was washed with H_2O, dried ($MgSO_4$), and concd. The yield of crude product was 89% (C=O, 1780 cm^{-1}). The chloroformate was converted into the desired carbamate by adding 1 equiv each of an amine (ethylenimine or Me_2NH) and Et_3N. The conditions and work-up procedure paralleled those just described.

Citronellol was converted into the P derivatives by treatment with 1 equiv each of the required acid halide and Et_3N.

Citronellylamine Derivatives.—The amine was prepared by LAH reduction of the oxime.[8] However, yields were variable and depended largely on the freshness of the reducing agent. Citronellylamine reacted with hexamethylene diisocyanate in Et_2O exothermically to produce the diurea as a ppt. The amine was converted into its other listed derivatives by reaction with the acid halide and Et_3N as described for citronellol.

Epoxidation of the ethyl (3,7-dimethyl-6-octenyl)carbamate was carried out with 1 equiv of *m*-chloroperbenzoic acid in CH_2Cl_2. The mixture was held at 5–10° during addn of the olefins and was allowed to stand at room temp overnight. After extraction with Na_2CO_3, the organic soln was dried (Na_2SO_4), concd, and dist by using a short-path distn apparatus.

The nmr spectrum of *P,P*-bis(1-aziridinyl)-*N*-(3,7-dimethyl-6-octenyl)phosphinic amide showed the following absorptions: 0.88 d (CH_3CH), 1.57 and 1.65 (cis and trans allylic Me, respectively), 1.93 d (—N  , J_{PH} = 15 Hz), 5.05 (vinyl H).

Acknowledgment.—The authors express their gratitude to C. G. LaBrecque and coworkers, Entomology Research Division's Insects Affecting Man Investigations Laboratory, Gainesville, Fla., for the tests of housefly sterility.

(8) D. Arigoni and O. Jeger, *Helv. Chim. Acta.*, **37**, 881 (1954).

Synthesis of New Urethans. *p*-Ethylsulfonyl- and *p*-Dimethylsulfamoylcarbanilic Acid Esters

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Several *p*-arylsulfonylcarbanilic acid esters were reported to have antitumor activities.[1] New urethans listed in Table I were prepared by Curtius degradation of appropriate benzoyl azides.

The compounds proved to be inactive[2] (T/C = 89–102% at 400 mg/kg) against the L-1210 lymphoid leukemia in BDF_1 mice, and the Walker carcinosarcoma 256 in random-bred albino rats.

Experimental Section[3]

***p*-Ethylsulfonylbenzoyl Azide.**—*p*-Ethylsulfonylbenzoic acid ethyl ester (mp 64°) was prepared by known methods from *p*-ethylsulfonylbenzoic acid[4] and transformed to *p*-ethylsulfonylbenzoylhydrazide (mp 164°). This hydrazide (2.28 g, 0.01 mole) in 20 ml of 50% AcOH was stirred vigorously at ice bath temperature to give 2.27 g of azide (95%) mp 125° dec. *Anal.* ($C_9H_9N_3O_3S$) C, H, N.

p-Dimethylsulfamoylbenzoyl azide was prepared similarly from *p*-dimethylsulfamoylbenzoyl hydrazide[5] as a white powder (91%), mp 109° dec. *Anal.* ($C_9H_{10}N_4O_3S$) C, H, N.

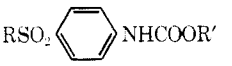
(1) Al. Mavrodin, C. Demetrescu, and C. Chirita, *Rev. Roum. Chim.*, **10**, 1025 (1965).

(2) Screening results were supplied by CCNCS of the National Institutes of Health, Bethesda, Md.

(3) Melting points were taken on a Kofler hot stage microscope and were uncorrected. The ir spectra were determined with a Leitz model III spectrograph. Nmr spectra were obtained on a Varian A60A instrument.

(4) H. Sato, *Yakugsku Zasshi*, **72**, 74 (1952).

TABLE I



R	R′	Mp, °C	Yield, %	Formula[a]
Et	Et	135	89	$C_{11}H_{15}NO_4S$
Et	*t*-Bu	129	93	$C_{13}H_{19}NO_4S$
Et	*n*-Hexyl	109	95	$C_{15}H_{23}NO_4S$
Et	*n*-Octyl	124	88	$C_{17}H_{27}NO_4S$
Et	Allyl	121	86	$C_{12}H_{15}NO_4S$
Et	Benzyl	136	96	$C_{16}H_{17}NO_4S$
Et	Cholesteryl	222	92	$C_{36}H_{55}NO_4S$
Et	Cyclopentyl	142	79	$C_{14}H_{19}NO_4S$
Et	Cyclohexyl	139	83	$C_{15}H_{21}NO_4S$
Et	Cycloheptyl	120	85	$C_{16}H_{23}NO_4S$
Et	Cyclooctyl	127	79	$C_{17}H_{25}NO_4S$
Et	*o*-$MeOC_6H_4$	191	80	$C_{16}H_{17}NO_5S$
Et	Thymyl	143	84	$C_{19}H_{23}NO_4S$
Et	6-Allyl-4-$MeOC_6H_3$	154	73	$C_{19}H_{21}NO_5S$
Et	Ph_2CH	195	76	$C_{22}H_{21}NO_4S$
Et	α-Cyclohexyl-α-methylbenzyl	136	79	$C_{23}H_{29}NO_4S$
Et	*p*-Menth-3-yl	170	92	$C_{19}H_{29}NO_4S$
Me_2N	Et	127	71	$C_{11}H_{16}N_2O_4S$
Me_2N	*i*-Pr	159	76	$C_{12}H_{18}N_2O_4S$
Me_2N	*t*-Bu	169	78	$C_{13}H_{20}N_2O_4S$
Me_2N	*n*-Am	105	72	$C_{14}H_{22}N_2O_4S$
Me_2N	*n*-Hexyl	95	69	$C_{15}H_{24}N_2O_4S$
Me_2N	*n*-Octyl	107	68	$C_{17}H_{28}N_2O_4S$
Me_2N	Allyl	110	73	$C_{12}H_{16}N_2O_4S$
Me_2N	Cyclopentyl	170	86	$C_{14}H_{20}N_2O_4S$
Me_2N	Cyclohexyl	176	81	$C_{15}H_{22}N_2O_4S$
Me_2N	Cycloheptyl	170	83	$C_{16}H_{24}N_2O_4S$
Me_2N	Cyclooctyl	174	79	$C_{17}H_{27}N_2O_4S$
Me_2N	Benzyl	142	88	$C_{16}H_{18}N_2O_4S$
Me_2N	Cholesteryl	220	80	$C_{36}H_{56}N_2O_4S$
Me_2N	Ph_2CH	195	91	$C_{22}H_{22}N_2O_4S$
Me_2N	Ph_3C	132	65	$C_{28}H_{26}N_2O_4S$
Me_2N	Thymyl	155	78	$C_{15}H_{24}N_2O_4S$
Me_2N	*p*-Menth-3-yl	173	76	$C_{19}H_{30}N_2O_4S$
Me_2N	*o*-Methoxyphenyl	155	69	$C_{16}H_{18}N_2O_5S$
Me_2N	6-Allyl-4-$MeOC_6H_3$	193	70	$C_{19}H_{22}N_2O_5S$
Me_2N	α-Cyclohexyl-α-methylbenzyl	120	64	$C_{23}H_{30}N_2O_4S$

[a] All compounds were analyzed for C, H, N, and the results were satisfactory. Similarly ir and nmr spectra were as expected.

***p*-Ethylsulfonylcarbanilic Acid Benzyl Ester.**—*p*-Ethylsulfonylbenzoyl azide, (2.3 g, 0.01 mole) and 2.48 g (0.02 mole) of benzyl alcohol was refluxed for 1 hr in 20 ml of dry PhMe. The solvent was evaporated and the residue was recrystallized from dil EtOH to give 2.9 g (90%) of white plates, mp 136°. The other compounds listed in Table I were prepared in a similar way, except for the Et esters which were prepared by 3-hr refluxing of the appropriate azide in 10 times its weight of abs EtOH.

(5) H. Shirai, M. Yoneda, and N. Oda, *Nagoya Shiatsu Daigaku. Yakugakubu Kiyo*, **2**, 45 (1954); *Chem. Abstr.*, **50**, 11337 (1956).

Synthesis of 5,7-Dimethoxyindole[1]

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The predominance of the indole nucleus and its methoxy analogs in many biologically active systems

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is well documented. A previous report of the synthesis of 5,7-dimethoxyindole[2] *via* decarboxylation of the corresponding 2-carboxylic acid of mp 178°, reported the indole as having mp 159–160°. In our hands, 5,7-dimethoxyindole was prepared in an unequivocal manner and the literature melting point and report of its preparation are apparently in error.

Experimental Section[3]

3,5-Dimethoxy-2β-dinitrostyrene.—To a solution of 3,5-dimethoxy-β-nitrostyrene[4] (5.1 g, 0.024 mole) in Ac_2O (90 ml) was added, with stirring, powdered $Cu(NO_3)_2$ (7.2 g) portionwise over 70 min. Red fumes were evolved and the temperature rose to 70°. Stirring was continued for 1 hr, the reaction mixture was poured over ice, and the resultant product collected by filtration. Recrystallization from EtOH yielded 4.32 g (75%) of pale yellow needles, mp 179–181°. *Anal.* ($C_{10}H_{10}N_2$) C, H, N.

5,7-Dimethoxyindole.—Fe powder (30 g) was added to 3,5-dimethoxy-2β-dinitrostyrene (8.6 g, 0.033 mole) in AcOH (150 ml, 80%). An exothermic reaction occurred on slightly warming the mixture. The mixture was allowed to stand 1 hr, diluted with H_2O, and extracted with CH_2Cl_2. The organic layer was washed with H_2O, dried ($MgSO_4$), filtered, and evaporated to dryness to yield an oil 4.3 g. Chromatography on silica gel yielded 3.3 g (57%) of product, mp 81–83°. Recrystallization for Et_2O–pet ether gave a sample, mp 83–84°; nmr (60 Mcps, $CDCl_3$), 6.45 multiplet, 2 H, 6.76 doublet, 1 H, and 7.1 triplet 1 H (aromatic protons) and 8.4 ppm broad band 1 H, (amine proton). *Anal.* ($C_{10}H_{11}NO_2$) C, H, N.

(2) V. Oskar Sus, M. Glos, K. Moller, and H. D. Eberhardt, *Justus Liebigs Ann. Chem.*, **583**, 150 (1953).

(3) Melting points were taken in capillaries and are uncorrected.

(4) H. Lloyd, E. A. Kielar, R. Hight, S. Uyeo, H. Falles, and W. Wildman, *J. Org. Chem.*, **27**, 373 (1960).

Dithienylpiperidylthenilates

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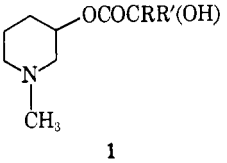
Compounds of type 1 have been shown to be potent anticholenergics and psychotomimetics.[1] Increases in pharmacologic response when R = phenyl is changed to thienyl have been noted.[2] We wish to show that compounds of type **1** can be synthesized despite the



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marked instability of the thenilic acids.[3a,b]

Experimental Section[4]

Methyl Thenilates (Table I).—A suspension of 0.01 mole of the thenil[5] in 20 ml of H_2O and 0.05 mole of KOH was stirred and refluxed under N for 30 min longer than required to effect soln. The cooled soln was acidified with concd HCl to congo red and immediately extracted with Et_2O. The dried (Na_2SO_4) extracts were treated with excess CH_2N_2 and stirred for 30 min, and solvents were removed at reduced pressure. The residue was recrystallized from pet ether (bp 60–90°).

Table I

Methyl Esters of Thenilic Acids

No.	R,R'	Mp °C	Yield, %	Formula[b]
2	2-Thienyl	92–94	69	$C_{11}H_{10}O_3S_2$
3	3-Thienyl	80–81	70	$C_{11}H_{10}O_3S_2$
4	5-Chloro-2-thienyl	*a*	92	$C_{11}H_8Cl_2O_3S_2$
5	2-Thianapthyl	103–104	62	$C_{19}H_{14}O_3S_2$

[a] Liquid, molecular distilled at 130° (0.01 torr). [b] All compounds analyzed correctly for C,H,S.

Table II

N-Methyl-3-piperidyl Esters of Thenilic Acids

No.	R,R'	Mp °C	Yield, %	Formula[a]
6	2-Thienyl	201–204	24	$C_{16}H_{20}ClNO_3S_2$
7	3-Thienyl	228–231	48	$C_{16}H_{20}ClNO_3S_2$
8	5-Chloro-2-thienyl	203–205	37	$C_{16}H_{18}Cl_3NO_3S_2$
9	2-Thianapthyl	233–234	42	$C_{24}H_{24}ClNO_3S_2$

[a] All compounds analyzed correctly for C,H,N,S.

***N*-Methyl-3-piperidyl Esters (Table II).**—A mixture of 0.01 mole of methyl thenilate, 0.01 mole of *N*-methyl-3-piperidinol, and 0.01 g of NaOMe in 40 ml of dry heptane was refluxed 6 hr under N_2. The cooled soln was washed with H_2O, dried (Na_2SO_4), and taken to dryness by rotary evaporator. The residue was dissolved in 20 ml of *i*-PrOH, and 20 ml of Et_2O saturated with dry HCl was added. The amino ester hydrochloride was recrystallized from 90% EtOH–H_2O.

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(1) J. H. Biel, L. G. Abood, W. K. Hoya, H. A. Leiser, P. A. Nuhfer, and E. F. Kluchesky, *J. Org. Chem.*, **26**, 4096 (1961).

(2) J. H. Biel, E. P. Sprengeler, H. A. Leiser, J. Horner, A. Drukker, and H. L. Friedman, *J. Amer. Chem. Soc.*, **77**, 2250 (1955).

(3) (a) S. Z. Cardon and H. P. Lankelma, *ibid.*, **70**, 4248 (1948); (b) E. Campaigne and R. C. Bourgeois, *ibid.*, **75**, 2702 (1953).

(4) Analysis indicated only by the symbols of the elements were within 0.4% of the theoretical values.

(5) 2,2,-Thenil and 3,3,-thenil are known. Bis(5-chloro)-2,2′-thenil and 2,2′-thianapthil were prepared analogously.

Acetylenics. 1. Aromatic Amines Containing the Acetylenic Triple Bond

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Some recent work in our laboratories on oxybutynin-like compounds which were shown by Thibodeau[1] to exhibit unusually long duration of action against Tremorine-produced tremors, prompted us to undertake a systematic study of the acetylenic bond in centrally and perepherally active drugs. As part of this study, some aromatic amines (Table I), similar to known phenethylamines derivatives, but containing the acetylenic bond were synthesized.

Experimental Section

Method A.—1-phenyl-3-bromo-1-propyne (I) (52 g, 0.25 mole) was added to 2.5 mole of liquid NH_3 or the appropriate amine in a pressure reactor. The whole was heated at 35° for 30 min and the unreacted amine allowed to excape. Et_2O (150 ml) was added to the residue and the whole was filtered, dried, and evapd. The residue was again taken up in Et_2O and a solution of HCl gas in Et_2O was added until pptn was complete. The solid was recrystd from Me_2CO or EtOAc.

Method B.—Phenylacetylene (0.3 mole), paraformaldehyde (0.31 mole), Me_2NH(II) (0.6 mole), and $Cu(OAc)_2$ (0.2 g) in 150 ml of dioxane were refluxed with stirring under a Dry Ice conden-

(1) G. Thibodeau, University of Montreal, personal communication.