Communications TO THE EDITOR

Phenazasiline Compounds Derived from Di-*p*-tolylamine

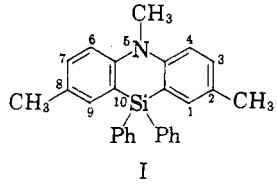
Sir:

The general interest in nitrogen-containing heterocyclic silanes, having the phenazasiline nucleus, has prompted the development of simplified procedures for their preparation. These compounds were first prepared by the extended heating of diphenylsilane with various phenothiazine derivatives.[1] Later, phenazasiline derivatives were synthesized by the reaction of *N*-alkyl-2,2′-dilithiodiphenylamine with appropriate silicon halides[2] and hydrides.[3] This latter method offers the advantages of greater versatility and increased yields. It suffers in that 2,2′-dibromodiphenylamine[4] is difficult to prepare and that *N*-alkylation has only been accomplished by treatment with methyllithium and then with a refluxing tetrahydrofuran solution of alkyl sulfate.[2]

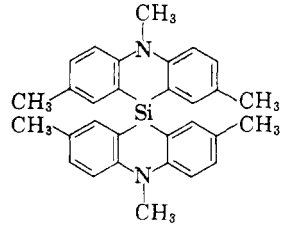
To overcome the limited accessibility of the 2,2′-dibromodiphenylamine, an investigation of the direct bromination of certain diarylamines was undertaken. We have found that it is possible to dibrominate both di-*p*-tolylamine and *N*-methyldi-*p*-tolylamine in good yields. The *N*-methyl-2,2′-dibromodi-*p*-tolylamine was converted to the dilithium derivative by halogen-metal interconversion with *n*-butyllithium, and then subsequently to the phenazasiline derivatives by treatment with the appropriate silicon halide.

A glacial acetic acid solution of *N*-methyldi-*p*-tolylamine[5] cooled in an ice-bath was treated with two molar equivalents of bromine by dropwise addition. After hydrolysis with a dilute solution of sodium bisulfite, the resulting solid was filtered and recrystallized three times from absolute ethanol giving a 60.8% yield of *N*-methyl-2,2′-dibromodi-*p*-tolylamine as large colorless needles, m.p. 102.5–104°. *Anal.* Calcd. for $C_{15}H_{15}Br_2N$: Br, 43.30; N, 3.80. Found: Br, 43.26, 43.06; N, 4.04, 3.86. The use of 2.5 mol. equiv. of bromine afforded a 76.5% yield of the dibromo derivative. Similarly, the bromination of di-*p*-tolylamine with 2 equiv. of bromine gave a 63.5% yield of 2,2′-dibromodi-*p*-tolylamine, m.p. 57.5–59°. *Anal.* Calcd. for $C_{14}H_{13}Br_2N$: Br, 45.01; N, 3.95. Found: Br, 44.64, 44.59; N, 3.92, 3.76. Treatment of 2,2′-dibromodi-*p*-tolylamine with methyllithium[6] and then with a refluxing tetrahydrofuran solution of dimethyl sulfate affordedt he above *N*-methyl-2,2′-dibromodi-*p*-tolylamine in an 88.7% yield (mixed m.p.).

An ethereal solution of *N*-methyl-2,2′-dibromodi-*p*-tolylamine was treated with 2 equiv. of *n*-butyllithium and stirred for 45 min. at 0°. Dichlorodiphenylsilane was added and the reaction mixture stirred at room temperature for 18 hr. Dry toluene was added and the ether distilled. After refluxing for 4 hr. Color Test I was negative and the reaction mixture was hydrolyzed. The resulting solid was recrystallized three times from petroleum ether (b.p. 60–70°) giving a 49.5% yield of 2,5,8-trimethyl-10,10-diphenylphenazasiline (I), m.p. 163–165°. *Anal.* Calcd. for $C_{27}H_{25}NSi$: C, 82.81; H, 6.44; N, 3.58; Si, 7.19. Found: C, 82.93, 83.13; H, 6.13, 6.18; N, 3.49, 3.43; Si, 7.30, 7.08.



I



II

Analogously, 2 mol. equiv. of *N*-methyl-2,2′-dilithiodi-*p*-tolylamine, prepared as above from *N*-methyl-2,2′-dibromodi-*p*-tolylamine and *n*-butyllithium, were reacted with silicon tetrachloride in a refluxing toluene solution. After work-up and four recrystallizations from cyclohexane, there was obtained a 34.7% yield of 2,2′,5,5′,8,8′-hexamethyl-10,10′-spirobiphenazasiline (II), m.p. 230–233°. *Anal.* Calcd. for $C_{30}H_{30}N_2Si$: C, 80.67; H, 6.77; Si, 6.29. Found: C, 80.74, 80.70; H, 6.70, 6.56; Si, 6.34, 6.24.

Procedures for the synthesis of other phenazasiline compounds and related types are being examined.

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(3) Unpublished studies.

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(6) All reactions involving organometallic compounds were carried out in an atmosphere of dry, oxygen-free nitrogen; and all melting points are uncorrected.

frared analyses were obtained through the courtesy of the Institute for Atomic Research.

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Adrenal Hormones and Related Compounds. VI.[1] A Series of 2-Fluorotestosterone Derivatives

Sir:

Diminution or elimination of androgenic activity without loss of other properties exhibited by "androgens" is a major objective in the modification of C-19-steroids. Partial success has been achieved in the preparation of the preferentially anabolic agents 9α-fluoro-11β-hydroxy-17-methyltestosterone (Halotestin),[2] 19-nortestosterone and its esters,[3] and 17-ethyl-19-nortestosterone,[4] and in the recent findings that Halotestin[5] and 2-methylandrostanolone[6] are of particular value in the treatment of mammary carcinoma.

Since the introduction of perchloryl fluoride and the development of techniques for its use in the fluorination of carbanions,[7] a number of α-fluoro ketosteroids have been prepared.[8] We now wish to report the synthesis of some 2-fluoro derivatives in the testosterone series.

When testosterone, 17-methyltestosterone, 9(11)-dehydro-17-methyltestosterone,[2] 11β-hydroxy-17-methyltestosterone,[2] and 9α-fluoro-11β-hydroxy-17-methyltestosterone[2] were condensed with ethyl oxalate using sodium methoxide in *t*-butyl alcohol,[1] the sodium enolates of the resulting 2-glyoxylates were obtained. These salts were treated with perchloryl fluoride in methanol and afforded, after basic cleavage of the ethoxyoxalyl residues, the corresponding 2-fluoro derivatives (see Table I). While 2,9-difluoro-11β-hydroxy-17-methyltestosterone was thus obtained in quite low yield it could be readily prepared from 2-fluoro-9(11)-dehydro-17-methyltestosterone *via* the opening of its 9,11β-epoxide with hydrogen fluoride.

TABLE I

9α-X- 11β-Y- 17α-Z- 2-FLUOROTESTOSTERONES

X	Y	Z	M.P., °C.	Yield, %	Anal., Found, % C	H	F
H	H	H	159.5–161	70	74.54	9.12	5.91
H	H	CH_3	174–174.5	42	75.17	9.53	6.10
H	OH	CH_3	217–220	60	71.79	8.51	5.6
F	OH	CH_3	228 (dec.)	8	68.08	8.29	9.67
$\Delta^{9(11)}$		CH_3	182–182.5	53	75.27	8.95	5.96

While many androgens have been reported to inhibit the mammary fibroadenoma in the rat,[9] 2-fluorotestosterone was found to effect nearly 100% inhibition of the mammary fibroadenoma which had become resistant to the action of testosterone propionate.[10] Even at elevated doses, 2-fluorotestosterone exhibited no indication of androgenic activity[11] yet, in the female rat, marked increases in body weight were observed.[12]

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(1) Paper V in this series: A. H. Nathan, B. J. Magerlein, and J. A. Hogg, *J. Am. Chem. Soc.*, in press.

(2) M. E. Herr, J. A. Hogg, and R. H. Levin, *J. Am. Chem. Soc.*, **78**, 500 (1956).

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(10) Private communication from Dr. E. M. Glenn.

(11) L. E. Barnes, R. O. Stafford, M. E. Guild, L. C. Thole and K. J. Olson, *Endocrinology*, **55**, 77 (1954).

(12) We wish to thank Drs. E. M. Glenn and W. E. Dulin and S. L. Richardson, S. C. Lyster, and B. J. Bowman of our Department of Endocrinology for the biological data summarized above.

Preparation and Some Reactions of Allyllithium

Sir:

Recent mention[1] that allyllithium has found use in the U.S.S.R. as a catalyst for stereospecific polymerization of dienes prompts this report of our new synthesis of allyllithium and methallyllithium by the exchange reaction between organolithium reagents and allyl- and methallyl-tin compounds.[2] Allyllithium was prepared first[3] by reaction of allylmagnesium bromide and lithium. However, the resulting solution of allyllithium was contaminated

(1) *Chem. Eng. News*, **37**, No. 27, 41 (1959).

(2) A similar reaction was used to prepare vinyllithium for the first time: D. Seyferth and M. A. Weiner, *Chem. & Ind. (London)*, **1959**, 402.

(3) T. E. Londergan, U. S. Patent **2,734,091** (1956).