurochloride, recrystallising this, separating the gold by means of sulphuretted hydrogen, and decomposing the choline chloride thus obtained with silver oxide. The base, freed from water as far as possible by evaporating its solution on the water-bath, forms a thick strongly alkaline syrup, which solidifies in the desiccator to an extremely hygroscopic, crystalline mass; it quickly absorbs carbonic anhydride, has a caustic and somewhat bitter taste, is quite odourless, and is decomposed at a high temperature with formation of trimethylamine. The chloride of the base is also extremely deliquescent, and yields a characteristic platino-chloride, which is almost insoluble in alcohol, but very soluble even in cold water, crystallising out in fine orange tables.

Although the foregoing observations leave little doubt that the base present in hops is, as we have supposed, identical with choline, we have nevertheless submitted its aurochloride to analysis, as it can be very readily obtained in a pure state.

If to a moderately concentrated solution of the base or its chloride, gold chloride be added, the double salt is at once thrown down as a yellow precipitate, which is easily soluble in boiling water and

alcohol, and on recrystallisation from these liquids is obtained in the form of small needles or fine prisms.

- I. 0.532 gram gold salt dried at 100° gave 0.2725 gram CO₂ and 0.158 gram OH₂.
- II. 0.596 gram gold salt gave 0.264 gram Au.
- III. 0.623 gram gold salt gave 0.2757 gram Au.
- IV. 0.3303 gram gold salt gave 0.1465 gram Au.

These numbers agree fairly well with the formula

as will be seen from the following:—

	Calculated.		Found.			
			I.	II.	III.	IV.
C ₅	60	13.54	13.95	—	—	—
H ₁₄	14	3.16	3.32	—	—	—
N	14	3.16	—	—	—	—
O	16	3.61	—	—	—	—
Au.....	197	44.48	—	44.29	44.39	44.35
Cl ₄	142	32.06	—	—	—	—
	443	100.00				

Regarding the mode of combination* and the quantity in which choline exists in hops, we are at present unable to give a satisfactory explanation. As to the latter point, however, we may say that, according to the method described, we have not been able to obtain more than about $\frac{1}{30}$ per cent. from the hops.

It was to be expected that choline would also be found in beer, and we have, in fact, succeeded in extracting it therefrom with ease, making use of a method similar to that described above.

Whether the circumstance that choline is present in beer has any physiological significance, is a question which we are not in a position to decide; it is, however, interesting that this never-failing and peculiar constituent of the brain-substance should also be present in one of our most important articles of diet.

* We consider it not improbable that choline exists in hops in loose combination with resin, and that such a combination may form that bitter principle of hops which is easily soluble in water. We have found that a very dilute aqueous solution of choline is capable of dissolving comparatively large quantities of hop resin, thereby producing a liquid of an intensely bitter taste.