TABLE I

AMINE OXIDES OF SOME DESOXYCODEINES

Compound	Yield, %	M.p., °C.	Formula	Carbon, % Calcd.	Carbon, % Found	Hydrogen, % Calcd.	Hydrogen, % Found
Δ^6-Desoxycodeine-N-oxide	80	94-98	$C_{18}H_{21}O_3N\cdot{}^1/_3H_2O^a$	70.8	70.9	7.2	7.0
Picrate		212-217	$C_{24}H_{24}O_{10}N_4$	54.6	54.3	4.6	4.8
Δ^7-Desoxycodeine-N-oxide	84	173-176	$C_{18}H_{21}O_3N$	72.2	71.9	7.1	6.9
Δ^8-Desoxycodeine-N-oxide	77	160-164	$C_{18}H_{21}O_3N\cdot{}^1/_3H_2O^a$	70.8	71.1	7.2	7.2
Picrate		188-192	$C_{24}H_{24}O_{10}N_4$	54.6	54.8	4.6	4.9
6-Methyl-Δ^6-desoxycodeine-N-oxide	91	183-187 192-196[b]	$C_{19}H_{23}O_3N$	72.8	72.5	7.4	7.3
Dihydrodesoxycodeine-N-oxide	64	95-98	$C_{18}H_{23}O_3N$	71.7	71.3	7.7	7.4
Picrate		118-121	$C_{24}H_{26}O_{10}N_4$	54.3	54.5	4.9	4.8

[a] Extremely hygroscopic; drying at elevated temperatures caused partial decomposition. [b] Dimorphic forms.

6-Methyl-Δ^5-desoxycodeine was formed by the action of thionyl chloride on 6-methyldihydrocodeine.[9]

1-Bromodihydrodesoxycodeine.—A solution of 800 mg. (5 mmoles) of bromine in 10 ml. of glacial acetic acid was added over a ten-minute period to a cold solution of 715 mg. (2.5 mmoles) of dihydrodesoxycodeine in 20 ml. of 3 *N* acetic acid. The aqueous solution was made distinctly alkaline with concd. sodium hydroxide and was extracted with three 25-ml. portions of chloroform. Drying with sodium sulfate and evaporation of the chloroform left 810 mg. (89% yield) of solid residue which was crystallized from methanol, m.p. 159-161°.

Anal. Calcd. for $C_{18}H_{22}NO_3Br$: C, 59.3; H, 6.1; Br, 21.9. Found: C, 59.3; H, 6.3; Br. 21.7.

Oxidations with Perbenzoic Acid.—Perbenzoic acid was prepared from benzoyl peroxide[10] and stored as a 0.5 *M* solution in chloroform at 5°. Prior to a rate of oxidation determination, a sufficient portion of this stock was diluted to 0.15 *M* and allowed to stand overnight at 0°, by which time its titer had become constant. In this solution was then dissolved a quantity of alkaloid equal to about 15 mole % of the peracid present, and the progress of the oxidation was followed by withdrawing aliquots and comparing their titer with those of a parallel solution to which no alkaloid had been added.

A perbenzoic acid solution in benzene was prepared in the same manner as above, using benzene as the initial extractant rather than chloroform. Oxidations in benzene were followed at 8 and 23°.

Oxidations with Monoperphthalic Acid. Amine Oxide Formation.—Ethereal monoperphthalic acid was prepared from phthalic anhydride and alkaline hydrogen peroxide,[11] and the ether was evaporated and replaced with purified acetone (distilled from potassium permanganate and then potassium carbonate). Such an acetone solution was completely stable at 0° for at least 24 hours and was used in the oxidation studies.

The general procedure for preparing the amine oxides consisted in treating the codeine derivative with approximately 300 mole % of monoperphthalic acid as a 0.1 *M* solution in acetone and allowing the solution to stand at 0° for 30 minutes. Excess saturated sodium bicarbonate solution was then added, the mixture was filtered, and the filtrate was evaporated to dryness. The residue was distributed between chloroform and water using three additional portions of chloroform. Drying and evaporating the chloroform left a residue which was either crystallized from benzene or chromatographed on alumina (Merck). In the latter case, benzene was used for development and 5% isopropyl alcohol in benzene for elution. Evaporation of the combined isopropyl alcohol–benzene fractions gave residues which were crystalline in some instances or were crystallized from benzene in others.

Amine oxide picrates were prepared in and were recrystal ized from methanol.

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(9) L. Small and H. Rapoport, *J. Org. Chem.*, **12**, 284 (1947).

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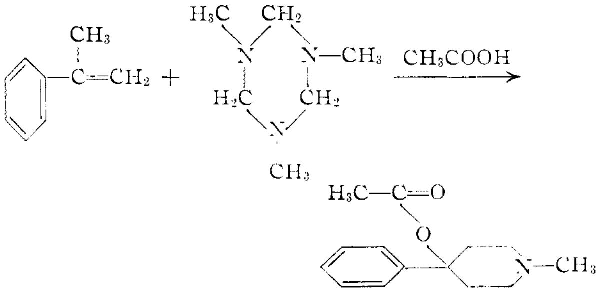
The Aminomethylation of Olefins. III. The Synthesis of 1-Methyl-4-phenyl-4-acetoxypiperidine

BY CLAUDE J. SCHMIDLE AND RICHARD C. MANSFIELD

RECEIVED JUNE 22, 1955

The analgesic activity of a series of 1-alkyl-4-aryl-4-acyloxypiperidines has been reported.[1] A previous communication[2] has described studies in our laboratories concerned with a new method of preparation of 1-alkyl-4-aryl-4-piperidinols. The synthesis of 1-methyl-4-phenyl-4-acetoxypiperidine has now been accomplished by a one-step process involving the reaction of α-methylstyrene, acetic acid and N,N′,N″-trimethyltrimethylenetriamine. The latter material can be easily prepared[3] from methylamine and formaldehyde.



The reaction proceeded without a catalyst but the addition of concentrated sulfuric acid or phosphoric acid gave improved yields. When 85% orthophosphoric acid was used it was necessary to eliminate water by introduction of a calculated amount of acetic anhydride to the reaction mixture prior to addition of the amine and olefin. Excess acetic acid acted as solvent in the reaction which was carried out using N,N′,N″-trimethyltrimethylenetriamine and α-methylstyrene on an equimolar basis.

TABLE I

PREPARATION OF 1-METHYL-4-PHENYL-4-ACETOXYPIPERIDINE

Mole catalyst per mole α-methylstyrene	Time, hr.	Temp., °C.	Yield, %
None	4	115	17.2
1.0 H_3PO_4	4	115	30.1
0.8 H_2SO_4	5	115	29.6

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Acknowledgment.—The authors are indebted to Mr. C. W. Nash for microanalyses.

Experimental

1-Methyl-4-phenyl-4-acetoxypiperidine (Using H_3PO_4).—To a stirred mixture of 240 g. (4.0 moles) of glacial acetic acid and 51 g. (0.50 mole) of acetic anhydride was slowly added with external cooling 58 g. (0.50 mole) of 85% orthophosphoric acid. After the exothermic reaction had ceased there was added with cooling 65 g. (0.50 mole) of N,N′,N″-trimethyltrimethylenetriamine followed by 59 g. (0.50 mole) of α-methylstyrene. The mixture was stirred at 115° for 4 hr., allowed to stand 2 days, diluted with 500 ml. of water, extracted with benzene and made basic with sodium carbonate. The amine was taken up in benzene, dried over anhydrous potassium carbonate and distilled to give 35 g. (30.1%) of 1-methyl-4-phenyl-4-acetoxypiperidine, b.p. 100–120° (0.85 mm.). This crystallized and melted at 62–64° after recrystallization from heptane.

Anal. Calcd. for $C_{14}H_{19}NO_2$: C, 72.07; H, 8.21; N, 6.00. Found: C, 71.96; H, 8.34; N, 5.97.

The hydrochloride melted at 211–212° after recrystallization from acetone (lit.[4] m.p. 212–213°).

Anal. Calcd. for $C_{14}H_{20}NO_2Cl$: C, 62.33; H, 7.47; N, 5.19; Cl, 13.1. Found: C, 62.26; H, 7.59; N, 5.19; Cl, 13.2.

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The Stereochemistry of the Debromination of *meso*-1,2-Dibromo-1,2-dideuteroethane by Iodide Ion

BY W. M. SCHUBERT, HARVEY STEADLY AND B. S. RABINOVITCH

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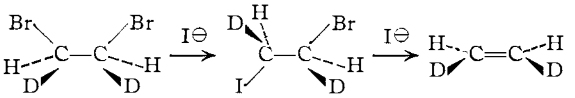
Recently, Hine and Brader have concluded that the debromination of ethylene bromide by iodide ion proceeds by a rate-controlling step of SN2 displacement by iodide ion, followed by a faster step of *trans* elimination on the intermediate bromoiodide.[1] The over-all result of this path would be *cis* removal of the bromine atoms (eq. 1). The conclusion was based on a comparison of substitution and elimination rates of a number of halides and involved a number of reasonable assumptions.



(1)

Since *meso*-1,2-dibromo-1,2-dideuteroethane was available in these laboratories from a previous study on the stereochemistry of debromination,[2] it was decided to determine directly the steric course of bromine elimination with iodide ion in this system.

As predicted for the reaction path proposed by Hine and Brader, the net steric course of the reaction in 90% aqueous methanol at 59° was one of exclusive *cis* elimination, within experimental error. *cis*-Ethylene-d_2 was isolated in about 60% yield (Table I). In a control experiment, treatment of *trans*-ethylene-d_2 with an appropriate mixture of iodide ion, iodine and bromine, under the reaction conditions gave a negligible amount of isomerization to *cis*-olefin. It was confirmed that treatment of *meso*-1,2-dibromo-1,2-dideuteroethane with zinc in water yielded the *trans* elimination product,[2] *trans*-ethylene-d_2, and that *dl*-2,3-dibromobutane with iodide ion gave *trans* elimination[3] (in contrast to ethylene dibromide), yielding greater than 95% of *cis*-2-butene and less than 5% *trans*-2-butene.

TABLE I

Compound	Reagents	*cis* in olefin mixture, %
95% *meso*-5%-*dl*-CHDBrCHDBr	KI in 90% CH_3OH (59°)	94.0, 93.0
trans-Ethylene-d_2	KI + I_2 + Br_2 in 90% CH_3OH (59°)	2.0
dl-2,3-Dibromobutane	KI in 90% CH_3OH (59°)	95–100

Experimental

Materials.—*trans*-Ethylene-d_2, *meso*-1,2-dibromo-1,2-dideuteroethane and *dl*-2,3-dibromobutane were prepared as previously described.[2,4] Infrared analysis of the *meso*-1,2-dibromo-1,2-dideuteroethane showed it to contain 5% of the *dl*-isomer.[4]

Debromination Procedures.—A mixture of *meso*-1,2-dibromo-1,2-dideuteroethane (0.0132 g.), methanol (1 ml.), water (0.1 ml.) and potassium iodide (0.75 g.) was heated in a sealed tube at 59° for 24 hr. in the dark. The tube was broken and the ethylene isolated in about 60% yield. The infrared analysis was carried out as before.[2] The same procedure was used for *dl*-2,3-dibromobutane.

The debromination of *meso*-1,2-dibromo-1,2-dideuteroethane with zinc metal and analysis of the olefin product was carried out as before.[2]

Control Experiment.—A mixture of *trans*-ethylene-d_2 (3 ml., gas), methanol (1 ml.), water (0.1 ml.), iodine (0.03 g.) and bromine (0.02 g.) was heated at 59° in a sealed tube for 24 hr. The olefin was isolated and analyzed as above.

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[1] J. Hine and W. H. Brader, Jr., THIS JOURNAL, **77**, 361 (1955).

[2] W. M. Schubert, B. S. Rabinovitch, N. R. Larson and V. A. Sims, *ibid.*, **74**, 4590 (1952).

[3] S. Winstein, W. G. Young and D. Pressman, *ibid.*, **61**, 1645 (1939).

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Reactions in Sunlight. XVIII. Dimerization of *o*-Phthalaldehyde

BY ALEXANDER SCHÖNBERG AND AHMED MUSTAFA

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Thiele and Günther[1] state that although *o*-phthalaldehyde (I) is stable in the dark, upon exposure to sunlight it forms a mixture of colorless substances which is crumbly in character. We have found that a solution of I in benzene, exposed to sunlight for one day (July), forms a colorless crystalline photodimer III which reduces ammoniacal silver nitrate solution. The photo-dimer forms a crystalline monophenylhydrazone and a monoöxime. On heating under reduced pressure, III dissociates to give a colorless sublimate, which was identified as phthalide II. The photo-dimer should, therefore, be either III or IIIa; IIIa is ruled out by the infrared absorption spectrum.

Absorption bands were observed in the infrared spectrum of the photodimer at 2820, 1739, 1368, 1290, 1213 and 910 cm.$^{-1}$, arising from an aromatic aldehyde; at 1748, and 1287 cm.$^{-1}$ from a carbonyl

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[1] J. Thiele and O. Günther, *Ann.*, **347**, 107 (1906).