A number of 1-butyl-8-aminoalkyl-4-methyl-7-azaindoles are synthesized, viz. 1-butyl-4-methyl-7-azatryptamine, 1-butyl-8-aminomethyl-4-methyl-7-azaindole, and 1-butyl-8-dimethylaminomethyl-4-methyl-7-azaindole (1-butyl-4-methyl-7-azagramine). It is shown, using butylamine, that aliphatic primary amines behave differently in the reaction with trichlorocollidine from aromatic amines, and similarly to ammonia. The reaction product from trichlorocollidine and butylamine (as well as dibutylamine) is 1-butyl-4-methyl-6-chloro-7-azaindoline. Tributylamine is isolated from among the products of reaction of trichlorocollidine with dibutylamine, and the mechanism of its formation is considered.

Previous papers in this series [1, 2] described the synthesis of various 8-aminoalkyl-4-methyl-7-azaindoles, unsubstituted at the pyrrole nitrogen, or containing a phenyl substituent.

It was of interest, for further study of this series of compounds, to synthesize the corresponding 1-butyl-substituted 3-aminoalkyl-4-methyl-7-azaindoles. The starting compound for these syntheses was 1-butyl-4-methyl-6-chloro-7-azaindoline (I), the product of reaction of trichlorocollidine (II) with dibutylamine [3, 4].

From the previously advanced mechanism for this kind of reaction [5], the formation of I by reaction of trichlorocollidine with dibutylamine can be represented by the following equations:

\[ \text{CH}_3 \text{CHCH}_2 \text{Cl} + \text{NH}_2 \text{C}_4 \text{H}_9 \rightarrow \text{CH}_3 \text{C}_4 \text{H}_9 \text{N}^- + \text{C}_4 \text{H}_9 \text{Cl}^- \]

The final state in the synthesis of I by the above reactions involves dealkylation of a quaternary azaindoline derivative III. Under the reaction conditions the butyl group splitting off in the dealkylation, will react with excess dibutylamine to give tributylamine. To isolate the latter fraction of low-boiling amines formed in reaction of II with dibutylamine, it was acetylated with acetic anhydride. The tributylamine, incapable of undergoing acetylation, was separated from the N-acetyldibutylamine by extraction with hydrochloric acid, and was characterized as the base, its hydrochloride, and its picrate. Analysis of the starting dibutylamine showed that it did not contain tertiary amines, thus confirming that tributylamine was formed during the synthesis of the azaindoline derivative I.

As preparation of I from II and dibutylamine was accompanied by splitting off of a butyl group, it was of interest to use butylamine instead of dibutylamine for reaction with trichlorocollidine, and in that way to cut out the dealkylation stage. Previous work with aromatic amines [3, 6] showed that similar replacement of N-alkylanilines by aniline in a reaction with trichlorocollidine leads, independent of the amount of amine taken, to formation of only 1-phenyl-4-methyl-6-phenylamino-7-azaindoline instead of 1-phenyl-4-methyl-6-chloro-7-azaindoline. Hence in the aromatic series, change from secondary to primary amine is accompanied by replacement of the position 6 chlorine atom of the azaindoline derivatives by an amino group. Furthermore, only 4-methyl-6-chloro-7-azaindoline [7] is formed when trichlorocollidine reacts with ammonia, and the position 6 chlorine atom is not replaced.

*For Part XVI see [1].
Investigation of the reaction of trichlorocollidine with butylamine and dibutylamine showed that one and the same product, 1-butyl-4-methyl-6-chloro-7-azaindoline (I), was formed in both cases. Hence primary aliphatic amines behave, in reaction with trichlorocollidine, like ammonia, and unlike primary aromatic amines.

1-Butyl-4-methyl-6-chloro-7-azaindoline (I) was converted by a previously described method [8] into 1-butyl-4-methyl-7-azaindole (IV). The UV spectrum plot for azaindole IV is displaced towards the short wave region in comparison with that for the azaindoline I, as in all other cases [6, 7] (Fig. 1).

1-Butyl-4-methyl-7-azaindole (IV), like 1-phenyl-4-methyl-7-azaindole [9], showed a capacity for electrophilic substitution at position 3. Reaction with paraform and dimethylamine hydrochloride IV converted it to 1-butyl-4-methyl-7-azagramine (V), while a Wilsmeyer reaction with phosphorus oxychloride and dimethylformamide converted it to 1-butyl-3-formyl-4-methyl-7-azaindole (VI). The latter was also prepared by reacting the azagramine V with urotropine in boiling propionic acid.

Condensing 1-butyl-3-formyl-4-methyl-7-azaindole (VI) with nitromethane gave the nitrovinyl derivative VIII, lithium aluminum hydride reduction of which in boiling tetrahydrofuran gave 1-butyl-4-methyl-7-azatryptamine IX. The lower homolog of that compound, 1-butyl-3-aminomethyl-4-methyl-7-azaindole VII was obtained by zinc and hydrochloric acid reduction of the oxime of the aldehyde VI.

**Experimental**

Isolation of tributylamine from the reaction of trichlorocollidine II with dibutylamine. 53.8 g (0.24 mole) II and 58.2 g (0.45 mole) dibutylamine were heated together at 140° for 7 hr. Then 70 ml water was added to the reaction products, and the whole extracted with ether. The ether solution was extracted with 240 ml 15% HCl, then twice with 70 ml water each time. Distillation of the etheral extract, as previously described [8], gave 18.1 g (29%) 2, 6-dichloro-3-vinyl-4-methylpyridine, 28.3 g (48%) trichlorocollidine, and 6.8 g (9%) 2-chloro-8-(8-chloroethyl)-4-methyl-6-dibutylaminopyridine. The HCl and water solutions obtained by extraction were bulked, made alkaline to phenolphthalein with 50% aqueous K₂CO₃, and extracted with ether, after which the extract was dried over K₂CO₃, the ether distilled off, and the mixed low-boiling amines distilled off on a water bath under reduced pressure. Mass 45.8 g. The residue distilled at 147-148° (1 mm) to give 9.15 g (17%) 1-butyl-4-methyl-6-chloro-7-azaindoline (I). UV spectrum*: λ max μ (lg ε): 263 (3.97), 318 (3.73). The mixture of low-boiling amines was boiled for 3 hr with

* Yu. M. Viktorov participated in the experimental work.
** All UV spectra were determined with a SF-4 spectrophotometer, in ethanol solution.