

(strain), *Klebsiella pneumoniae*, *Candida albicans*, *Trichomonas foetus*, and *Trychophyton mentagrophytes*. All were inactive.

Experimental Section^a

Method A. 5-Substituted 2-Alkylmercapto-6-hydroxy-4-carboxypyrimidines.—To an S-alkylpseudothiourea sulfate (0.425 mole) dissolved in 1 l. of water was added 0.85 mole of the ethyl ester of the corresponding α -substituted ethoxalylacetate^b followed by 168 g (2.55 moles) of KOH dissolved in 300 ml of water. The resulting solution was allowed to stand at room temperature for 2 days. The reaction mixture was extracted with ether and treated with charcoal and then made strongly acidic with HCl. The product precipitated as a white precipitate. It was washed liberally with water and recrystallized by dissolving it in 1% NaOH solution, filtering through charcoal, and acidifying the hot solution with HCl.

Method B. 5-Substituted 2-Amino-6-hydroxy-4-carboxypyrimidine.—5-Substituted 2-methylmercapto-6-hydroxy-4-carboxypyrimidine (10 g) was dissolved in 100 ml of 30% NH₄OH solution and the mixture was heated in a bomb at 120° for 16 hr. The reaction mixture was cooled and slowly acidified with HCl. The white precipitate was washed with water and purified as described in the above procedure.

Method C. 5-Substituted 2,6-Dihydroxy-4-carboxypyrimidine.—Substituted 6-hydroxy-2-methylmercapto-4-carboxypyrimidine (10 g) was refluxed 6 hr with 250 ml of concentrated HCl solution. After cooling, the mixture was diluted with 250 ml of water, and the precipitate was collected and washed with water and acetone. The product was purified as described in the above procedure.

(5) Melting points were taken in open capillary tubes on a Mel-Temp apparatus and are corrected. Analyses are by Alfred Bernhardt Microanalytical Laboratories, Molheim, Germany.

(6) R. F. B. Cox and S. M. McElvain, "Organic Syntheses," Coll. Vol. II, John Wiley and Sons, Inc., New York, N. Y., 1943, p 272.

Routes to Unsymmetrical N,N'-Diarylethylenediamines

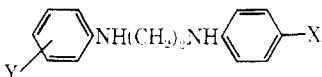
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Received July 11, 1966

Unsymmetrical diarylethylenediamines are of value both as precursors to imidazolidines and piperazines and as chelating ligands for transition metals. Two routes for the preparation are offered.

TABLE I^a
UNSYMMETRICAL ETHYLENEDIAMINES

		Method of prepn	Crude yield, % (final step)	Mp, °C ^b	Color	Carbon, %		Hydrogen, %		Nitrogen, %	
Y	X					Calcd	Found	Calcd	Found	Calcd	Found
<i>p</i> -(CH ₃) ₂ N	<i>p</i> -OCH ₃	I ^c	50	94–96	White	71.55	71.50	8.12	7.98		
<i>p</i> -NO ₂	<i>p</i> -(CH ₃) ₂ N	II ^d	65	161.5–163.0	Red-brown	63.98	64.07	6.71	6.84		
<i>p</i> -NO ₂	<i>p</i> -CH ₃ O	II ^c	50	151.5–152.0	Red-purple	62.69	62.55	5.97	6.15		
<i>p</i> -NO ₂	<i>p</i> -CH ₃	II ^e	65	161.5–162.5	Gold-orange	66.40	66.11	6.32	6.47	15.40	15.76
<i>m</i> -NO ₂	<i>p</i> -(CH ₃) ₂ N	II ^e	40	117.5–119	Yellow-orange	63.98	63.67	6.71	6.65		
<i>m</i> -NO ₂	<i>p</i> -CH ₃ O	II ^c	85	109.0–109.5	Red-orange	62.69	62.58	5.97	5.90	14.63	14.82

^a Elemental analyses were performed by Schwarzkopf Microanalytical Laboratory. ^b Recorded (uncorrected) on a Townson and Mercer type 5, melting point block. ^c Amine used in the final step was *p*-anisidine. ^d Amine used in the final step was N,N-dimethyl-*p*-phenylenediamine. ^e Amine used in the final step was *p*-toluidine.

Experimental Section

Procedure I.—The first route, of general utility, requires the preparation of a 2-aminoethanol by the action of an arylamine on 2-chloroethanol, conversion of the alcohol to a bromide with HBr, and, finally, amination of the resulting bromide with a second arylamine. The preparation of 2-(*p*-dimethylaminoanilino)- and 2-(*p*-methoxyanilino)ethanol followed that of Jacobs and Heidelberg,¹ while the procedure for the synthesis of the corresponding bromides was that of Pearlman.² The crude hydrobromide (0.1 mole) was heated with the appropriate arylamine (0.4 mole) at 100° for 6–10 hr with stirring, and the mixture was poured while hot and fluid into cold, swirling water (300 ml). After thorough homogenization of the precipitate, the solution was neutralized with aqueous NaOH, and the precipitate was filtered and washed with water. The precipitate was then thoroughly extracted with 1:1 methanol-water (300 ml), collected, and washed with methanol-water. Recrystallization was from ethanol or ethanol-water.

Procedure II.—The second procedure is for the special case where one aryl group carries a strongly electron-attracting substituent such as a nitro group. A mixture of *p*-nitroaniline (0.31 mole, technical grade), Na₂CO₃ (0.14 mole), and 1-bromo-2-chloroethane (70 ml) was heated at gentle reflux for 40 hr with stirring. After cooling, the mixture was suction filtered and the precipitate was washed with 1-bromo-2-chloroethane (*ca.* 20 ml). The filtrate was evaporated to one-half volume *in vacuo* and cooled. Crude product was obtained in 30% yield (20 g). Four recrystallizations from ethanol-water produced material melting at 87.0–88.3°. The product of this reaction appears to be a mixture of 2-nitroanilinoethyl halides as evidenced by elemental analyses of various samples of short melting point range and the rather complex nmr spectrum.

Addition of chlorobromoethane to the molten amine (equimolar quantities) and Na₂CO₃ at 150° and continued heating at this temperature for 20 hr gave N,N'-bis(*p*-nitrophenyl)ethylenediamine. The same procedure sufficed for *m*-nitroaniline where the product (yield 18%) was recrystallized once from ether and twice from CCl₄.

The crude halide (*ca.* 0.05 mole) was then mixed with the appropriate aryl amine (0.2 mole) and heated to 100° for 12–16 hr (magnetic stirring). After cooling, this mixture was stirred with 95% ethanol (150 ml) for several hours and filtered. In only two cases, N-(*p*-dimethylamino)phenyl-N'-(*p*-nitrophenyl)ethylenediamine and N-(*p*-dimethylamino)phenyl-N'-(*m*-nitrophenyl)ethylenediamine, was solution effected. In these instances water (75–100 ml) was added to the ethanol filtrate to induce precipitation. Recrystallization was from ethanol or ethanol-water. Results are summarized in Table I.

Acknowledgments.—This investigation was supported by Public Health Service Research Grant CA-07064-03 from the National Cancer Institute and by National Science Foundation Grant GP-5025. We are indebted to the National Science Foundation for a Predoctoral Fellowship to C. H. Yoder.

(1) W. A. Jacobs and M. Heidelberg, *J. Biol. Chem.*, **21**, 403 (1915).

(2) W. M. Pearlman, *J. Am. Chem. Soc.*, **70**, 871 (1948).