Preparation of 5-(1-pyrrolidyl)-2-aminopentane (III) from ethyl acetoacetate and β-1-pyrrolidylethyl chloride[1a] was patterned after the synthesis used for noval diamine.[3] Alkylation of III with 4,7-dichloroquinoline occurred smoothly to give the desired aminoquinoline (I).

In suppressive tests on *p. gallinaceum* in the chick, the order of activity and toxicity of I was analogous to that of Chloroquine.[4]

Experimental

5-(1-Pyrrolidyl)-3-carbethoxypentanone-2.—A solution of 400 g. (2.35 moles) of pyrrolidylethyl chloride hydrochloride in 200 ml. of water was treated with Nuchar C twice. The resulting light yellow solution was covered with 200 ml. of benzene, cooled to 5° and cold 50% potassium hydroxide was added with stirring and cooling below 12°. The upper organic layer was separated and the aqueous layer extracted twice with 100-ml. portions of benzene. Titration of a sample of the combined layers indicated 2.25 moles of base in solution or 96% of theory.

The sodium salt of 172 g. of acetoacetic ester in 1 l. of dry benzene was prepared with 26.0 g. of sodium sand. After addition of the ester was complete the mixture was boiled under reflux for one hour. One half of the above benzene solution of pyrrolidylethyl chloride was added dropwise. No reaction was apparent and the mixture was boiled under reflux for ten hours. After two hours nearly all the material was in solution.

5-Pyrrolidylpentanone-2.—To the above solution was added dilute sulfuric acid (from 160 ml. of water, 140 g. of ice, and 75 ml. of sulfuric acid). When about two-thirds of the acid had been added the solution was filtered and the layers separated. The remainder of the acid was used to dissolve the solid on the filter and to wash the benzene layer. The combined aqueous layers were washed with 100 ml. of benzene. The benzene was removed by distillation and the residual solution was boiled under reflux for seventeen hours. To the cooled solution was added 430 ml. of 30% sodium hydroxide with cooling and an organic layer of 184 g. was removed. The aqueous layer was extracted three times with 100-ml. portions of benzene. The dried organic layer was distilled to give 129 g. (74%) of material boiling at 92–98° (11–13 mm.). Redistillation of this gave a fraction which weighed 98.2 g.; b. p. 93–95° (11 mm.), $n^{20}D$ 1.4589.

Anal. Calcd. for $C_9H_{17}NO$: C, 69.63; H, 11.04; N, 9.02. Found: C, 70.10; H, 11.07; N, 8.35.

5-Pyrrolidyl-2-aminopentane.—A solution of 88.1 g. (0.568 mole) of 5-pyrrolidylpentanone-2, in a mixed solvent consisting of 100 ml. of dry ammonia and 100 ml. of dry methanol was reduced in two portions in the presence of Raney nickel catalyst. Reduction was complete after one and one-third to two hours at 100°. After filtration and removal of solvent the residue was distilled to give 86.8 g. of 5-pyrrolidyl-2-aminopentane, b. p. 92–97° (11–12 mm.), $n^{20}D$ 1.4665. This was purified through the dithiocarbamate[5] to give a product which boiled at 93–94° (11 mm.), $n^{20}D$ 1.4674.

Anal. Calcd. for $C_9H_{20}N_2$: C, 69.17; H, 12.89. Found: C, 69.45; H, 12.44.

The picrate after recrystallization from ethanol melted at 148–149°.

Anal. Calcd. for $C_{21}H_{26}N_8O_{14}$: C, 41.04; H, 4.27. Found: C, 41.06; H, 4.27.

7-Chloro-4-[1-methyl-4-(1-pyrrolidyl)-butylamino]-quinoline.—A mixture of 29.0 g. (0.147 mole) of 4,7-dichloroquinoline and 50.0 g. (0.322 mole) of 5-pyrrolidyl-2-aminopentane was heated with stirring for six hours at 160–170°. The cold mixture was taken up in 120 ml. of 50% acetic acid with cooling. After addition of 100 ml. of ether, 140 ml. of 30% sodium hydroxide was added to give a strongly basic solution. The mixture was shaken, the ether layer separated, and the aqueous layer was extracted with three 100-ml. portions of ether. The combined ether extracts were dried over magnesium sulfate. After removal of the solvent, 20.1 g. of an oil boiling at 93° (11 mm.) was obtained leaving a residue of 45.7 g. (98%). A portion (31 g.) of this dark green fluorescent residue was taken up in 100 ml. of hot methylcyclohexane. Upon cooling 28 g. of yellow solid, m. p. 98–107°, was obtained. Three recrystallizations from methylcyclohexane gave some oily solid as a first precipitate and 13 g. of white 7-chloro-4-[1-methyl-4-(1-pyrrolidyl)-butylamino]-quinoline, m. p. 110–111°.

Anal. Calcd. for $C_{18}H_{24}N_3Cl$: C, 68.01; H, 7.61; N, 13.22. Found: C, 68.11; H, 7.52; N, 12.68.

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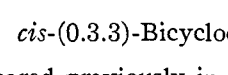
(3) Research and Manufacturing at I. G. Farbenindustrie; British Intelligence Objectives Subcommittee, Appendix 9, Processes 3–7.

(4) We wish to express our appreciation to the National Institute of Health and to William Longenecker for these pharmacological data.

(5) Jones, *Ind. Eng. Chem., Anal. Ed.*, **7**, 431 (1944).

The Preparation and Properties of *cis*-(0.3.3)-Bicycloöctane

BY A. W. RYTINA,[1] ROBERT W. SCHIESSLER AND FRANK C. WHITMORE[2]

cis-(0.3.3)-Bicycloöctane  was prepared previously in very small quantity by Linstead and Cook[3] by heating the semicarbazone of *cis*-α-(0.3.3)bicycloöctanone with potassium hydroxide at 200–210°. A small-scale trial of this method by the present workers resulted in a poor (less than 40%) yield of hydrocarbon, therefore the conversion of the ketone to hydrocarbon was accomplished by the modified Wolff–Kishner reaction.[4] A 68% yield of bicycloöctane was realized, based on carefully purified material.

The hydrocarbon was purified by fractional distillation through a 25-plate helix-packed column, and the following properties determined.

°C.	Density,[a] g./ml.	Viscosity,[b] cp.
0.0	0.8863	2.839
20.0	.8695	1.859
37.8	.8543	1.350
60.0	.8353	0.9598

B. p.: 136.5° (±0.2°) at 738.3 mm.

M. p.: *ca.* −49° (much difficulty was encountered with glass formation)

$n^{20}D$: 1.4622

Mol. refraction (20°C.): found 34.85; calcd. 34.76

[a] ±0.0001; corrected for air buoyancy. [b] ±0.2%.

Experimental

Following the method of Linstead,[3] a total of 300 g. of pure *cis*-α-(0.3.3)bicycloöctanone was prepared from indene by hydrogenation to hydrindene, sulfonation, fusion with potassium hydroxide of the resultant 5-hydrin-

(1) Present address: Rohm and Haas, Philadelphia, Pa.

(2) Deceased.

(3) Linstead and Cook, *J. Chem. Soc.*, 946 (1934).

(4) Whitmore, Herr, Clarke, Rowland and Schiessler, THIS JOURNAL, **67**, 2059 (1945).

denesulfonic acid, hydrogenation to 5-hydrindanol, nitric acid oxidation to 1-carboxy-2-cyclopentane-beta-propionic acid,[3] and cyclo-decarboxylation to the desired ketone over barium oxide.

To a 300-ml. Aminco hydrogenation bomb was charged 53 g. (0.43 mole) of purified *cis*-α-[0.3.3]bicycloöctanone, 43 g. (0.86 mole) of 100% hydrazine hydrate, 225 g. (4.0 moles) of potassium hydroxide and one liter of triethylene glycol.[4] The mixture was shaken at 195° for twenty-three hours in the sealed bomb. After cooling to room temperature, the reaction mixture was removed from the bomb (foaming), diluted with water, and the mixture steam-distilled. The two liters of steam distillate was acidified with 10% hydrochloric acid and extracted with 400 ml. of ethyl ether. The ether was removed from the separated, dried organic layer by distillation through a 20-plate fractionating column. To the residue was added 35 ml. of 2-octanone, and the mixture carefully fractionated through a 20-plate column to yield 32 g. of material boiling at 136–137° at 735 mm.

This product was combined with 19 g. of material prepared by the semicarbazone method[3] and distilled through a 25-plate column, yielding 49.5 g. of constant boiling, constant index *cis*-(0.3.3)bicycloöctane, b. p. 137° (735 mm.), $n^{20}D$ 1.4622. The hydrocarbon was filtered through a 2 × 20 cm. tube filled with activated silica gel (28–200 mesh), and the physical properties determined.

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DEPARTMENT OF CHEMISTRY
PENNSYLVANIA STATE COLLEGE
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The Preparation of α-Trifluoro-*p*-phenylacetophenone

BY J. H. SAUNDERS, R. J. SLOCOMBE AND EDGAR E. HARDY

Trifluoroacetic acid was converted to the acid chloride and this in turn to α-trifluoro-*p*-phenylacetophenone with an over-all yield of 53%. Recrystallization of this compound from methanol apparently gave the solvated ketone containing one molar equivalent of methanol.

Trifluoroacetyl Chloride.—A 1-liter 3-necked flask was equipped with a dropping funnel, stopper, and an 8-in. helix-packed column. A partial take-off still-head and a Hopkins type, Dry Ice-cooled condenser were attached to the column. The head and condenser gas outlet were then connected to a Dry Ice trap. Two hundred sixty grams (1.25 moles) of phosphorus pentachloride was placed in the flask and 96 g. (0.84 mole) of trifluoroacetic acid was added in 5-cc. portions. To ensure complete reaction the system was maintained under total reflux while the first 5 cc. of acid was added and for an additional ten minutes. Then all of the acid chloride produced from this portion of acid was distilled into the cold receiver before adding the next 5 cc. of acid. Proceeding in this manner about six hours were required for the entire reaction. When all of the acid had been added and had reacted the flask and its contents were warmed to 50° to drive out the last traces of acid chloride. The yield of the clear, straw-colored liquid, which contained some hydrogen chloride, was 119 g.

α-Trifluoro-*p*-phenylacetophenone.—The method of Simons and Ramler[1] was followed. From 205 g. (1.33 moles) of biphenyl, 178.5 g. (1.33 moles) of aluminum chloride, and the acid chloride from 96 g. (0.84 mole) of trifluoroacetic acid there was obtained 114 g. (55.6%) of recovered biphenyl and 112 g. (53.4% based on trifluoroacetic acid, 75.6% based on biphenyl consumed) of α-trifluoro-*p*-phenylacetophenone, b. p. 130–133° (3 mm.). After recrystallization from 60–70° petroleum solvent the compound melted at 51.2–51.4°.

Anal.[2] Calcd. for $C_{14}H_9OF_3$: C, 67.20; H, 3.62. Found: C, 67.48; H, 3.84.

When this product was recrystallized from methanol or methanol and water a new compound, m. p. 102.5–103.5°, was obtained. When this compound was heated above its melting point a condensable gas, presumably methanol, was evolved, and the residue again melted at 51.0–51.4°. Analysis indicated the presence of one mole of methanol per mole of ketone. The difficulty with which a solid of constant melting point was obtained indicated that this compound may have been unstable in methanol solution or that other states of solvation may have existed.

Anal. Calcd. for $C_{15}H_{13}O_2F_3$: C, 63.83; H, 4.64. Found: C, 64.03; H, 4.37.

The α-trifluoro-*p*-phenylacetophenone was insoluble in 10% sodium hydroxide solution but was rapidly hydrolyzed by warm alkali. The observed products were a gas, doubtless fluoroform,[1] and biphenyl-4-carboxylic acid, m. p. 226–228°. Gull and Turner reported m. p. 228° for this acid.[3]

(1) Simons and Ramler, THIS JOURNAL, **65**, 389 (1943).

(2) Microanalyses were made by the Clark Microanalytical Laboratory, Urbana, Illinois.

(3) Gull and Turner, *J. Chem. Soc.*, 491 (1929).

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Chlorination of *t*-Butylbenzene to 1-Chloro-2-methyl-2-phenylpropane

BY WILLIAM E. TRUCE, E. T. MCBEE AND C. C. ALFIERI

The side chain of *t*-butylbenzene has been considered too inert to undergo reaction directly with the halogens. It was claimed that chlorination of *t*-butylbenzene in the presence of sunlight caused ring substitution only.[1] However, we chlorinated *t*-butylbenzene to 1-chloro-2-methyl-2-phenylpropane in 48% conversion. (This compound had been obtained previously by the peroxide-induced chlorination of *t*-butylbenzene with sulfuryl chloride.[2])

Proof of structure consisted of oxidizing the product to benzoic acid in small yield with alkaline potassium permanganate,[3] and carbonation of the corresponding Grignard reagent to the known 3-methyl-3-phenylbutyric acid[4] in 49% over-all conversion. The poor yield of benzoic acid in the above oxidation is to be anticipated for *t*-alkylbenzenes.[5] The preparation of the Grignard reagent was difficult to initiate. When the reaction started, it proceeded slowly but smoothly and an

(1) Salibil, *Chem. Ztg.*, **35**, 97 (1911); *Chem. Zentr.*, **83**, 1581 (1912).

(2) Kharasch and Brown, THIS JOURNAL, **61**, 2142 (1939).

(3) Shriner and Fuson, "Identification of Organic Compounds," 2nd ed., John Wiley and Sons, Inc., New York, N. Y., 1940, p. 163.

(4) Saboor, *J. Chem. Soc.*, 922 (1945); Hoffman, THIS JOURNAL, **51**, 2545 (1929).

(5) Legge, *ibid.*, **69**, 2079 (1947).