CXLVII. THE CHEMICAL CONSTITUTION OF SPERMINE.

II. THE METHYLATION OF SPERMINE.

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IN a previous communication [1924] it was shown that the base spermine can be isolated from a variety of tissues and has the formula $C_{10}H_{26}N_4$.

Of the various methods of attacking the problem of its chemical constitution which have been tried, the most promising appears to lie in the exhaustive methylation of the base. It has been found that by this procedure ten methyl groups are taken up by spermine, giving a quaternary ammonium base $C_{20}H_{50}N_4(OH)_4$ and indicating that two of its nitrogen atoms are primary whilst the other two are secondary. The degradation of this base yields at least two simpler bases, the identification of which will be attempted with the larger amounts of spermine now available.

EXPERIMENTAL.

Methylation of spermine. 1.59 g. spermine hydrochloride were dissolved in 5 cc. water; 40 cc. 2 % KOH in methyl alcohol and 5 cc. CH_3I were then added. The mixture was heated to 40° in a water-bath under a reflux condenser until its reaction was neutral to litmus, which occurred in 30–45 minutes. 10 cc. 4 % KOH in methyl alcohol were then added and the heating continued. At about half-hourly intervals, the solution having become neutral again, similar quantities of KOH were added; in all, fourteen such additions and three of 4 cc. CH_3I were made. To the practically neutral solution water was added to dissolve the crystalline material which had separated and the methyl alcohol and excess of methyl iodide were distilled off *in vacuo*. The iodides in the aqueous residue were converted into chlorides by shaking with excess of freshly precipitated silver chloride, and to the filtrate (300 cc.) from this was added a saturated aqueous solution of mercuric chloride. This precipitates the very sparingly soluble mercurichloride of decamethylspermine. After standing the mercurichloride was filtered off, washed with water and dried in a vacuum desiccator. Yield 7.05 g. This salt was suspended in 500 cc. water, heated on the water-bath and the mercury was removed by H_2S . The HgS was suspended in 500 cc. hot water and again treated with

H₂S to ensure complete decomposition. The combined filtrates were concentrated on the water-bath to about 150 cc. when excess of sodium picrate solution was added. The picrate, after standing, was filtered off, washed with a little water and dried at 90°. Yield 5.7 g. This is a practically theoretically quantitative yield. After recrystallisation from water 5 g. of the pure picrate were obtained from which a solution of the chloride was made in the usual way and the following salts prepared.

Decamethylspermine chloroaurate: C₂₀H₅₀N₄ (AuCl₄)₄. This salt is very sparingly soluble in water, but is readily soluble in mixtures of water and acetone from which it crystallises in glistening, diamond-shaped plates. Recrystallised from 15 % HCl it is obtained as short, prismatic needles. M.P. 278–280° with decomposition. It contains no water of crystallisation.

Analysis. 0.1300 g. gave 0.0598 g. Au.

Au found, 46.0 %; calc. 46.30 %.

Decamethylspermine chloroplatinate: C₂₀H₅₀N₄ (PtCl₆)₂. This salt is very insoluble in water and alcohol. Recrystallised from 15 % HCl it is obtained as a dull orange powder, the crystalline form of which resembles that of ammonium chloride. M.P. 286–288° with decomposition. It contains no water of crystallisation.

Analysis. 0.1757 g. gave 0.0588 g. Pt.

Pt found, 33.47 %; calc. 33.56 %.

Decamethylspermine tetrapicrate: C₂₀H₅₀N₄ (C₆H₂O₇N₃)₄. This salt is very sparingly soluble in water (about 1 part in 6500 at room temperature), from which it crystallises in long, thin, flat needles. M.P. 272–274° with decomposition.

Analysis. 0.08135 g. gave 0.1399 g. nitron picrate.

Picric acid found, 72.80 %; calc. 72.82 %.

Decamethylspermine mercurichloride. This salt is very insoluble in cold water and can be recrystallised from dilute HCl in star-shaped groups of thick prisms. M.P. 268°.

The *chloride* of the ammonium base is very hygroscopic; with a solution of iodine in potassium iodide it gives a chocolate-brown crystalline precipitate, and a crystalline precipitate with an alcoholic solution of zinc chloride.

REFERENCE.

Dudley, Rosenheim, M. C. and Rosenheim, O. (1924). *Biochem. J.* 18, 1263