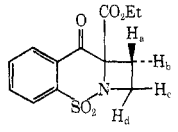
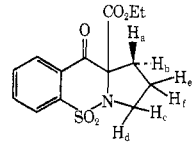
ascribe to be H_b in **6** appears at such low field (δ 3.4). Protons which we assign to H_a and H_b in **7** appear as a two-proton multiplet centered at δ 2.72. Protons assigned H_c and H_d in both molecules are observed at δ 4.0–3.5, which appears to be consistent with adjacency to the electronegative nitrogen atom. It seems difficult to invoke primary deshielding effects on H_b in **6** by the aromatic carbonyl group (H_b in **6** and H_b in **7** both approach coplanarity with the aromatic carbonyl group) because the same large effect (deshielding of H_b) is not observed in **7**. If our analysis of the molecular models is correct, H_b in **6** is about 0.8 Å closer to the nearest sulfonamide oxygen than H_b in **7** which may account for its appearance at lower field. Because the conformational preferences of **6** and **7** are not known, these chemical shift assignments should be regarded as tentative.



6



7

3-Acyl-4-hydroxy-2*H*-1,2-benzothiazine 1,1-Dioxides. II.[1] Reaction with Aziridines. Nucleophilic Displacements on (1,2,3,4-Tetrahydro-11-hydroxy-1-oxopyrazino[1,2-*b*][1,2]benzothiazin-2-yl)ethyl Methanesulfonate 6,6-Dioxide

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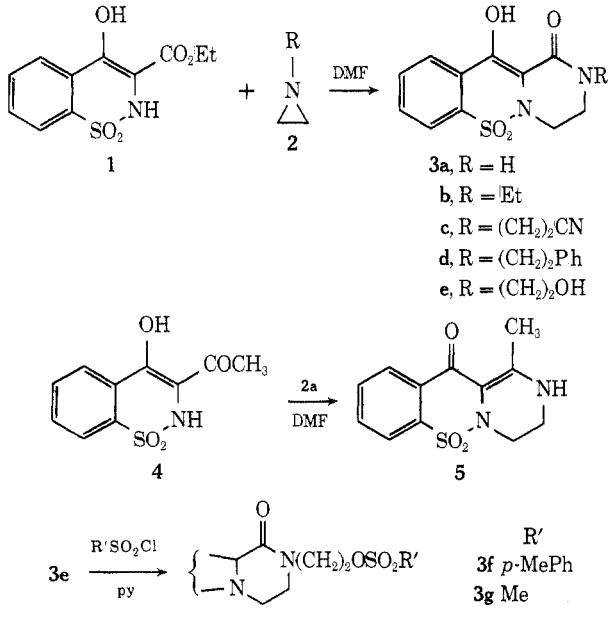
Received September 18, 1973

Ethyl 4-hydroxy-2*H*-1,2-benzothiazine-3-carboxylate 1,1-dioxide (**1**) reacts with aziridines **2** to give 1,2,3,4-tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-dioxides (**3**) in 60–95% yields. Reactions of 2-ethyl methanesulfonate **3g** with various sulfur and nitrogen nucleophiles have been shown to proceed *via* the intermediate 2,3,5,6-tetrahydro-13*H*-oxazolo[2′,3′:3,4]pyrazino[1,2-*b*][1,2]benzothiazin-13-one 8,8-dioxide (**6**). The different reaction pathways taken by either **3g** or **6** with primary and secondary amines are described in terms of a postulated mechanism.

Aziridines (ethylenimines) are known to undergo autocatalytic ring-opening reactions with a variety of acidic nucleophiles.[2] The availability of carboxylate **1** in these laboratories prompted us to explore the apparently little-investigated reactions of acidic sulfonamides[3,4] with ethylenimines **2**.

Scheme I

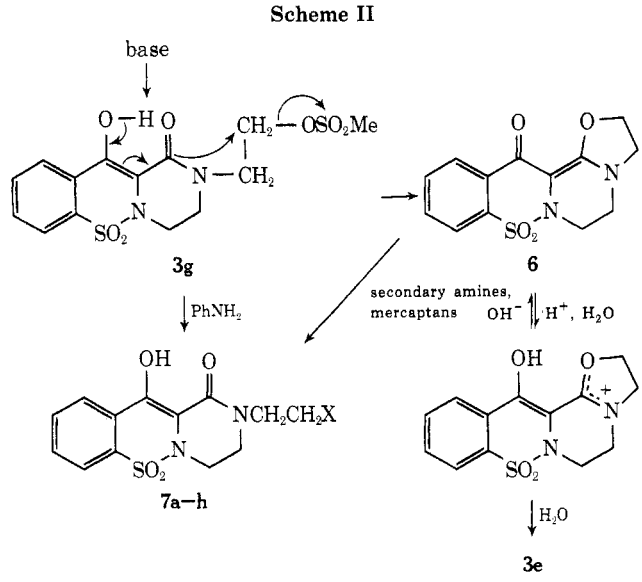


Treatment of ester **1** in DMF solution with **2** gave novel piperazines **3** in 60–90% yields (Scheme I, Table I). These compounds were acidic and completely enolic (nmr). Reaction of 3-acetylbenzothiazine **4**[5] with ethylenimine (**2a**) afforded piperazine **5** in only 8% yield. Treatment of **4** with other aziridines was not attempted.

Further work was centered on reactions of ethanol **3e** and its sulfonate esters **3f**[6] and **3g**.

Treatment of **3g** with either dimethylamine or sodium methyl mercaptide led to isolation of a bright yellow product which was assigned structure **6**. The latter reaction also afforded the expected product **7f** in 28% yield. Methanolic triethylamine, used preparatively, gave **6** in 83% yield. The uv spectrum of **6** showed a reversible 21-nm hypsochromic shift in acid, indicating oxazolinium ion formation (Scheme II). Dilute aqueous hydrochloric acid converted **6** to alcohol **3e**.

Scheme II



Formation of **7f** in the reaction of **3g** with methyl mercaptide led us to investigate the possibility that **6** might

Table I
Preparation of 1,2,3,4-Tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxides (3)[a,b]

Compd	R	Method	Yield, %	Mp, °C	Uv_{max} (MeOH), nm (ε)	Formula
3a	H	A	60	(260) 262–264[c]	246 (7,600)	$C_{11}H_{10}N_2O_4S$
		C	22		339 (10,700)	
3b	Et	C	41	(155) 156–159	249 (7,660)	$C_{13}H_{14}N_2O_4S$
					342 (11,700)	
3c	$(CH_2)_2CN$	B	95	190–191	248 (8,100)	$C_{14}H_{13}N_3O_4S$
		C	60		343 (11,200)	
3d	$(CH_2)_2Ph$	C	43	163.5–165.5	250 (8,250)	$C_{19}H_{18}N_2O_4S$
					343 (12,600)	
3e	$(CH_2)_2OH$	B	83	158–161	249 (8,000)	$C_{13}H_{14}N_2O_5S$
					343 (12,300)	

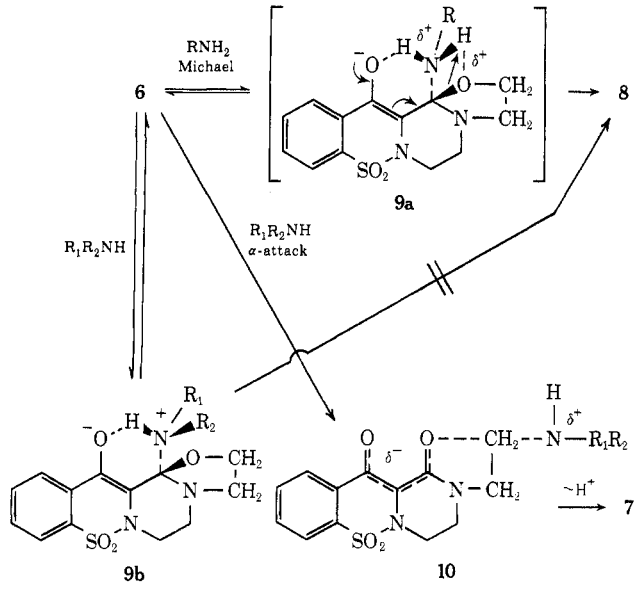
[a] For other physical data, see Experimental Section. [b] Satisfactory analytical values (±0.30% for C, H, N, S) were reported for all compounds in table: Ed. [c] With slight decomposition.

be a reaction intermediate capable of undergoing ring-opening reactions in the presence of nucleophiles. Indeed, when either **6** or **3g** was allowed to react with secondary amines and mercaptide ions, products assigned structure **7** were obtained in good yield (Scheme II, Table II). Evidence (tlc) supporting the intermediacy of **6** was obtained from those reactions in which **3g** was employed as starting material. The reaction of **3g** with aniline, however, does not proceed *via* **6** (*vide infra*).

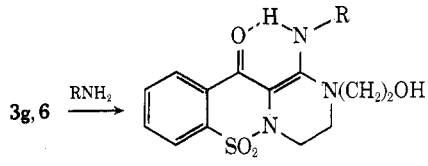
Reactions of **3g** with ammonia and primary amines were also found to proceed *via* intermediate **6**, affording brilliant yellow products which were assigned eneamidine structure **8** (Scheme III). These compounds, in contrast with those of structure **7**, failed to show positive ferric chloride tests, and their uv spectra underwent marked hypsochromic shifts (40–66 nm) in acidified methanol. These shifts indicated amidinium cation formation analogous to the ion derived from **6**. No evidence was obtained for any products of structure **7** in these reactions.

As previously stated, **3g**, when heated with aniline, does not proceed through **6** to **7e** (tlc). Treatment of **6**, however, with aniline under the same conditions resulted in a sluggish reaction which was incomplete after 72 hr. A new yellow product, **7e**, **6**, and at least five minor components were present in the reaction mixture. Preparative tlc, carried out on a portion of this mixture, allowed isolation of the yellow substance, which was assigned structure **8d** on the basis of uv (neutral and acid) and mass spectroscopy.

Apparently, **6** operates as a remarkably selective substrate in its reactions with nucleophiles. To account for these observations, we propose the following mechanism.



Scheme III



8a, R = $(CH_2)_2Ph$
b, R = H
c, R = Me
d, R = Ph

3g + $PhNH_2$ ⟶ **7e**

6 + $PhNH_2$ ⟶ **7e** + **8d**

Inspection of the structures of final products **7** and **8** clearly shows that strongly H-bonded compounds are formed in all cases. Formation of **7** results from displacement of the ring oxygen atom of **6** as a resonance-stabilized anion of the β-ketoamide type **10**. On the other hand, products of structure **8** are derived from a Michael addition. A postulated transition state for the reactions of **6** with ammonia and primary amines is represented by **9a**. Ammonia and primary amines have a proton in addition to that required for H-bond formation. This additional proton is available for transfer to the oxazolidine oxygen atom, allowing its conversion to an oxonium-type leaving group. Thus, **9a** can collapse to **8**.

Secondary amines may react reversibly *via* the Michael pathway **9b**. However, in this case, only one proton is available and that, apparently, is utilized for incipient H-bond formation. Since no additional proton is available for transfer to ring oxygen, the only plausible route to **8** is by expulsion of the relatively poor leaving group alkoxide ion. Amine nitrogen, being more basic than oxygen, simply retains the only available proton and is rejected, permitting reaction by the α route.

The reaction of aniline with **6** mainly by the α route can be explained by steric factors and its lower basicity.

Experimental Section[7]

The following procedures are illustrative of the methods used for the preparations of **3** (Table I).

Method A. Low-Boiling (<100°) Aziridines in DMF. 1,2,3,4-Tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (3a). A solution of 13.46 g (0.05 mol) of **1**[1] in 100 ml of DMF was cooled with stirring to 5° and then 2.32 g (0.054 mol) of **2a** was added dropwise. The reaction mixture was allowed to stir at 3–5° for 1.5 hr and then overnight at room temperature. Most of the solvent was removed *in vacuo* and to the residue was added a solution of 20 ml of aqueous HCl (10%) in 100 ml of H_2O. The resulting gummy solid was triturated with acetone–MeOH, affording 8.0 g of **3a**. Recrystallization from ace-

Table II
Physical Data for 2-(2-Substituted)ethyl Derivatives 7[a]

Compd	X	Mp, °C	Yield (method)		Uv$_{max}$ (MeOH), nm (ε)	Formula
7a		(181) 184–186	53	(A)[b]	248 (7,800)	$C_{18}H_{23}N_3O_4S$
			78	(B)[c]	342 (12,100)	
7b	NMe_2	105–107	53	(C)[d]	243 (6,900)	$C_{15}H_{19}N_3O_4S$
					343 (8,700)	
7c		165–166	41	(C)	248 (7,700)	$C_{18}H_{24}N_4O_4S$
					342 (12,700)	
7d		152–153	80	(C)	248 (7,400)	$C_{17}H_{21}N_3O_5S$
					347 (10,800)	
7e	NHPh	144–145	66.5	(C)	248 (19,600)	$C_{19}H_{19}N_3O_4S$
			47	(B)	300 (5,300)	
					347 (12,400)	
7f	SMe	122–123	65	(C)	250 (8,000)	$C_{14}H_{16}N_2O_4S_2$
					345 (12,000)	
7g	SCH_2Ph	113–115	70	(C)	250 (7,900)	$C_{20}H_{20}N_2O_4S_2$
					345 (10,900)	
7h	SPh	141–142	80	(C)	251 (14,600)	$C_{19}H_{18}N_2O_4S_2$
					344 (9,200)	

[a] Satisfactory analytical data were reported for all compounds in table: Ed. [b] Tosylate **3f**. [c] Intermediate **6**. [d] Mesylate **3g**.

tone gave the analytical sample: ir (KBr) 3290, 3180, 1650, and 1598 cm^{-1}; nmr (DMF–NaOD) δ 3.60 (m, 4, NCH_2CH_2N).

Method B. High-Boiling (>100°) Aziridines in DMF. 1,2,3,4-Tetrahydro-11-hydroxy-2-(2-hydroxy)ethylpyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (3e). To a warm (steam bath), well-stirred solution of 73.5 g (0.273 mol) of **1** in 120 ml of DMF was added dropwise over 1 hr 31.7 g (0.364 mol) of 1-(2-hydroxy)ethylaziridine (**2e**) in 50 ml of DMF. Five minutes after completion of the addition, the reaction mixture was poured onto crushed ice. The resulting crystals were collected, dried, and recrystallized from acetone–MeOH, affording 70.1 g of **3e**: ir ($CHCl_3$) 3620, 3440, and 1620 cm^{-1}; nmr (DMSO-d_6) δ 13.60 (s, 1, enol H), 7.92 (m, 4, aromatic), 3.75 (~9 H, NCH_2CH_2N + NCH_2CH_2O + OH).

2-(2-Cyano)ethyl-1,2,3,4-tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2,]benzothiazin-1(2*H*)-one 6,6-Dioxide (3c). This preparation was carried out in a manner analogous to that described for **3e** using a 1:1.5 molar ratio of **1** to **2c**. The yield was 30.5 g, ir ($CHCl_3$) 2245 (CN), 1623 and 1600 cm^{-1} (shoulder).

Method C. Refluxing EtOH. 1,2,3,4-Tetrahydro-11-hydroxy-2-phenethylpyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (3d). A solution of 13.46 g (0.05 mol) of **1** and 11.04 g (0.075 mol) of 1-phenethylaziridine (**2d**) in 60 ml of absolute EtOH was heated under reflux overnight. The resulting solid, after recrystallization from acetone–EtOH (95%), gave 7.89 g of pure **3d**: ir ($CHCl_3$) 1622 and 1600 cm^{-1} (shoulder); nmr ($CDCl_3$) δ 13.28 (s, 1, enol H), 8.2–7.5 (m, 4, aromatic, 7.25 (s, 5, Ph), 3.82–3.28 (m, 6, NCH_2CH_2Ph + NCH_2CH_2N), 2.92 (t, 2, J = 7 Hz, $-CH_2CH_2Ph$).

2-Ethyl-1,2,3,4-tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]-benzothiazin-1(2*H*)-one 6,6-Dioxide (3b). This preparation, carried out on the same scale as that described for **3d**, afforded 6.12 g of pure product: ir ($CHCl_3$) 1623 cm^{-1}; nmr ($CDCl_3$) δ 13.31 (s, 1, enol H), 3.80 (m, 4, NCH_2CH_2N), 3.50 (q, 2, NCH_2CH_3, J = 7 Hz, overlapping part of the A_2B_2 system), 1.21 (t, 3, CH_2CH_3, J = 7 Hz).

3,4-Dihydro-1-methylpyrazino[1,2-*b*][1,2]benzothiazin-11(2*H*)-one 6,6-Dioxide (5). A solution of 23.9 g (0.1 mol) of **4**[5] in 100 ml of DMF was stirred while 4.3 g (0.1 mol) of **2a** was added dropwise. Following the addition the mixture was heated for 1 hr on the steam bath, after which time most of the DMF was removed *in vacuo*. The resulting dark tar was triturated with acetone and allowed to remain overnight. The solid was recrystallized twice from DMSO–H_2O to give 2.2 g (8.3%) of **5** as a yellow solid: mp 285° dec; ir (KBr) 3270, 3240 (shoulder), 3220 (shoulder), 1620 (shoulder), 1595, and 1580 cm^{-1}; uv max (CH_3CN) 255 nm (ε 9100) and 383 (10,700).

Anal. Calcd for $C_{12}H_{12}N_2O_3S$: C, 54.53; H, 4.58; N, 10.60; S, 12.13. Found: C, 54.09; H, 4.79; N, 10.41; S, 12.16.

(1,2,3,4-Tetrahydro-11-hydroxy-1-oxopyrazino[1,2-*b*][1,2]-benzothiazin-2-yl)ethyl Methanesulfonate 6,6-Dioxide (3g). A solution of 27.93 g (0.09 mol) of **3e** in 100 ml of dry (KOH) pyridine was cooled to −5° in an ice–salt water bath. Methanesulfonyl chloride (20.54 g, 0.18 mol) was added such that the temperature did not rise above 0°. A heavy slurry of pyridinium chloride formed. The reaction mixture was poured onto ice containing excess HCl. The resulting solid was filtered, washed well with H_2O, and dried, yield 34.9 g (99%). Recrystallization from dioxane–MeOH gave pure **3g**: mp 172–174°; ir (KBr) 1622, 1600 cm^{-1} (shoulder); uv max (MeOH) 250 nm (ε 7500) and 350 (8250); nmr (DMF-d_7) δ 13.42 (s, broad, enol H), 8.2-7.8 (m, 4, aromatic), 4.62 (t, J = 5.5 Hz, 2, $NCH_2CH_2OSO_2$), 3.98 (m, 6, NCH_2CH_2N + NCH_2CH_2O–), 1.98 (s, 3, SO_2CH_3).

Anal. Calcd for $C_{14}H_{16}N_2O_7S_2$: C, 43.29; H, 4.15; N, 7.21. Found: C, 43.28; H, 4.15; N, 7.16.

3f. The toluenesulfonate ester was prepared in a manner analogous to that described for **3g**. Following acidic work-up, the oily ester was extracted into methylene chloride, washed successively with brine and brine (100 ml)–$NaHCO_3$ (20 ml, saturated), and dried (Na_2SO_4). After solvent removal *in vacuo*, the oil was dissolved in sufficient dioxane–ethanol (*ca.* 1:1) to make 300 ml of a stock solution. Aliquots of this solution were used for reactions with piperidine and phenethylamine.

2,3,5,6-Tetrahydro-13*H*-oxazolo[2′,3′:3,4]pyrazino[1,2-*b*][1,2]benzothiazin-13-one 8,8-Dioxide (6). A. A suspension of 7.77 g (0.02 mol) of **3g** in 150 ml of MeOH was treated with 4.05 g (0.04 mol) of triethylamine. After heating under reflux for 20 min, tlc indicated complete reaction. Solvent removal *in vacuo* and trituration with ice water gave crude **6**. Recrystallization from EtOH (95%) gave 5.15 g (83.1%) of pure **6**: mp 196–198° dec; ir ($CHCl_3$) 1640, 1590, 1570, 1549–1542 cm^{-1}; uv max (MeOH) 252 nm (ε 11,300) and 377 (12,700); uv max (MeOH–HCl) 255 nm (ε 8500) and 356 (14,700); nmr ($CDCl_3$) δ 8.3–8.1 (m, 1, aromatic), 7.9–7.6 (m, 3, aromatic), 4.75 (t, 2, J = 8.5 Hz, OCH_2CH_2N), 4.0–3.45 (m, 6, NCH_2CH_2N + OCH_2CH_2N).

Anal. Calcd for $C_{13}H_{12}N_2O_4S$: C, 53.43; H, 4.14; N, 9.59. Found: C, 53.30; H, 4.18; N, 9.59.

B. From 3g and Dimethylamine. To a solution of 4.5 g (0.1 mol) of dimethylamine in MeOH was added 3.88 g (0.01 mol) of **3g**. After stirring at ambient temperature for 1 hr, no **3g** remained as shown by tlc [silica gel GF: benzene–acetone (1.5:1)]. Removal of solvent and excess amine *in vacuo* followed by trituration with water gave **6** identical in all respects with that obtained by procedures A and C. No **7b** was detected under these conditions.

C. From 3g and Sodium Methyl Mercaptide. Methanol (25 ml) containing 0.9 g (0.04 g-atom) of dissolved sodium was concentrated *in vacuo* to a thick syrup which was taken up in DMF (50 ml) and saturated with MeSH. To this solution was added 15 g (0.039 mol) of **3g**. After stirring for 2 hr, the solvent was removed *in vacuo*. Fractional crystallization of the residual solid from MeOH–H_2O and acetone–H_2O combinations gave 3.5 g (28%) of **7f** (*vide infra*) and sufficient **6** (*ca.* 100 mg) for characterization (ir, uv, nmr, tlc, melting point). Physical data for compounds **7a–h** are shown in Table II.

1,2,3,4-Tetrahydro-11-hydroxy-2-[2-(1-piperidino)]ethylpyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (7a). Method A. To a 75-ml aliquot of the dioxane–EtOH stock solution con-

taining *ca.* 0.025 mol of tosylate ester **3f** was added a solution of 6.4 g (0.075 mol) of piperidine in 20 ml of absolute EtOH. The reaction mixture was stirred at ambient temperature overnight. The solvent was removed *in vacuo* and to the residue was added dilute aqueous $NaHCO_3$ (5%) which threw down a gummy solid. Recrystallization from acetone–MeOH gave 5.05 g of **7a** as a light yellow solid, ir ($CHCl_3$) 1619 cm^{-1}.

Method B. A solution of **6** (6 g, 0.02 mol) and piperidine (2.13 g, 0.025 mol) in 40 ml of DMF was heated for 1.5 hr on the steam bath. Solvent removal *in vacuo* followed by treatment with aqueous $NaHCO_3$ (5%) and recrystallization above gave 5.91 g of **7a** identical in all respects with that obtained by method A.

Method C. 2-(2-Dimethylamino)ethyl-1,2,3,4-tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (7b). To a saturated solution of anhydrous dimethylamine in 50 ml of DMF was added 20.0 g (0.0515 mol) of **3g.** After stirring for 15 min, additional dimethylamine was passed into the solution until saturated. Heating for 1 hr on the steam bath followed successively by removal of solvent *in vacuo,* dissolution of the residue in dilute HCl (1.3 *N*), and precipitation of the free base by aqueous $NaHCO_3$ (5%) and recrystallization as above gave 5.91 g of **7a** acetone–H_2O gave 9.1 g of pure **7b,** ir ($CHCl_3$) 1620 cm^{-1}.

Preparations of **7c, 7d** and **7e** were analogous to those described above. DMF solutions of **3g** (1 mol) were treated with 2.2–3.0 molar equiv of the corresponding amine with warming (steam bath). Each compound was recrystallized from acetone–H_2O.

Reaction of 6 with Aniline (7e and 8d). A solution of 2.92 g (0.01 mol) of **6** and 5.59 g (0.06 mol) of aniline was heated on the steam bath for 72 hr, after which time most of the DMF was removed *in vacuo.* Dilution of the residue with 50 ml of MeOH and cooling afforded 2.5 g of a solid comprised mostly of **7e** containing lesser amounts of **6, 8d,** and unidentified materials. Recrystallization from acetone–MeOH gave 1.8 g (47%) of pure **7e** identical with that obtained previously (melting point, tlc, ir).

The methanolic mother liquors from which **7e** was obtained were reconcentrated *in vacuo* and to this residue was added *ca.* 200 ml of ether. A small amount of dark solid (mostly **7e** by tlc) was discarded. The ether solution was washed successively with H_2O, dilute HCl (10%) (to remove aniline and residual **6**), and saturated $NaHCO_3$. After drying over anhydrous K_2CO_3, a portion of this solution was applied to 1000-μ silica gel GF preparative tlc plates (Analtech). Development with benzene–acetone (2:1), scraping the prominent yellow band (R_f 0.7), extraction with acetone, filtration (diatomaceous earth), and solvent removal *in vacuo* gave a yellow oil which was redissolved in fresh ether (100 ml) and refiltered as before. Concentration to *ca.* 5 ml, cooling, and scratching gave 10 mg of homogeneous **8d:** mp 174–175°; uv max (MeOH) 235 nm (ϵ 11,600), 248–260 (broad shoulder, ϵ 10,900), and 404 (14,600); uv max (MeOH–HCl) 236 nm (ϵ 12,900), 247 (shoulder, 11,700), and 338 (10,800); mass spectrum (70 eV) M^+ *m/e* 385.

2-(2-Benzylthio)ethyl-1,2,3,4-tetrahydro-11-hydroxypyrazino[1,2-*b*][1,2]benzothiazin-1(2*H*)-one 6,6-Dioxide (7g). This procedure is illustrative of the reactions of sodium mercaptides with **3g** (Table II). Two equivalents each of sodium methyl and benzyl mercaptide and 1 equiv of thiophenolate were used. These reactions generated **6,** which was also independently shown to undergo ring-opening reactions with thiophenolate and methyl mercaptide anions.

To 20 ml of MeOH was added 0.69 g (0.027 g-atom) of sodium. After the sodium had dissolved, excess MeOH was removed *in vacuo;* 20 ml of DMF was added followed by 3.41 g (0.027 mol) of benzyl mercaptan. To this solution was added with stirring 5.0 g (0.013 mol) of **3g** followed by 50 ml of DMF. Tlc indicated rapid conversion to **6.** Heating was employed to complete conversion of **6** to **7g.** An aqueous work-up followed by recrystallization from acetone–H_2O gave 3.75 g of pure **7g,** ir ($CHCl_3$) 1625 and 1595 cm^{-1}.

3,4-Dihydro-2-(2-hydroxy)ethyl-1-phenethylaminopyrazino-[1,2-*b*][1,2]benzothiazin-11(2*H*)-one 6,6-Dioxide (8a). To 20 ml of absolute EtOH containing 9.1 g (0.075 mol) of phenethylamine was added 75 ml of the dioxane–EtOH solution of **3h** (*ca.* 0.025 mol). The reaction mixture was allowed to stir overnight at ambient temperatures. After removal of solvent *in vacuo* the residue was triturated with water–dilute aqueous $NaHCO_3$ (5%) and the aqueous layer was discarded. The resulting gummy solid was taken up in MeOH. Cooling and scratching gave crystals which were recrystallized from acetone–MeOH, affording 2.5 g (24%) of pure **8a:** mp 144–146°; uv max (MeOH) 252 nm (ϵ 10,300) and 388 (12,000); uv max (MeOH–HCl) 247 nm (ϵ 10,800), 275–300 (broad shoulder, ~7000), and 329 (10,700); ir (KBr) 1573, 1550 (shoulder), and 1540 cm^{-1}.

Anal. Calcd for $C_{21}H_{23}N_3O_4S$: C, 61.00; H, 5.61; N, 10.16; S, 7.76. Found: C, 60.97; H, 5.66; N, 10.17; S, 7.75.

Compound **8a** was also prepared from (1) **3g** (1 mol) and phenethylamine (3 mol) in DMF, and (2) from **6** (1 mol) and phenethylamine (3 mol) in DMF. The product from each of these reactions was identical in all respects with **9a** prepared from **3h.**

1-Amino-3,4-dihydro-2-(2-hydroxy)ethylpyrazino[1,2-*b*][1,2]benzothiazin-11(2*H*)-one 6,6-Dioxide (8b). To 2 pints of rapidly stirred aqueous NH_3 (28%) was added 58.26 g (0.15 mol) of **3g.** The starting material dissolved, and upon continued stirring yellow crystals separated. Tlc indicated the presence of **6** in the mixture. Stirring was continued until **6** disappeared. Filtration and recrystallization from $CHCl_3$–EtOH (95%) gave pure **8b:** mp 204–206° dec; uv max (MeOH) 246–252 nm (broad shoulder, ϵ 9360), 254 (9450), and 379 (12,300); uv max (MeOH–HCl) 253 nm (ϵ 9700), 294 (shoulder, 5400), and 340 (12,600); ir (KBr) 1592 (shoulder), 1580, 1560, and 1540 cm^{-1}; nmr (DMSO-d_6) δ 9.25 (broad, enol OH), 8.25–8.0 (m, 1, aromatic), 7.85–7.6 (m, 3, aromatic), 5.13 (t, 1, CH_2OH), 3.9–3.3 (m, 8, two A_2B_2 patterns).

Anal. Calcd for $C_{13}H_{15}N_3O_4S$: C, 50.47; H, 4.89; N, 13.58; S, 10.37. Found: C, 50.32; H, 4.99; N, 13.53; S, 10.35.

3,4-Dihydro-2-(2-hydroxy)ethyl-1-methylaminopyrazino[1,2-*b*][1,2]benzothiazin-11(2*H*)-one 6,6-Dioxide (8c). This preparation was carried out in DMF saturated with methylamine (anhydrous) using 20.0 g (0.052 mol) of **3g.** After solvent removal *in vacuo,* treatment with H_2O threw down a solid which was recrystallized from acetone–H_2O, affording 9.5 g (59%) of pure **8c:** mp 174–175°; uv max (MeOH) 252 nm (ϵ 9500) and 385 (12,600); uv max (MeOH–HCl) 248 nm (ϵ 9900) and 328 (10,400); ir (KBr) 1600, 1590, and 1550 cm^{-1}; nmr (DMSO-d_6) δ 10.47 (broad, enol H), 8.2–7.9 (m, 1, aromatic), 7.85–7.5 (m, 3, aromatic), 5.08 (poorly resolved triplet, 1, CH_2OH), 3.8–3.4 (m, 8, two A_2B_2 patterns), 3.05 (d, 3, $NHCH_3$). The addition of DCl to the nmr solution caused collapse of the NHMe signal to a singlet.

Anal. Calcd for $C_{14}H_{17}N_3O_4S$: C, 52.00; H, 5.30; N, 12.99. Found: C, 51.93; H, 5.33; N, 13.32.

Acknowledgment. The authors express their great appreciation to the Dow Chemical Co., Midland, Mich., for generous samples of the aziridines used in this work. We also wish to thank Mrs. Mary C. Christie for the spectral data and Mrs. Barbara L. Twardzik for some experimental results.

Registry No.—**1,** 24683-21-4; **2a,** 151-56-4; **2c,** 1072-66-8; **2d,** 3164-46-3; **2e,** 1072-52-2; **3a,** 51016-24-1; **3b,** 51016-25-2; **3c,** 51016-28-5; **3d,** 51016-27-4; **3e,** 51016-26-3; **3f,** 51016-29-6; **3g,** 51016-30-9; **4,** 51015-24-8; **5,** 5016-31-0; **6,** 51016-32-1; **7a,** 51016-33-2; **7b,** 51016-34-3; **7c,** 51016-35-4; **7d,** 51016-36-5; **7e,** 51016-37-6; **7f,** 51016-38-7; **7g,** 51016-39-8; **7h,** 51016-40-1; **8a,** 51016-41-2; **8b,** 51016-42-3; **8c,** 51016-43-4; **8d,** 51016-44-5.

References and Notes

(1) Paper I: C. R. Rasmussen, *J. Org. Chem.,* **39,** 1554 (1974).
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(6) Oily tosylate ester **3f** was prepared initially and employed as a dioxane–ethanol solution in reactions with piperidine and phenethylamine. Since its reactions were later shown to be essentially identical with those of mesylate **3g,** discussion has been limited to **3g.**
(7) See paper I for instrumentation.