98. A Ring Enlargement from Seven- to Ten-Membered-Ring Sulfonamide Derivatives

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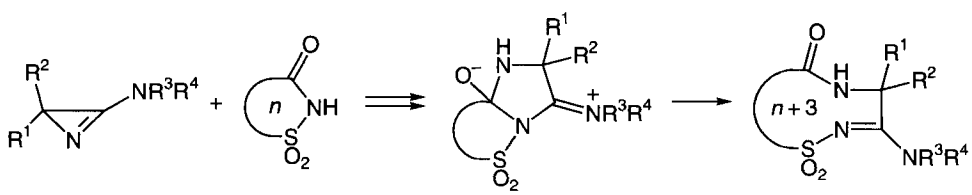
The reaction of 3-(dimethylamino)-2,2-dimethyl-2*H*-azirine (**1a**) with 4,5-dihydro-7,8-dimethoxy-1,2-benzothiazepin-3-one 1,1-dioxide (**4**) in dioxane at room temperature gave the correspondingly substituted 4*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide **5a** in 64% yield (*Scheme 2*). The structure of this novel ten-membered ring-enlargement product was established by X-ray crystallography (*Fig.*). Under more vigorous conditions (refluxing dichloroethane), **5a** was formed together with the isomeric **6a**, both in low yield. The 3-(dimethylamino)-2*H*-azirines **1b** and **1c** reacted sluggishly to give the two isomeric ring-enlargement products of type **5** and **6** in yields of 24–29% and 2–4%, respectively (*Table 1*). Even less reactive is 2,2-dimethyl-3-(*N*-methyl-*N*-phenylamino)-2*H*-azirine (**1d**), which reacted with **4** in MeCN only at 65°. Under these conditions, besides numerous decomposition products, only traces of **5d** and **6d** were formed. No ring enlargement was observed with the sterically crowded **1e**, which bears an isopropyl group at C(2).

1. Introduction. – Several ring-enlargement reactions of NH-acidic heterocycles with a $pK_a < 8$ and 3-amino-2*H*-azirines **1** have been shown to yield $(n + 3)$-membered heterocycles [1] (*Scheme 1*). The intermediate in these ring expansions is supposedly a zwitterion of type **A**. Especially smooth reactions occurred with cyclic sulfonamides **2** as a result of their low pK_a values. Thus, saccharin and analogous five-membered sulfonamides reacted to give 4*H*-1,2,5-thiadiazocin-6-one 1,1-dioxides [2] [3]. In a similar manner, the six-mem-

Scheme 1



1 **2** **A** **3**

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bered 3,4-dihydro-2*H*-1,2,4-benzothiadiazin-3-one 1,1-dioxides as well as 3,4-dihydro-2*H*-1,2-benzothiazin-3-one 1,1-dioxides reacted with **1** yielding the corresponding nine-membered 1,2,5,7-benzothiatriazonin-6-one and 1,2,5-benzothiadiazonin-6-one 1,1-dioxides, respectively [4] [5].

With the aim to further extend the scope of this ring enlargement, we reacted a seven-membered thiazepin-3-one 1,1-dioxide with 3-amino-2*H*-azirines **1**.

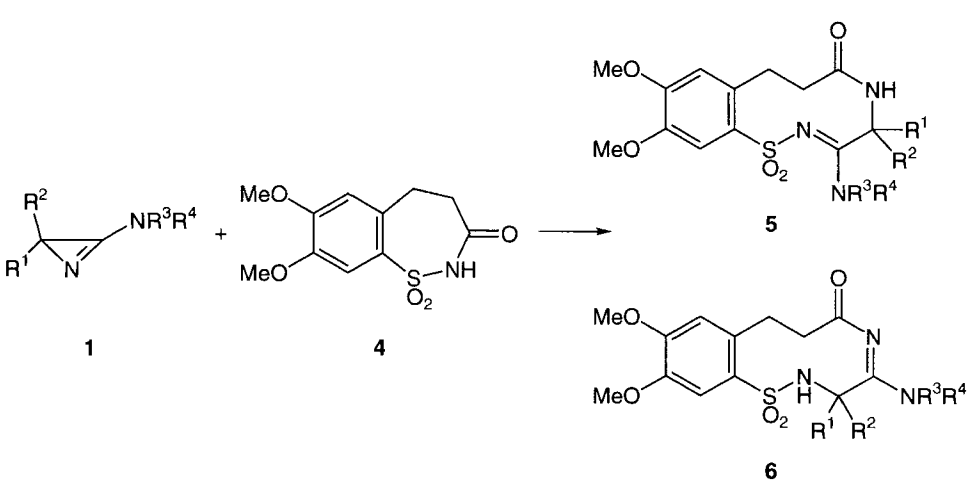
2. Results and Discussion. – The chosen starting material, 4,5-dihydro-7,8-dimethoxy-1,2-benzothiazepin-3-one 1,1-dioxide (**4**), was prepared following the procedure described in [6]. The reaction of **4** with a small excess of 3-(dimethylamino)-2,2-dimethyl-2*H*-azirine (**1a**) in dioxane at room temperature was completed after 24 h (TLC). The precipitate was filtered off and shown to be 3-(dimethylamino)-5,6,7,8-tetrahydro-10,11-dimethoxy-4,4-dimethyl-4*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide (**5a**; *Scheme 2*, *Table 1*).

The structure of **5a** was deduced from the spectral data by comparison with the data of previously described compounds of type **3**. An X-ray structure analysis with suitable crystals grown from MeOH established the molecular structure shown in the *Figure*. The molecules are linked by intermolecular H-bonds, between the NH group and one of the MeO groups, into infinite one-dimensional chains which run parallel to the *y*-axis.

When a mixture of **1a** and **4** in dichloroethane was refluxed, the starting materials disappeared after 3 h. Chromatographic workup of the complex reaction mixture gave **5a** and an isomeric 1:1 adduct, both in low yield (4.7 and 3.3%); the remaining material was an intractable mixture. The spectral data of the second product support the structure of the isomeric adduct **6a**[3]).

In an analogous manner, **4** was reacted with the aminoazirines **1b–e** in MeCN. Whereas, with **1b**, the reaction proceeded at room temperature, 50° was required in the case of **1c**. In both reactions, two isomeric adducts of type **5** and **6** were formed, **5** being

Scheme 2



[3]) After refluxing a solution of **5a** in dichloroethane for 3 h, no **6a** could be detected.

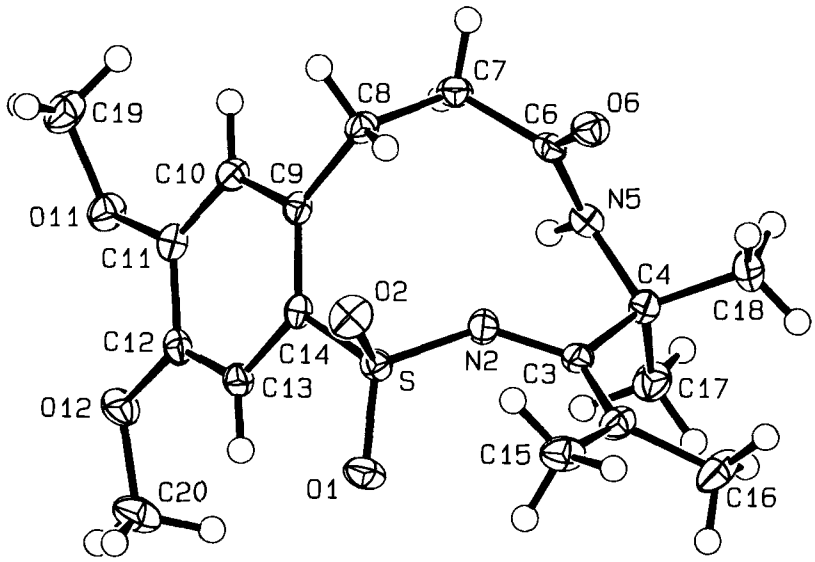


Figure. *ORTEP Plot* [7] *of the molecular structure of* **5a** (thermal ellipsoids with 50% probability)

the main product (*Table 1*). With the *N*-phenyl derivative **1d**, the reaction was sluggish, even at 65°. After 70 h, **5d** and **6d** were isolated with yields of only 1.5 and 0.6%, respectively. No reaction was observed between the 2-isopropyl-2-methylazirine **1e** and **4** at room temperature, and after 28 h at 60°, an intractable mixture was obtained, from which neither an adduct of type **5** nor of type **6** could be isolated.

The reaction of **1a** and **4** at room temperature shows that ring enlargement to ten-membered 1,2,5-thiadiazecine derivatives **5** proceeds in the expected way. The reaction mechanism *via* aziridine **B**, ring enlargement to give the zwitterionic intermediate **C** and a second ring enlargement to give the final product **5**, is well known (*Scheme 3*). It is worth mentioning that azirines **1b–e** react much more slowly and less cleanly with **4**. A similar difference in the reactivity of 3-amino-2*H*-azirines **1** was also observed in previous

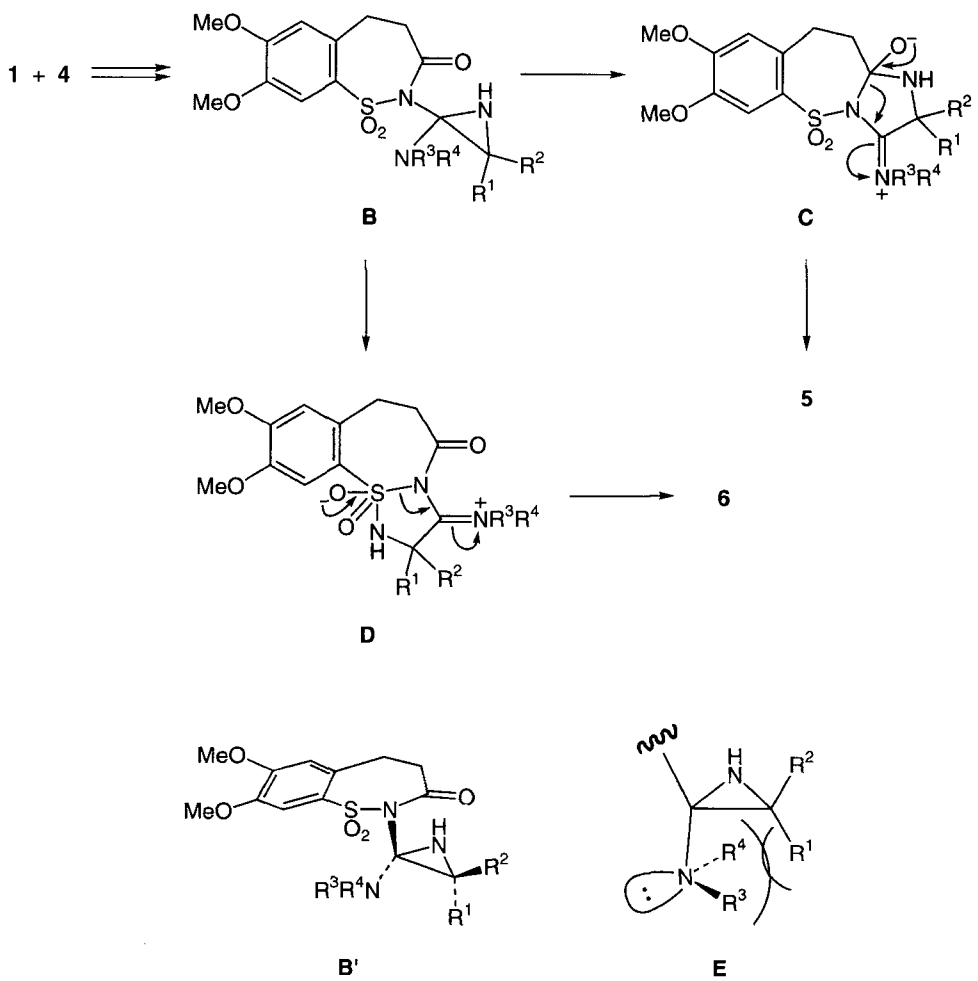
Table 1. *Formation of 1,2,5-Benzothiadiazecin-6-one 1,1-Dioxides* **5** *and* **6** *from the Reaction of* **1** *and* **4**

	R^1	R^2	R^3	R^4	Reaction conditions	Products [%]	
1a	Me	Me	Me	Me	dioxane, r.t., 24 h	**5a** (64)	
1a					dichloroethane, reflux, 3 h	**5a** (4.7)	**6a** (3.3)
1b	$-(CH_2)_4-$		Me	Me	MeCN, r.t., 84 h	**5b** (29)	**6b** (1.6)
1c	$PhCH_2$	Me	Me	Me	MeCN, 50°, 20 h	**5c** (24)[a])	**6c** (4.1)[a])
1d	Me	Me	Ph	Me	MeCN, 65°, 70 h	**5d** (1.5)	**6d** (0.6)
1e	Me_2CH	Me	Me	Me	MeCN, r.t., 21 d	no reaction	
1e					MeCN, 60°, 28 h	–	

[a]) The assignment of the structures is uncertain.

studies (see [5] and refs. cit. therein). As an explanation of the observations for **1c** and **1e**, we propose a steric effect of the larger substituent at C(2) as well as a stereoelectronic effect: because of the bulkiness of R^1, the nucleophilic attack of deprotonated **4** at the amidinium C-atom of protonated **1** occurs *trans* to R^1, leading to aziridine **B'** ($R^1 = PhCH_2$, Me_2CH) as an intermediate. This nucleophilic attack is also slowed down in the case of **1b** with the relatively rigid spirocyclic ring system. The transformation of **B** to zwitterion **C** proceeds *via* cleavage of the C–N bond adjacent to the amino group. According to *Deslongchamps* [8], this ring opening should be assisted by the electron lone pair in the antiperiplanar orientation (see **E**). The required orientation of the amino group is unfavorable when R^1 is a bulky group.

Scheme 3



The slow and sluggish reaction in case of the *N*-phenyl-substituted 3-amino-2*H*-azirine **1d** can be rationalized by electronic effects: the ring enlargement **B** → **C** proceeds with participation of the lone pair of the amino group, which in the *N*-methyl-*N*-phenylamino group is less available than in the dimethylamino group.

Rather unexpected is the formation of isomeric ring-enlarged heterocycles of type **6**, though an analogous reaction has been observed in a reaction with a 1,2-thiazol-3-one 1,1-dioxide [3]. A reaction mechanism *via* nucleophilic attack of the aziridine N-atom in **B** at the S-atom of the SO_2 group to give intermediate **D** is reasonable (*Scheme 3*). As **6** is the minor product in all examples and is formed only under vigorous conditions in the case of **1a**, the attack at the CO group must be favored over that at the SO_2 group.

In conclusion, it should be mentioned that ring enlargement of cyclic *N*-acylsulfonamides (= *N*-sulfonylcarboxamides) and **1** to give (*n* + 3)-membered derivatives is a general reaction, but the ease of the reaction depends strongly on the ring size. Whereas the formation of seven- [9] and eight-membered rings is a fast and smooth process, the ring expansion to nine- [5] and ten-membered analogues are much slower and in some cases less clean.

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Experimental Part

General. See [10]. If not otherwise stated, IR spectra in $CHCl_3$, ^{1}H- and ^{13}C-NMR spectra (300 and 50.4 MHz, resp.) in $CDCl_3$, and CI-MS with NH_3.

1. *Reaction of 3-(Dimethylamino)-2,2-dimethyl-2*H*-azirine* (**1a**) *with 4,5-Dihydro-7,8-dimethoxy-1,2-benzothiazepin-3-one 1,1-Dioxide* (**4**) [6]. 1.1. A soln. of **1a** (250 mg, 2.23 mmol) and **4** (500 mg, 1.85 mmol) in dry dioxane (3 ml) was stirred at r.t for 24 h. Some precipitate was formed after 1 h, and after 24 h, no starting material could be detected by TLC. The precipitate was filtered off and washed with Et_2O: 456 mg (64%) of *3-(dimethylamino)-5,6,7,8-tetrahydro-10,11-dimethoxy-4,4-dimethyl-4*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**5a**). Colorless solid. M.p. 210–212°. IR: 3200*m* (br.), 2930*m*, 1670*s*, 1590*m*, 1570*s*, 1525*m*, 1500*m*, 1455*m*, 1430*m*, 1395*m*, 1380*w*, 1360*w*, 1340*w*, 1275*s*, 1255*s*, 1165*w*, 1135*s*, 1115*s*, 1045*m*, 970*w*, 870*m*, 850*w*. ^{1}H-NMR: 7.52 (*s*, H–C(12)); 6.69 (*s*, H–C(9)); 6.19 (*s*, NH); 3.91, 3.89 (2*s*, 2 MeO); 3.34 (*s*, Me_2N); 3.7–3.4 (br., CH_2CO); 2.51 (*t*-like, CH_2); 1.68 (*s*, Me_2C). ^{1}H-NMR ($CDCl_3$, −39°): 7.45 (*s*, H–C(12)); 6.70 (*s*, H–C(9)); 4.2–3.9 (*m*, 2 H); 3.93, 3.88 (2*s*, 2 MeO); 3.37, 3.33 (2*s*, Me_2N); 3.1–2.7 (*m*, 2 H); 2.29 (*t*-like, 1 H); 1.82, 1.52 (2 br. *s*, Me_2C). ^{13}C-NMR: 174.1, 168.5 (2*s*, C=O, C=N); 151.1, 146.9, 135.9, 131.2 (4*s*, 4 arom. C); 113.4, 111.1 (2*d*[4]), 2 arom. CH); 59.8 (*s*, Me_2C); 55.9, 55.8 (2*q*, 2 MeO); 43.5 (*q*, Me_2N); 40.1, 28.9 (2*t*, 2 CH_2); 27.7 (*q*, Me_2C). CI-MS: 386 (20), 385 (65), 384 (100, $[M + 1]^+$), 340 (15), 339 (35), 272 (12). Anal. calc. for $C_{17}H_{25}N_3O_5S$ (383.27): C 53.28, H 6.52, N 10.96, S 8.37; found: C 53.42, H 6.93, N 11.02, S 8.36.

Suitable crystals for the X-ray analysis of **5a** were grown from MeOH.

1.2. A soln. of **1a** (150 mg, 1.3 mmol) and **4** (300 mg, 1.1 mmol) in dichloroethane (4 ml) was refluxed for 3 h, *i.e.*, until complete conversion of **4**. The solvent was evaporated and the residue chromatographed on SiO_2 (CH_2Cl_2/MeOH 25:1): 20 mg (4.7%) of **5a** and 14 mg (3.3%) of *4-(dimethylamino)-3,6,7,8-tetrahydro-10,11-dimethoxy-3,3-dimethyl-2*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**6a**). Colorless solid. IR: 3230*m*, 2930*m*, 1650*s*, 1620*m*, 1560*s*, 1500*m*, 1455*m*, 1420*m*, 1390*m*, 1360*w*, 1340*w*, 1255*s*, 1170*w*, 1130*s*, 1105*m*, 1040*m*, 970*w*, 855*m*. ^{1}H-NMR: 7.55 (*s*, H–C(12)); 7.03 (br. *s*, NH); 6.74 (*s*, H–C(9)); 3.90, 3.89 (2*s*, 2 MeO); 3.29 (*s*, Me_2N); 2.98 (*t*-like, 1 H); 2.64 (*t*-like, 2 H); 2.1–1.7 (very br., 1 H); 1.55 (*s*, Me_2C). CI-MS: 385 (15), 384 (22, $[M + 1]^+$), 341 (25), 340 (50), 339 (100), 272 (10).

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[4]) These signals are doubled in the decoupled spectrum.

2. *Reaction of 2-(Dimethylamino)-1-azaspiro[2.4]hept-1-ene* (**1b**) *with* **4**. Under slight warming, **4** (501 mg, 1.85 mmol) was dissolved in MeCN (14 ml). After cooling to r.t., **1b** (307 mg, 2.23 mmol) was added and the soln. stirred at r.t. for 84 h. The mixture was evaporated and the residue chromatographed (prep. TLC (SiO_2, CH_2Cl_2/EtOH 92:8)): 220 mg (29%) of *3-(dimethylamino)-5,6,7,8-tetrahydro-10,11-dimethoxyspiro[4*H*-1,2,5-benzothiadiazecine-4,1'-cyclopentan]-6-one 1,1-dioxide* (**5b**) and 12 mg (1.6%) of *4-(dimethylamino)-3,6,7,8-tetrahydro-10,11-dimethoxyspiro[2*H*-1,2,5-benzothiadiazecine-4,1'-cyclopentan]-6-one 1,1-dioxide* (**6b**).

5b: Colorless crystals. M.p. 174–175° (AcOEt/hexane). IR: 3415*w*, 3000*m*, 2970*m*, 1730*w*, 1673*m*, 1605*w*, 1573*m*, 1537*m*, 1510*s*, 1465*m*, 1445*m*, 1398*m*, 1355*w*, 1262*s* (br.), 1150*m*, 1125*s*, 1052*m*, 868*m*. ^{1}H-NMR: 7.56 (*s*, H–C(12)); 6.61 (*s*, H–C(9)); 6.60 (br. *s*, NH); 3.91, 3.90 (2*s*, 2 MeO); 3.31 (*s*, Me_2N); 2.7–2.4 (*m*, 2 CH_2); 2.05–1.9 (*m*, 2 H); 1.85–1.7 (*m*, 4 H); 1.65–1.55 (*m*, 2 H). ^{13}C-NMR (CD_3OD): 177.1, 172.2 (2*s*, C=O, C=N); 152.9, 148.5, 137.7, 133.0 (4*s*, 4 arom. C); 116.0, 113.0 (2d^4), 2 arom. CH); 56.5 (*s*, C(4)); 50.3, 49.9 (2*q*, 2 MeO); 44.1 (br. *q*, Me_2N); 39.8 (*t*, CH_2); 39.6 (*t*, 2 CH_2); 30.8 (*t*, CH_2); 23.6 (*t*, 2 CH_2). CI-MS: 411 (8), 410 (33, $[M + 1]^+$), 384 (8), 383 (20), 382 (79), 367 (8), 366 (19), 365 (100). Anal. calc. for $C_{19}H_{27}N_3O_5S$ (409.51): C 55.73, H 6.65, N 10.26, S 7.83; found: C 55.64, H6.41, N 10.28, S 7.89.

6b: Colorless solid. M.p. 192–193°. IR: 3420*w*, 2990*w*, 2950*m*, 1655*m*, 1625*s*, 1600*m*, 1568*w*, 1505*s*, 1460*m*, 1450*m*, 1438*m*, 1386*m*, 1325*m*, 1258*s*, 1165*m*, 1142*s*, 1093*s*, 1047*s*, 1008*s*, 865*m*. ^{1}H-NMR: 7.41 (*s*, H–C(12)); 6.77 (*s*, H–C(9)); 6.67 (br. *s*, NH); 3.83, 3.81 (2*s*, 2 MeO); 3.18 (*t*, CH_2CO); 2.80 (br. *s*, Me_2N); 2.53 (*t*, CH_2); 2.25–2.05, 2.0–1.65, 1.65–1.45 (3*m*, 4 CH_2). ^{13}C-NMR (CD_3OD): 174.9, 173.8 (2*s*, C=O, C=N); 153.2, 148.3, 134.6, 134.3 (4*s*, 4 arom. C); 115.8, 112.9 (2d^4), 2 arom. CH); 67.5 (*s*, C(3)); 56.7, 56.6 (2*q*, 2 MeO); 38.5 (br., Me_2N); 37.9 (*t*, CH_2); 37.8 (*t*, 2 CH_2); 29.4 (*t*, CH_2); 25.0 (*t*, 2 CH_2). CI-MS: 410 (10, $[M + 1]^+$), 384 (12), 383 (31), 382 (71), 367 (10), 366 (20), 365 (100).

3. *Reaction of 2-Benzyl-3-(dimethylamino)-2-methyl-2*H*-azirine* (**1c**) *with* **4**. In analogy to *Exper. 2*, a mixture of **4** (501 mg, 1.85 mmol) and **1c** (415 mg, 2.20 mmol) in MeCN (14 ml) was heated to 50° for 6.5 h[5]). Evaporation and flash chromatography (SiO_2, CH_2Cl_2/EtOH 95:5) yielded 200 mg (23.6%) of *4-benzyl-3-(dimethylamino)-5,6,7,8-tetrahydro-10,11-dimethoxy-4-methyl-4*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**5c**) and an impure 2nd fraction. The latter was purified by prep. TLC (SiO_2, CH_2Cl_2/EtOH 9:1): 35 mg (4.1%) of *3-benzyl-4-(dimethylamino)-3,6,7,8-tetrahydro-10,11-dimethoxy-3-methyl-2*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**6c**).

5c: Colorless crystals. M.p. 120–122° (benzene/hexane). IR: 3410*w*, 3330*w*, 2985*m*, 1655*m*, 1620*s*, 1570*w*, 1505*s*, 1460*m*, 1450*m*, 1438*m*, 1388*m*, 1370*w*, 1330*m*, 1260*s*, 1235*m*, 1168*m*, 1143*s*, 1090*m*, 1048*m*, 972*w*, 868*m*. ^{1}H-NMR: 7.54 (*s*, H–C(12)); 7.25–7.1 (*m*, 3 arom. H); 6.85–6.75 (*m* with *s* at 6.77; 3 arom. H, NH); 3.92, 3.90 (2*s*, 2 MeO); 3.57, 3.19 (*AB*, J = 14, PhCH_2); 3.45–3.25 (*m*, CH_2CO); 3.09 (br. *s*, Me_2N); 2.61 (*t*-like, CH_2); 1.65 (*s*, Me). ^{13}C-NMR (CD_3OD): 174.6, 173.8 (2*s*, C=O, C=N); 153.2, 148.3, 138.1, 134.7, 134.3 (5*s*, 5 arom. C); 132.2, 129.1, 127.6 (3d^4), 5 arom. CH); 115.8, 112.8 (2d^4), 2 arom. CH); 60.2 (*s*, C(4)); 56.7, 56.6 (2*q*, 2 MeO); 42.5 (*t*, CH_2); 38.4 (*q*, Me_2N); 38.0 (*t*, PhCH_2); 29.0 (*t*, CH_2); 22.4 (*q*, Me). CI-MS: 462 (10), 461 (25), 460 (100, $[M + 1]^+$), 417 (10), 416 (20), 415 (90). Anal. calc. for $C_{23}H_{29}N_3O_5S$ (459.57): C 60.11, H 6.36, N 9.14, S 6.98; found: C 59.82, H 6.62, N 8.95, S 7.15.

6c: Colorless solid. M.p. 125–128°. IR: 3410*w*, 3330*w*, 2990*w*, 2960*w*, 1665*m*, 1620*m*, 1600*w*, 1568*s*, 1530*w*, 1503*s*, 1460*m*, 1450*m*, 1438*m*, 1420*w*, 1388*w*, 1370*w*, 1330*m* (br.), 1260*s*, 1240*m*, 1167*m*, 1143*s*, 1115*s*, 1090*m*, 1048*s*, 975*w*, 870*m*. ^{1}H-NMR: 7.49 (*s*, H–C(12)); 7.3–7.1 (*m*, 3 arom. H); 7.05–6.8 (*m*, 2 arom. H, NH); 6.77 (*s*, H–C(9)); 3.91, 3.88 (2*s*, 2 MeO); 3.45–3.1 (*m*, PhCH_2, CH_2CO); 2.97 (*s*, Me_2N); 2.7–2.5 (*m*, CH_2); 1.63 (*s*, Me). ^{13}C-NMR (CD_3OD, from mixture with **5c**): 174.0, 170.1 (2*s*, C=O, C=N); 152.5, 148.0, 138.0, 137.0, 133.8 (5*s*, 5 arom. C); 132.1, 129.1, 127.7 (3*d*, 5 arom. CH); 115.9, 112.1 (2*d*, 2 arom. CH); 61.9 (*s*, C(3)); 56.8, 56.7 (2*q*, 2 MeO); 44.3 (*q*, Me_2N); 43.9 (*t*, CH_2); 38.5 (*t*, PhCH_2); 29.0 (*t*, CH_2); 22.7 (*q*, Me). CI-MS: 462 (10), 461 (30), 460 (100, $[M + 1]^+$), 433 (9), 432 (16), 415 (10).

4. *Reaction of 2,2-Dimethyl-3-(*N*-methyl-*N*-phenylamino)-2*H*-azirine* (**1d**) *with* **4**. In analogy to *Exper. 2*, a mixture of **4** (500 mg, 1.85 mmol) and **1d** (410 mg, 2.20 mmol) in MeCN (14 ml) was heated to 65° for 70 h, after which no **1d** was present (TLC). After evaporation, the complex mixture was separated by TLC (SiO_2, CH_2Cl_2/EtOH 92:8): 12 mg (1.5%) of *5,6,7,8-tetrahydro-10,11-dimethoxy-4,4-dimethyl-3-(*N*-methyl-*N*-phenylamino)-4*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**5d**) and 5 mg (0.6%) of *3,6,7,8-tetrahydro-10,11-dimethoxy-3,3-dimethyl-4-(*N*-methyl-*N*-phenylamino)-2*H*-1,2,5-benzothiadiazecin-6-one 1,1-dioxide* (**6d**).

5d: Pale-yellow solid. M.p. 120–121° ($CHCl_3$/pentane). IR: 3420*w*, 3000*w*, 2965*w*, 2935*w*, 1675*m*, 1605*w*, 1512*s*, 1465*m*, 1442*w*, 1395*w*, 1385*w*, 1370*w*, 1358*w*, 1260*m*, 1190*w*, 1170*w*, 1130*s*, 1054*m*, 968*w*, 865*w*. ^{1}H-NMR:

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[5]) The same result was obtained after 20 h at r.t.

7.54 (*s*, H–C(12)); 7.35–7.25 (*m*, 3 arom. H, NH); 7.25–7.15 (*m*, 2 arom. H); 6.56 (*s*, H–C(9)); 3.85, 3.83 (2*s*, 2 MeO); 3.30 (*s*, MeN); 2.9–2.0 (br., CH_2CO); 1.8–0.9 (br. with *s* at 1.18, CH_2, Me_2C). CI-MS: 448 (8), 447 (26), 446 (100, $[M+1]^+$), 391 (16), 335 (12).

6d: Pale-yellow solid. IR: 3430*w*, 3370*w*, 3000*m*, 2980*s*, 2935*m*, 2875*m*, 1670*m*, 1630*m*, 1595*m*, 1510*s*, 1495*m*, 1458*m*, 1445*m*, 1387*s*, 1370*w*, 1352*m*, 1335*m*, 1266*s*, 1240*m*, 1172*m*, 1149*s*, 1110*s*, 1075*m*, 1053*m*, 1022*w*, 980*w*, 873*w*, 842*w*. ^{1}H-NMR: 7.43 (*s*, H–C(12)); 7.4–7.25 (*m*, 3 arom. H); 7.2–7.1 (*m*, 2 arom. H); 6.71 (*s*, H–C(9)); 6.14 (br. *s*, NH); 3.84, 3.83 (2*s*, 2 MeO); 3.18 (*t*-like, CH_2CO); 3.15 (*s*, MeN); 2.29 (*t*-like, CH_2); 1.28 (*s*, Me_2C).

5. *Reaction of 3-(Dimethylamino)-2-isopropyl-2-methyl-2*H*-azirine* (**1e**) *with* **4**. A mixture of **4** (500 mg, 1.85 mmol) and **1e** (308.5 mg, 2.2 mmol) in MeCN (14 ml) was stirred at r.t. No change was observed after 21 d (TLC). Heating the soln. to 60° (28 h) led to an intractable mixture.

6. *Control Experiments*. Soln. of **5a** in dichloroethane and **5b** in MeCN were stirred under reflux and at r.t., resp. No formation of the isomeric **6a** and **6b**, resp., could be detected by TLC and ^{1}H-NMR.

7. *Crystal-Structure Determination of* **5a**[6]. The intensities were collected on a *Rigaku-AFC5R* diffractometer using graphite-monochromated MoK_α radiation ($\lambda = 0.71069$ Å) and a 12 kW rotating anode generator. The intensities were corrected for *Lorentz* and polarization effects, and an empirical absorption correction was applied [11]. Data collection and refinement parameters are listed in *Table 2*. A view of the molecule is shown in the *Figure*. The structure was solved by direct methods using SHELXS86 [12], which revealed the positions of all non-H-atoms. The non-H-atoms were refined anisotropically. All of the H-atoms were located in a difference electron density map, and their positions were allowed to refine together with individual isotropic temperature factors. Refinements were on F using full-matrix least-squares procedures, which minimized the function $\Sigma w(|F_o| - |F_c|)^2$. Neutral-atom scattering factors for non-H-atoms are from [13a] and the scattering factors for H-atoms are from [14]. Anomalous dispersion effects were included in F_c [15]; the values for f' and f'' were those of [13b]. All calculations were performed using the TEXSAN [16] crystallographic software package.

Table 2. *Crystallographic Data for Compound* **5a**

	5a		**5a**
Crystallized from	MeOH	Absorption coefficient μ(MoK_α) [mm^{-1}]	0.2005
Empirical formula	$C_{17}H_{25}N_3O_5S$		
Formula weight	383.46	Crystal temp. [K]	173(1)
Crystal color, habit	colorless, plate	2θ (max) [°]	60
Crystal dimensions [mm]	0.13 × 0.38 × 0.38	Total reflections measured	5955
Crystal system	monoclinic	Symmetry-independent reflections	5315
Lattice parameters:			
Reflections for unit cell determination	25	Absorption correction min, max	0.916, 1.137
2θ range [°]	$35 < 2\theta < 40$	Reflections observed $[I > 3\sigma(I)]$	3786
a [Å]	8.584(3)	Variables	335
b [Å]	9.477(4)	Final R	0.0365
c [Å]	22.512(3)	R_w	0.0363
β [°]	93.14(2)	Weights	$1/w = \sigma^2(F_o) + (0.005F_o)^2$
V [Å^3]	1828.5(9)	Goodness of fit s	1.614
Space group	$P2_1/c$	Final Δ_{max}/σ	0.0002
Z	4	$\Delta\rho$ (max, min) [e Å^{-3}]	0.29, −0.32
D_{calc} [g cm^{-3}]	1.393		

[6]) Atomic coordinates, bond lengths, and bond angles were deposited with the *Cambridge Crystallographic Data Centre*, 12 Union Road, Cambridge CB2 1EZ, England.

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