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# New Type of Transannular Reactions in Azirine-Fused Medium-Size Heterocycles: Selective Transformations of Azirino[2,1-*e*][1,6]benzoxazocines and -benzothiazocines into Oxa(thia)zine and Oxa(thia)zole Derivatives

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**Abstract**—Opening of the three-membered ring in heterocyclic systems incorporating a dichloroaziridine ring fused to eight-membered O,N- or S,N-heterocycles is accompanied by transannular reactions with participation of the endocyclic oxygen and sulfur atoms. Depending on the conditions, the products are 1,4-benzoxazine (1,4-benzothiazine) or 1,3-benzoxazole (1,3-benzothiazole) derivatives. The discovered transformations were used as a basis of methods for the preparation of new heterocyclic systems, 2,3,4,4a-tetrahydro-1*H*-pyrido-[3,2-*b*][1,4]benzoxa(thia)zine derivatives, in domino or consecutive modes, as well as of pyrrolidinyl-substituted 1,3-benzoxa(thia)zoles.

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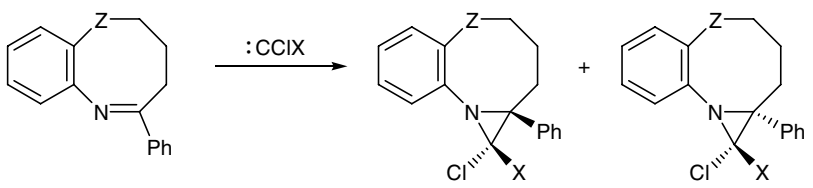
Transannular cyclizations underlie a relatively new but widely used and efficient method for building up various cyclic systems [1–4]. Transannular cyclizations are used most frequently for the synthesis of carbocycles [1–9], while cyclizations involving nitrogen [1, 2, 10–14], oxygen [15–18], or sulfur atom [19] have been reported in a few cases. Numerous transannular reactions imply formation of new rings with participation of an oxirane ring fused to a medium-size ring [2, 5, 13, 14, 16]. The only example of cyclization involving an azirine-containing fused system was described in [6]. Nevertheless, it is obvious that the synthetic potential of transannular reactions for the preparation of N-, O-, and S-containing heterocyclic compounds has been explored to a small extent.

In the present paper we report the results of our study on transannular reactions of azirino[2,1-*e*][1,6]-benzoxazocines and azirino[2,1-*e*][1,6]benzothiazocines (for preliminary communication, see [20]). Compounds **Ia** and **Ib** were synthesized by cycloaddition of dichlorocarbene (generated by alkaline hydrolysis of chloroform) to the C=N bond of 1,6-benzoxazocine (**IIa**) and 1,6-benzothiazocine (**IIb**), respectively (Scheme 1). Compound **Ic** was obtained as a single

**Scheme 1.**




**IIa**, **IIb** **Ia–Ic**, (*RS*,*RS*)-**Id** (*RS*,*SR*)-**Id**

**I**, Z = O, X = Cl (**a**), F (**c**); Z = S, X = Cl (**b**), F (**d**); **II**, Z = O (**a**), S (**b**).

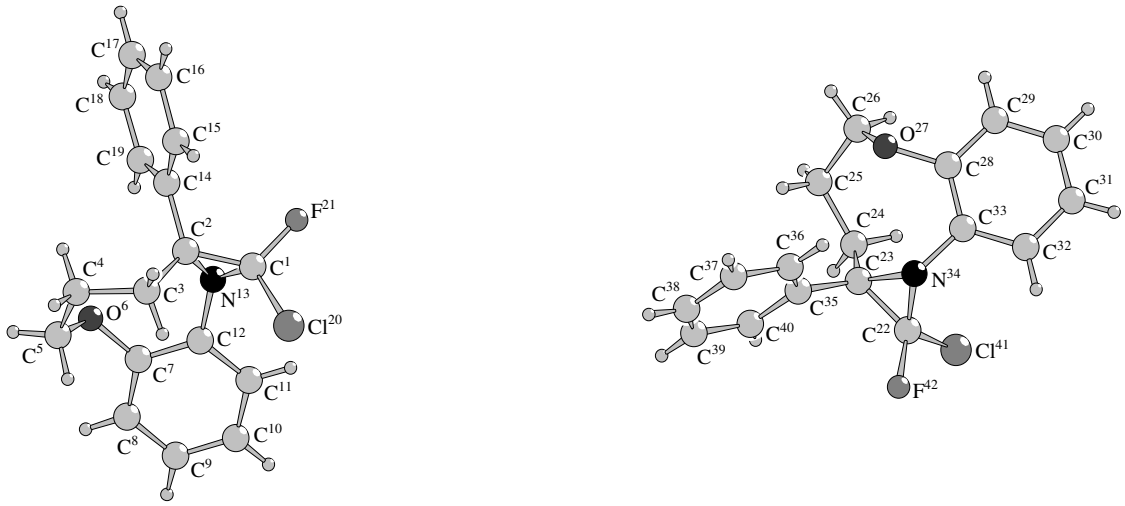



**Fig. 1.** Structures of two independent molecules of 1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzoxazocine (**Ic**) according to the X-ray diffraction data.

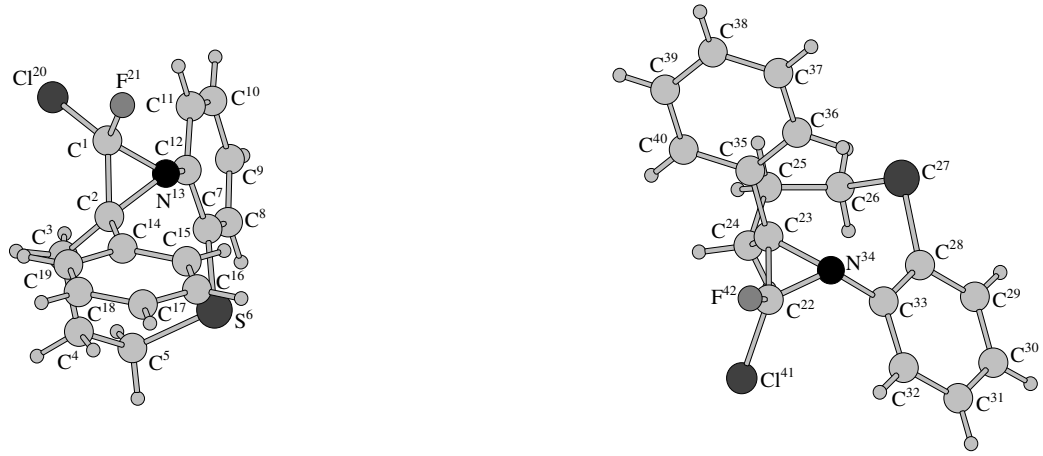



**Fig. 2.** Structures of two independent molecules of (*RS*,*RS*)-1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]-benzothiazocine (**Id**) according to the X-ray diffraction data.

(*RS*,*RS*)-isomer from 1,6-benzoxazocine (**IIa**) by the action of chlorofluorocarbene generated by alkaline hydrolysis of dichlorofluoromethane. However, we failed to apply the same procedure to generation of chlorofluorocarbene in the synthesis of sulfur-containing analog **Id**, for initial 1,6-benzothiazocine (**IIb**) underwent tarring under these conditions. We succeeded in synthesizing compound **Id** when chlorofluorocarbene was generated by thermocatalytic decomposition of sodium dichlorofluoroacetate in dichloroethane. The product was a mixture of (*RS*,*RS*) and (*RS*,*SR*) isomers at a ratio of 3:1. The steric structure of chlorofluoroaziridine derivatives **Ic** and **Id** was determined by X-ray analysis (Figs. 1–3; Tables 1–3).

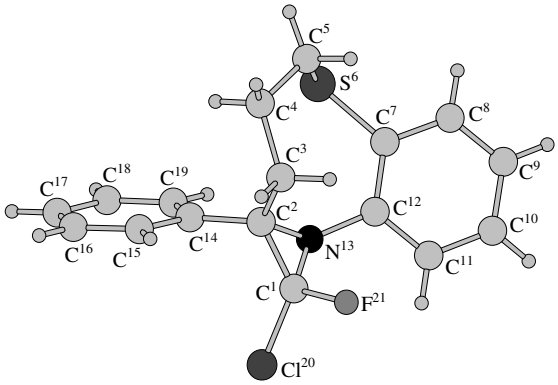



**Fig. 3.** Structure of the molecule of (*RS*,*SR*)-1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]-benzothiazocine (**Id**) according to the X-ray diffraction data.

The most typical transformation of 1,3-diaryl-2,2-dichloroaziridines on heating and under the action of nucleophiles is opening of the three-membered ring at the N–C$^3$ bond [21–27]. Although the aziridine ring in 1,1-dichloro-1,3,4,8b-tetrahydroazirino[2,1-*a*]isoquinolines could be opened at any of the three bonds, analysis of published data suggests that the most prob-

**Table 1.** Principal bond lengths (*d*) in two independent molecules of 1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzoxazocine (**Ic**)

| Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Cl^{20}$–$C^{1}$ | 1.743 | $C^{2}$–$C^{14}$ | 1.496 | $C^{10}$–$C^{11}$ | 1.387 | $Cl^{41}$–$C^{22}$ | 1.695 | $C^{23}$–$C^{35}$ | 1.497 | $C^{31}$–$C^{32}$ | 1.402 |
| $F^{21}$–$C^{1}$ | 1.378 | $C^{2}$–$C^{3}$ | 1.514 | $C^{11}$–$C^{12}$ | 1.396 | $F^{42}$–$C^{22}$ | 1.429 | $C^{23}$–$C^{24}$ | 1.524 | $C^{32}$–$C^{33}$ | 1.393 |
| $O^{6}$–$C^{7}$ | 1.374 | $C^{3}$–$C^{4}$ | 1.527 | $C^{14}$–$C^{19}$ | 1.385 | $O^{27}$–$C^{28}$ | 1.398 | $C^{24}$–$C^{25}$ | 1.511 | $C^{35}$–$C^{36}$ | 1.369 |
| $O^{6}$–$C^{5}$ | 1.444 | $C^{4}$–$C^{5}$ | 1.486 | $C^{14}$–$C^{15}$ | 1.384 | $O^{27}$–$C^{26}$ | 1.444 | $C^{25}$–$C^{26}$ | 1.487 | $C^{35}$–$C^{40}$ | 1.379 |
| $N^{13}$–$C^{1}$ | 1.391 | $C^{7}$–$C^{8}$ | 1.378 | $C^{15}$–$C^{16}$ | 1.396 | $N^{34}$–$C^{22}$ | 1.407 | $C^{28}$–$C^{29}$ | 1.393 | $C^{39}$–$C^{40}$ | 1.389 |
| $N^{13}$–$C^{12}$ | 1.412 | $C^{7}$–$C^{12}$ | 1.389 | $C^{16}$–$C^{17}$ | 1.372 | $N^{34}$–$C^{33}$ | 1.424 | $C^{28}$–$C^{33}$ | 1.367 | $C^{38}$–$C^{39}$ | 1.368 |
| $N^{13}$–$C^{2}$ | 1.495 | $C^{8}$–$C^{9}$ | 1.378 | $C^{17}$–$C^{18}$ | 1.372 | $N^{34}$–$C^{23}$ | 1.498 | $C^{29}$–$C^{30}$ | 1.366 | $C^{37}$–$C^{38}$ | 1.360 |
| $C^{1}$–$C^{2}$ | 1.477 | $C^{9}$–$C^{10}$ | 1.357 | $C^{18}$–$C^{19}$ | 1.387 | $C^{22}$–$C^{23}$ | 1.480 | $C^{30}$–$C^{31}$ | 1.347 | $C^{36}$–$C^{37}$ | 1.381 |

**Table 2.** Principal bond lengths (*d*) in two independent molecules of (*RS*,*RS*)-1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzothiazocine (**Id**)

| Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $Cl^{20}$–$C^{1}$ | 1.630 | $C^{2}$–$C^{14}$ | 1.503 | $C^{10}$–$C^{11}$ | 1.381 | $Cl^{41}$–$C^{22}$ | 1.735 | $C^{23}$–$C^{35}$ | 1.502 | $C^{31}$–$C^{32}$ | 1.384 |
| $F^{21}$–$C^{1}$ | 1.466 | $C^{2}$–$C^{3}$ | 1.523 | $C^{11}$–$C^{12}$ | 1.393 | $F^{42}$–$C^{22}$ | 1.400 | $C^{23}$–$C^{24}$ | 1.520 | $C^{32}$–$C^{33}$ | 1.399 |
| $S^{6}$–$C^{7}$ | 1.773 | $C^{3}$–$C^{4}$ | 1.527 | $C^{14}$–$C^{19}$ | 1.391 | $S^{27}$–$C^{28}$ | 1.769 | $C^{24}$–$C^{25}$ | 1.526 | $C^{35}$–$C^{36}$ | 1.383 |
| $S^{6}$–$C^{5}$ | 1.824 | $C^{4}$–$C^{5}$ | 1.514 | $C^{14}$–$C^{15}$ | 1.380 | $S^{27}$–$C^{26}$ | 1.826 | $C^{25}$–$C^{26}$ | 1.518 | $C^{35}$–$C^{40}$ | 1.389 |
| $N^{13}$–$C^{1}$ | 1.407 | $C^{7}$–$C^{8}$ | 1.398 | $C^{15}$–$C^{16}$ | 1.386 | $N^{34}$–$C^{22}$ | 1.398 | $C^{28}$–$C^{29}$ | 1.398 | $C^{39}$–$C^{40}$ | 1.397 |
| $N^{13}$–$C^{12}$ | 1.423 | $C^{7}$–$C^{12}$ | 1.397 | $C^{16}$–$C^{17}$ | 1.380 | $N^{34}$–$C^{33}$ | 1.409 | $C^{28}$–$C^{33}$ | 1.400 | $C^{38}$–$C^{39}$ | 1.381 |
| $N^{13}$–$C^{2}$ | 1.502 | $C^{8}$–$C^{9}$ | 1.377 | $C^{17}$–$C^{18}$ | 1.376 | $N^{34}$–$C^{23}$ | 1.507 | $C^{29}$–$C^{30}$ | 1.376 | $C^{37}$–$C^{38}$ | 1.371 |
| $C^{1}$–$C^{2}$ | 1.480 | $C^{9}$–$C^{10}$ | 1.382 | $C^{18}$–$C^{19}$ | 1.385 | $C^{22}$–$C^{23}$ | 1.490 | $C^{30}$–$C^{31}$ | 1.384 | $C^{36}$–$C^{37}$ | 1.382 |

able transformation of compounds **Ia**–**Id** on heating in methanol should be formation of nine-membered heterocycles like **III** via opening of the aziridine ring at the $C^{1a}$–$N^{10}$ bond [26, 27]. However, instead of the expected ring expansion products, heating of azirinobenzoxazocine **Ia** in methanol gave 1,4-benzoxazine derivatives **IVa**, **IVb**, **Va**, and **Vb** (Scheme 2). The transformation of azirinobenzoxazocine **Ia** into benzoxazine derivatives occurred even more readily in trifluoroacetic acid: the reaction afforded 85% of benzoxazine **Vb** at room temperature.

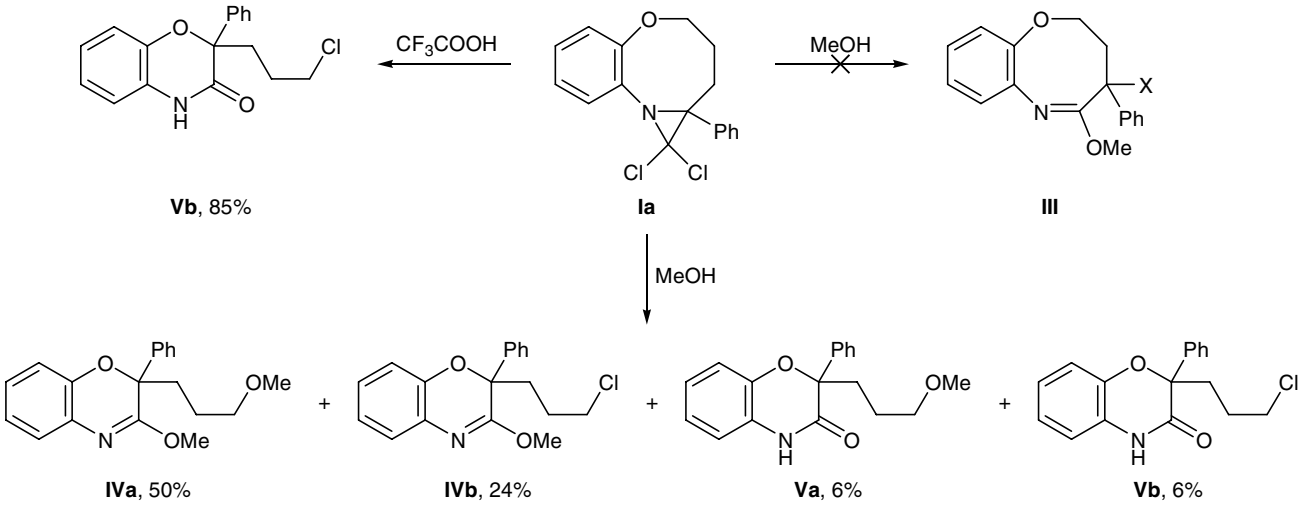
The structure of the isolated compounds was confirmed by IR and NMR spectroscopy and elemental analysis. The IR spectra of **Va** and **Vb** contained absorption bands due to stretching vibrations of the amide C=O (1700 $cm^{-1}$) and N–H bonds (3390–3400 $cm^{-1}$). In the $^{13}C$ NMR spectra of **IVa** and **IVb**, signals from the $C^{3}$ atom in the benzoxazine ring appeared at $\delta_C$ 167.0 and 166.7 ppm, respectively, while compounds **Va** and **Vb** displayed a signal from the amide carbonyl carbon atom at $\delta_C$ 167.7 ppm. The $C^{2}$ nucleus in **IVa**, **IVb**, **Va**, and **Vb** resonated at $\delta_C$ 80.8, 80.6, 84.3, and 84.1 ppm, respectively.

Compound **Ia** reacted with benzylamine in DMSO in a domino mode, resulting in fusion of an additional piperidine ring (Scheme 3). This transformation seems to be interesting from the synthetic viewpoint. We isolated in 36% yield pyrido[3,2-*b*][1,4]benzoxazine derivative **VI** whose structure was determined on the basis of the IR and NMR spectra and elemental analysis and was proved by the X-ray diffraction data [20].

**Table 3.** Principal bond lengths (*d*) in the molecule of (*RS*,*SR*)-1-chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzothiazocine (**Id**)

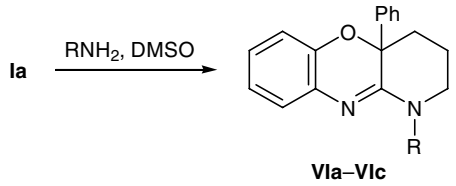
| Bond | *d*, Å | Bond | *d*, Å | Bond | *d*, Å |
|---|---|---|---|---|---|
| $Cl^{20}$–$C^{1}$ | 1.683 | $C^{2}$–$C^{14}$ | 1.503 | $C^{10}$–$C^{11}$ | 1.381 |
| $F^{21}$–$C^{1}$ | 1.481 | $C^{2}$–$C^{3}$ | 1.523 | $C^{11}$–$C^{12}$ | 1.393 |
| $S^{6}$–$C^{7}$ | 1.773 | $C^{3}$–$C^{4}$ | 1.527 | $C^{14}$–$C^{19}$ | 1.380 |
| $S^{6}$–$C^{5}$ | 1.824 | $C^{4}$–$C^{5}$ | 1.514 | $C^{14}$–$C^{15}$ | 1.391 |
| $N^{13}$–$C^{1}$ | 1.407 | $C^{7}$–$C^{8}$ | 1.398 | $C^{15}$–$C^{16}$ | 1.385 |
| $N^{13}$–$C^{12}$ | 1.423 | $C^{7}$–$C^{12}$ | 1.397 | $C^{16}$–$C^{17}$ | 1.376 |
| $N^{13}$–$C^{2}$ | 1.502 | $C^{8}$–$C^{9}$ | 1.377 | $C^{17}$–$C^{18}$ | 1.380 |
| $C^{1}$–$C^{2}$ | 1.480 | $C^{9}$–$C^{10}$ | 1.382 | $C^{18}$–$C^{19}$ | 1.386 |

**Scheme 2.**




Unfortunately, we failed to raise the yield by varying the reaction conditions (reactant ratio, solvent, temperature; addition of triethylamine). The reactions of **Ia** with *p*-chlorobenzylamine and isobutylamine gave only 23% of compounds **VIb** and **VIc**, respectively.

**Scheme 3.**

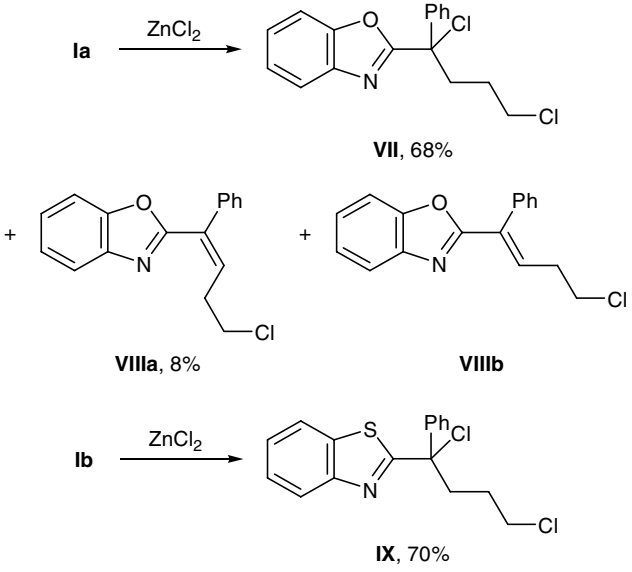



R = $PhCH_2$ (**a**, 36%), 4-$ClC_6H_4CH_2$ (**b**, 23%), *i*-Bu (**c**, 23%).

A different transformation occurred when azirinobenzoxazocine **Ia** was heated in the presence of zinc(II) chloride (Scheme 4). In this case, the products were 1,3-benzoxazole derivatives **VII** and **VIII**. Azirinobenzothiazocine **Ib** behaved similarly under the same conditions, and the corresponding 1,3-benzothiazole **IX** was isolated in 70% yield. The structure of compounds **VII** and **IX** was assigned on the basis of their IR, NMR, and mass spectra. In the $^{13}C$ NMR spectra of **VII** and **IX**, the $C^2$ atom resonated at $\delta_C$ 165.5 and 175.0 ppm, while the exocyclic carbon atom attached to phenyl ring and chlorine atom gave a signal at $\delta_C$ 70.5 and 76.1 ppm, respectively. The mass spectrum of **VII** (electron impact) contained the molecular ion peak with *m*/*z* 319, and compound **IX** (chemical ionization) showed the $[M + H]^+$ ion peak with *m*/*z* 336. The intensity ratio of the isotope peaks from the molecular ion of **VII** indicated the presence of two chlorine atoms in its molecule.

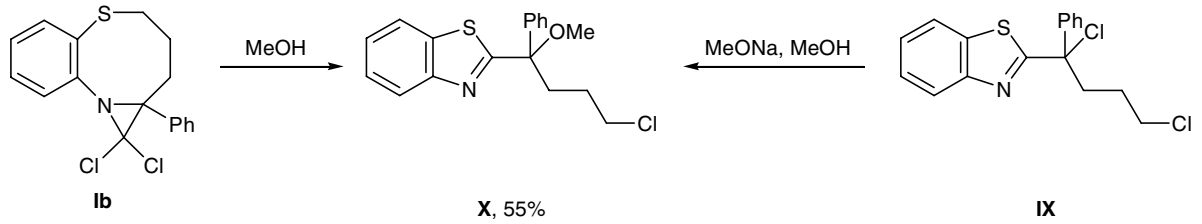
In the $^1H$ NMR spectra of **VIIIa** and **VIIIb** we observed signals from two methylene groups and aromatic protons and a triplet from the olefinic proton at δ 6.47 (*J* = 6.7 Hz) and 7.19 ppm (*J* = 6.5 Hz), respectively. The configuration of isomers **VIIIa** and **VIIIb** was established by comparing the chemical shift of the olefinic proton with those reported for structurally related compounds [28].

**Scheme 4.**




The chemical behavior of azirinobenzothiazocine **Ib** differed from the behavior of its oxygen analog **Ia**. No benzothiazine derivatives were formed when compound **Ib** was heated in methanol. Instead, we isolated 55% of benzothiazole derivative **X** (Scheme 5). The $C^2$ atom in **X** was characterized by a chemical shift of

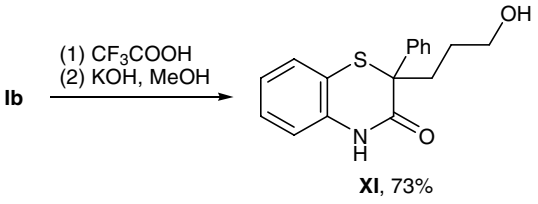
**Scheme 5.**




$\delta_C$ 177.1 ppm in the $^{13}C$ NMR spectra, and the exocyclic carbon atom attached to $C^2$ gave a signal at $\delta_C$ 83.2 ppm. Signals from the methylene groups in **X** appeared at $\delta_C$ 26.3, 32.0, and 45.1 ppm; these data rule out the structure having a terminal methoxy group in the side chain. For example, the chemical shifts of the terminal methoxy carbon atom in molecules **IVa** and **Va** are $\delta_C$ 72.3 and 72.4 ppm, respectively. The reaction of dichloride **IX** with sodium methoxide gave a product identical to **X** in spectral parameters.

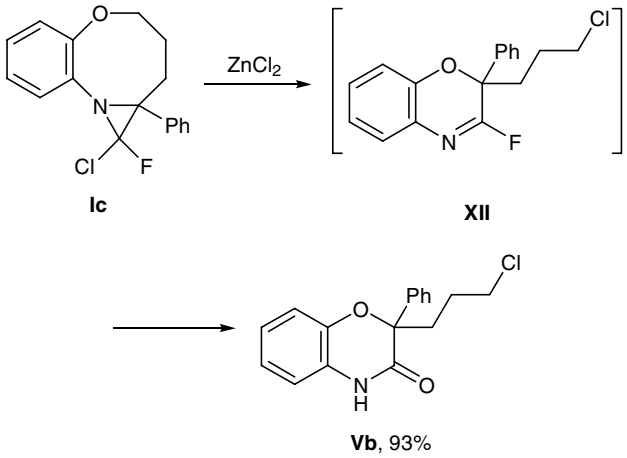
Nevertheless, we succeeded in obtaining benzothiazine derivative from aziridinobenzothiazocine **Ib** in strongly acidic medium. Compound **XI** was isolated in 73% yield in the reaction of **Ib** with trifluoroacetic acid, followed by treatment with KOH in methanol (Scheme 6). Benzothiazine **XI** showed in the IR spectrum three strong absorption bands belonging to stretching vibrations of the amide carbonyl (1700 $cm^{-1}$) and NH groups (3390 $cm^{-1}$) and side-chain OH group (3630 $cm^{-1}$). The terminal carbon atom in the side chain resonated at $\delta_C$ 62.5 ppm in the $^{13}C$ NMR spectrum, and the $C^2$ and $C^3$ signals were located at $\delta_C$ 55.1 and 169.1 ppm.

**Scheme 6.**



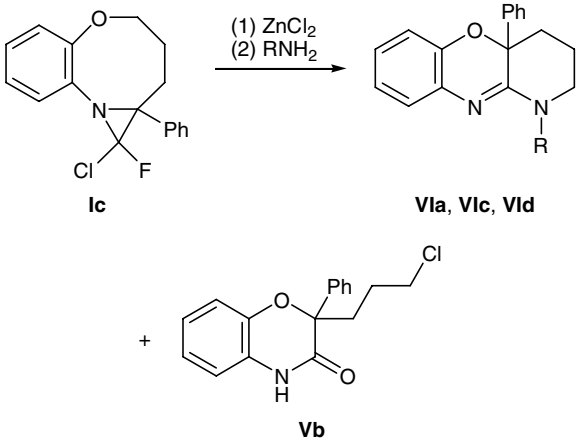

While studying the effect of the halogen nature on transannular transformations of aziridines **I**, we revealed considerable differences in the reactivities of dichloro derivatives **Ia** and **Ib**, on the one hand, and chlorofluoro derivatives **Ic** and **Id**, on the other. By heating azirinobenzoxazocine **Ic** in methanol we obtained compounds **Va** and **Vb** in 53 and 32% yield, respectively. However, no corresponding 1,3-benzoxazole derivative was formed in the reaction with zinc(II) chloride. Under these conditions, the product was oxazine derivative as well (amide **Vb**, 93%; Scheme 7). Presumably, the precursor of amide **Vb** is cyclic imidoyl fluoride **XII** which is formed from azirinobenzoxazocine **Ic** in almost quantitative yield.

**Scheme 7.**




Therefore, we proposed a more effective procedure for the synthesis of pyrido[3,2-*b*][1,4]benzoxazines **VIa**, **VIc**, and **VId**. In fact, successive treatment of azirinobenzoxazocine **Ic** first with anhydrous zinc(II)

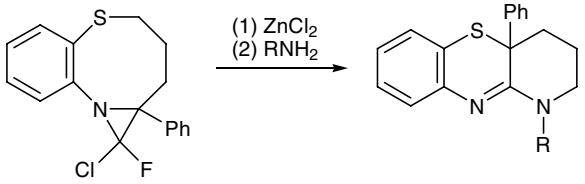
**Scheme 8.**




R = $PhCH_2$ (**a**, 68%), *i*-Bu (**c**, 63%), 3,4-$(MeO)_2C_6H_3CH_2$-$CH_2$ (**d**, 64%); **Vb**: 25, 36, and 12%, respectively.

chloride in methylene chloride at room temperature and then with primary amines in dimethyl sulfoxide on heating for a short time resulted in the formation of pyrido[3,2-*b*][1,4]benzoxazines **VIa**, **VIc**, and **VId** in 63–68% yield (Scheme 8; cf. the yields of **VIa**–**VIc** from **Ia**, 23–36%). The reaction was accompanied by formation of 12–36% of amide **Vb**. Following a similar procedure, we synthesized pyrido[3,2-*b*][1,4]benzothiazine derivatives **XIIIa** and **XIIIb** in 52% yield (Scheme 9). The $^{13}C$ NMR spectra of **XIIIa** and **XIIIb** displayed signals from $C^{4a}$ and $C^{10a}$ at $\delta_C$ 46.4, 46.2 and 154.7, 154.6 ppm, respectively.

**Scheme 9.**

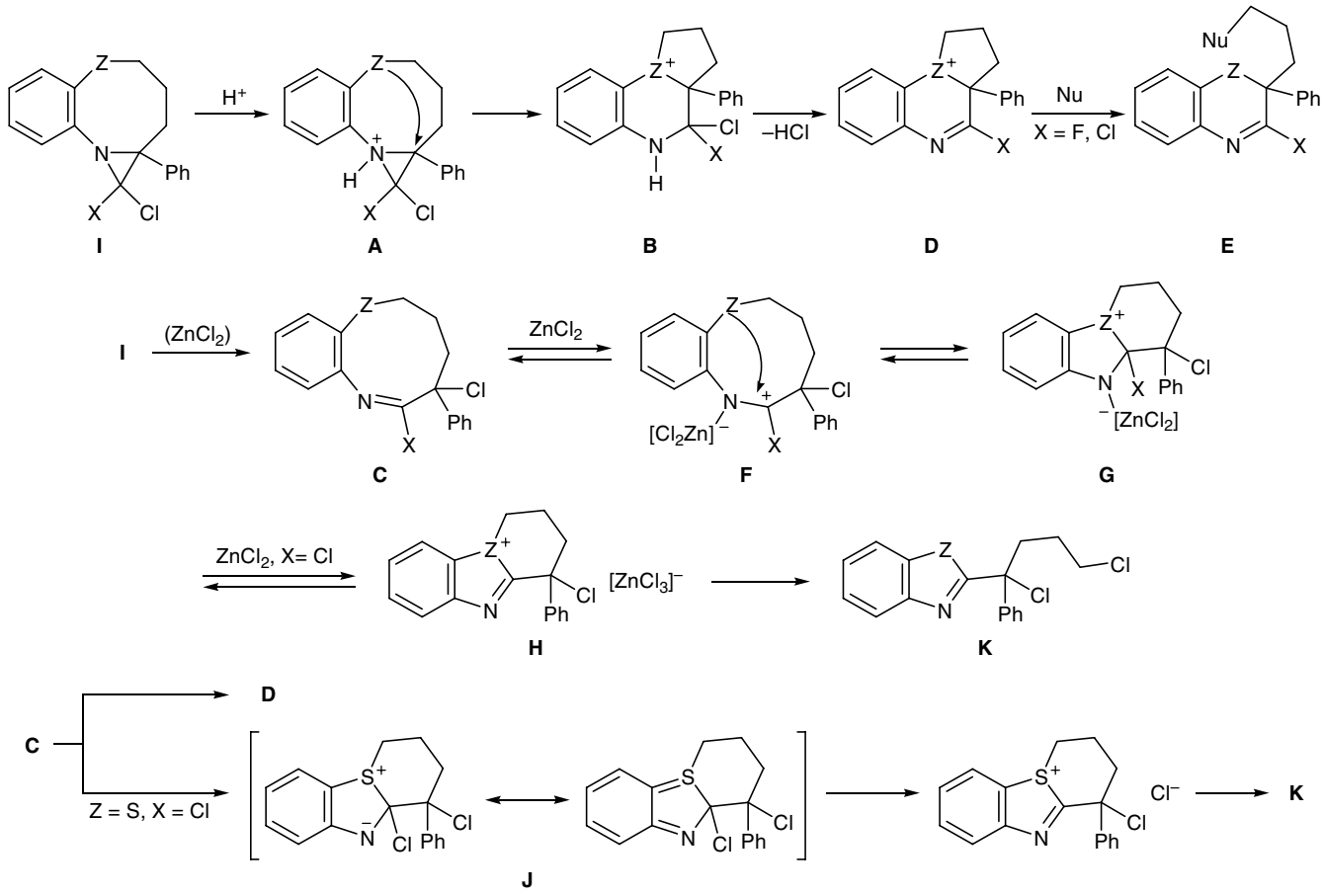



R = $PhCH_2$ (**a**, 52%), *i*-Bu (**b**, 52%).

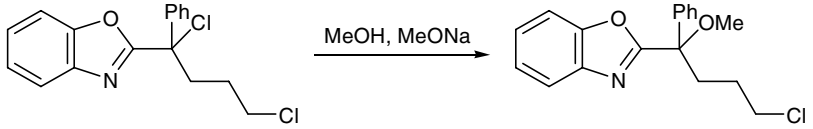
Our results indicated that, unlike dichloro-substituted derivatives **Ia** and **Ib**, chlorofluoro-substituted analogs **Ic** and **Id** do not undergo transannular reactions leading to formation of new five-membered ring even upon treatment with Lewis acids. Scheme 10 illustrates a probable mechanism which explains the observed dependence of the reaction pathway on the halogen and chalcogen nature. Protonation of aziridine **I** in a strong protic acid (such as $CF_3CO_2H$) gives intermediate **A** which undergoes opening of the aziridine ring via transannular nucleophilic attack by the endocyclic oxygen or sulfur atom on the bridgehead carbon atom. Elimination of hydrogen chloride from tricyclic intermediate **B** thus formed leads to structure **D**, and attack on the latter by external nucleophile yields compound **E** as precursor of benzoxazine and benzothiazine derivatives.

In the absence of strong protic acid, thermal cleavage of the dihaloaziridine ring gives nine-membered imidoyl halide **C** whose further transformations are determined by the halogen and chalcogen nature and the presence or absence of Lewis acid in the reaction

**Scheme 10.**



**Scheme 11.**




**VII** **XIV**, 76%

mixture. The reaction of imidoyl halide **C** with Lewis acid ($ZnCl_2$) yields complex **F** with enhanced electrophilicity of the imidoyl carbon atom, which facilitates elimination of chloride ion to form onium salt **H** as precursor of benzoxazoles and benzothiazoles **K**. The transformation of sulfur-containing imidoyl halide **C** into benzothiazole **K** may also occur in the absence of Lewis acid, e.g., due to additional stabilization via hypervalence bonding in intermediate **J**.

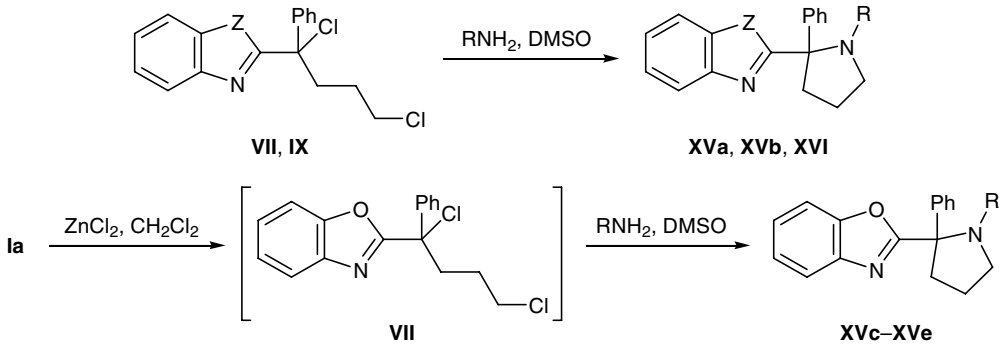
The transformation **G**→**Z** for fluorine-containing intermediate is hindered since fluoride ion is a bad leaving group; therefore, the equilibrium is displaced completely toward intermediate **D**, and only six-membered products are formed.

Transannular transformations of aziridines **I** often occur with conservation of the halogen atoms in the products, thus providing the possibility for further structural modifications. Taking into account that benzoxazole and benzothiazole derivatives are very interesting from the viewpoint of pharmacology (they are known to exhibit a broad spectrum of biological activity [29–31]), compounds **VII** and **IX** were brought into some chemical reactions, the most important of which were those leading to the formation of previously unknown pyrrolidinyl-substituted 1,3-benzoxazoles and 1,3-benzothiazoles.

Heating of dichloride **VII** in methanol in the presence of sodium methoxide resulted in selective replacement of the benzylic chlorine atom by methoxy group (Scheme 11). In the $^{13}C$ NMR spectrum of compound **XIV** thus obtained signals from the methylene carbon atoms were located at $\delta_C$ 25.9, 32.7, and 44.9 ppm, the signal from **C**PhOMe appeared at $\delta_C$ 80.5 ppm, and the C=N carbon atom resonated at $\delta_C$ 166.6 ppm.

Pyrrolidin-2-yl-substituted 1,3-benzoxazoles and benzothiazoles **XVa**, **XVb**, and **XVI** were readily obtained from dichlorides **VII** and **IX** by treatment with primary amines (yield 83, 53, and 32%, respectively; Scheme 12). Compounds like **XV** can also be synthesized from azirinobenzoxazocine **Ia** without isolation of intermediate dichloride **VII**. In this version, the

**Scheme 12.**

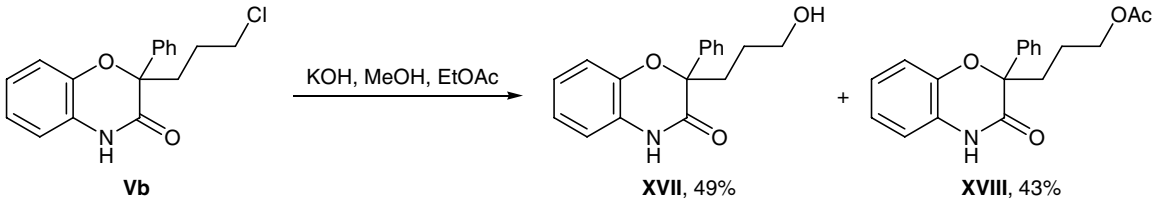



**VII**, **IX** **XVa**, **XVb**, **XVI**

**VII** **XVc**–**XVe**

**XV**, Z = O, R = $PhCH_2$ (**a**, 83%), 4-$ClC_6H_4CH_2$ (**b**, 53%), $PhCH_2CH_2$ (**c**, 48%), 4-$MeOC_6H_4$ (**d**, 39%), *i*-Bu (**e**, 30%); **XVI**, Z = S, R = $PhCH_2$ (32%).

**Scheme 13.**




**Vb** **XVII**, 49% **XVIII**, 43%

yields of **XVc–XVe** in the reactions with phenethylamine, anisidine, and isobutylamine were 48, 39, and 30%, respectively.

Compounds **XVa–XVe** and **XVI** were characterized by IR, NMR, and mass spectra. The $C^2$ signal in the $^{13}C$ NMR spectra of **XVa–XVe** and **XVI** appeared at $\delta_C$ 167.1–168.4 and 179.7 ppm, and the $C^{2'}$ atom in the pyrrolidine ring gave a signal at $\delta_C$ 70.3–71.9 and 74.2 ppm, respectively. The electron impact mass spectra of compounds **XVa–XVc** contained the molecular ion peaks (*m*/*z* 354, 368, and 388, respectively). Compounds **XVe** and **XVI** showed in the chemical ionization mass spectra $[M + H]^+$ ion peaks with *m*/*z* 321 and 371. The elemental compositions of **XVb**, **XVe**, and **XVI** calculated from the precise *m*/*z* values corresponded to the assumed structures.

Our attempt to build up a pyran-fused system via reaction of benzoxazinone **Vb** with KOH in methanol was unsuccessful. By extraction of the aqueous layer with ethyl acetate and subsequent separation by column chromatography we isolated compounds **XVII** and **XVIII** (Scheme 13).

The spectral parameters of compound **XVII** are very consistent with the data obtained for its sulfur-containing analog **XI**. The IR spectrum of **XVII** contained three strong absorption bands due to stretching vibrations of the amide carbonyl (1700 $cm^{-1}$) and NH groups (3405 $cm^{-1}$) and O–H bond (3630 $cm^{-1}$). Acetate **XVIII** displayed two carbonyl absorption bands at 1740 (ester) and 1695 $cm^{-1}$ (amide). In the $^{13}C$ NMR spectra of **XVII** and **XVIII**, signals at $\delta_C$ 62.5 and 64.3 ppm were assigned to the $CH_2O$ groups, the $C^2$ atom resonated at $\delta_C$ 84.5 and 84.2 ppm, and the amide carbonyl atom signal was located at $\delta_C$ 167.6 and 167.5 ppm, respectively.

## EXPERIMENTAL

The melting points were determined on a Boetius melting point apparatus (uncorrected values are given). The NMR spectra were measured on a Bruker DPX-300 spectrometer at 300 MHz for $^1H$ and 75 MHz for $^{13}C$. The elemental analyses were obtained on a Hewlett–Packard HP-185B CHN analyzer. The mass spectra were run on MAT-731 and MAT CH-7 instruments. The IR spectra were recorded on a UR 20 spectrometer (Carl Zeiss). The reaction mixtures were separated by column chromatography on Merck-60 silica gel. Compounds **IIa** and **IIb** [32] and anhydrous zinc(II) chloride [33] were prepared by known methods.

**1,1-Dichloro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzoxazocine (Ia).** Powdered potassium hydroxide, 2.4 g (42.8 mmol), was added under vigorous stirring to a solution of 1.2 g (5.063 mmol) of benzoxazocine **IIa** and 0.2 g (0.879 mmol) of benzyltriethylammonium chloride in 20 ml of chloroform, maintaining the temperature at 21 to 23°C using a cooling bath. The mixture was stirred for 30 min at that temperature, 10 ml of hexane was added, and the mixture was stirred for 30 min and filtered through a layer of silica gel. The solvent was distilled off from the filtrate on a rotary evaporator, and the residue was recrystallized from diethyl ether to isolate 1.42 g (88%) of compound **Ia** with mp 148–150°C (decomp., from hexane–$Et_2O$). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.45–1.60 m (1H), 1.70–1.85 m (2H), 2.60–2.68 m (1H), 3.61–3.69 m (1H), 4.58–4.63 m (1H), 7.10–7.30 m (4H), 7.40–7.50 m (3H), 7.55–7.65 m (2H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 26.4 ($CH_2$), 28.9 ($CH_2$), 60.2 (**C**Ph), 78.8 ($CCl_2$), 79.0 ($OCH_2$), 121.9, 123.3, 124.19, 124.21, 127.8, 128.27, 128.33, 135.4, 137.6, 151.8. Found, %: C 63.79; H 4.83; N 4.35. $C_{17}H_{15}Cl_2NO$. Calculated, %: C 63.77; H 4.72; N 4.37.

**1,1-Dichloro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzothiazocine (Ib).** Powdered potassium hydroxide, 4 g (71.4 mmol), was added under vigorous stirring to a solution of 2 g (7.905 mmol) of benzoxazocine **IIa** and 0.4 g (1.758 mmol) of benzyltriethylammonium chloride in 20 ml of chloroform, maintaining the temperature at 21 to 23°C using a cooling bath. The mixture was stirred for 2 h at that temperature, 30 ml of hexane was added, and the mixture was stirred for 30 min and filtered through a layer of basic aluminum oxide. The solvent was removed from the filtrate under reduced pressure on a rotary evaporator, and the residue was recrystallized from diethyl ether to isolate 1.25 g (48%) of azirinobenzothiazocine **Ib** with mp 144–146°C (decomp., from $Et_2O$). IR spectrum ($CHCl_3$), ν, $cm^{-1}$: 1480, 1580, 2380, 2410, 2920, 3040. $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.46–1.59 m (1H), 1.60–1.77 m (1H), 1.85–1.95 m (1H), 2.40–2.53 m (1H), 2.75–2.85 m (1H), 3.03–3.12 m (1H), 7.06–7.14 m (4H), 7.33–7.51 m (5H), 7.63–7.71 m (3H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 26.6 ($CH_2$), 30.3 ($CH_2$), 40.8 ($SCH_2$), 61.3 (**C**Ph), 78.3 ($CCl_2$), 121.5, 123.6, 124.5, 127.7, 128.0, 129.1, 129.8, 137.3, 138.9, 146.3. Found, %: C 60.72; H 4.76; N 3.90. $C_{17}H_{15}Cl_2NS$. Calculated, %: C 60.72; H 4.50; N 4.17.

**1-Chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzoxazocine (Ic).** Dichlorofluoromethane was passed over a period of 40 min through a mixture 1 g (4.219 mmol) of benzoxazocine **IIa**, 0.2 g (0.879 mmol) of benzyltriethylammonium chloride, and 2.5 g (44.6 mmol) of powdered potassium hydroxide in 10 ml of methylene chloride under vigorous stirring at 8–11°C. The mixture was filtered through a layer of silica gel, and the filtrate was evaporated on a rotary evaporator. The residue was recrystallized from diethyl ether to isolate 0.85 g (66%) of azirinobenzoxazocine **Ic** with mp 118–119°C (from $Et_2O$). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.42–1.54 m (1H), 1.56–1.70 m (1H), 1.74–1.92 m (1H), 2.57–2.63 m (1H), 3.63–3.73 m (1H), 4.60–4.65 m (1H), 7.11–7.24 m (4H), 7.34–7.50 m (3H), 7.60–7.66 m (2H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 25.6 d ($J$ = 2 Hz), 28.6 d ($J$ = 4 Hz), 60.1 d (**C**Ph, $J$ = 13 Hz), 78.9 ($OCH_2$), 98.9 d (CFCl, $J$ = 294 Hz), 122.1, 123.4, 124.1, 124.4, 127.8, 128.3, 128.4, 135.2, 135.9 d ($J$ = 4 Hz), 152.1 d ($J$ = 3 Hz). Found, %: C 67.41; H 4.94; N 4.48. $C_{17}H_{15}ClFNO$. Calculated, %: C 67.22; H 4.98; N 4.61. X-Ray diffraction data: $C_{17}H_{15}ClFNO$; $M$ 303.75; triclinic crystals; $a$ = 9.4377(11), $b$ = 10.279(2), $c$ = 16.1676(19) Å; α = 105.93(1), β = 90.49(1), γ = 94.25(1)°; $V$ = 1503.35(40) Å$^3$; $d_{calc}$ = 1.342 g/cm$^3$; space group $P$-1 (no. 2); $Z$ = 4 (two independent molecules); λ = 0.71073 Å; temperature 293 K; crystal habit 0.5×0.5×0.5 mm; $R$ = 0.0626; 6303 reflections (5317 independent reflections); Enraf–Nonius CAD4 diffractometer.

**1-Chloro-1-fluoro-1a-phenyl-1a,2,3,4-tetrahydro-1*H*-azirino[2,1-*e*][1,6]benzothiazocine (Id).** A solution of 1.2 g (4.743 mmol) of benzothiazocine **IIb** and 0.22 g (0.879 mmol) of benzyltriethylammonium chloride in 100 ml of dichloroethane was heated to the boiling point, and 16 g (94.7 mmol) of sodium dichlorofluoroacetate was added in small portions over a period of 3 h under vigorous stirring, maintaining the mixture slightly boiling. The solvent was removed under reduced pressure on a rotary evaporator, 50 ml of methylene chloride was added to the residue, the mixture was filtered through a 1-cm layer of silica gel, the filtrate was evaporated, and the residue was recrystallized from diethyl ether to isolate 0.48 g (32%) of azirinobenzothiazocine **Id** as a mixture of (*RS*,*RS*) and (*RS*,*SR*) isomers at a ratio of 3:1. mp 123–125°C (from $Et_2O$). IR spectrum ($CHCl_3$), ν, cm$^{-1}$: 1480, 1590, 2940, 3040, 3070. $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.38–1.85 m (3H), 2.42–2.53 m (1H), 2.65–2.77 m (1H), 3.05–3.11 m (1H), 7.08–7.14 m (1H), 7.28–7.49 m (5H), 7.62–7.75 m (3H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: (*RS*,*RS*): 25.8, 29.8 d ($J_{CF}$ = 3 Hz), 40.8 ($CH_2S$), 61.29 d (**C**Ph, $J_{CF}$ = 13 Hz), 98.2 d (CFCl, $J_{CF}$ = 294 Hz), 121.6, 123.8, 124.9 d ($J_{CF}$ = 3 Hz), 127.6, 128.14, 128.9, 129.7, 135.5 d ($J_{CF}$ = 4 Hz), 139.0, 146.2; (*RS*,*SR*): 25.9, 27.1, 40.9 ($CH_2S$), 61.31 d (**C**Ph, $J_{CF}$ = 16 Hz), 99.4 d (CFCl, $J_{CF}$ = 311 Hz), 121.4, 123.9, 125.8, 128.1, 128.7, 130.0, 136.7 d ($J_{CF}$ = 2 Hz), 138.9, 145.6 d ($J_{CF}$ = 4 Hz). Found, %: C 63.89; H 4.75; N 4.23. $C_{17}H_{15}ClFNS$. Calculated, %: C 63.84; H 4.73; N 4.38. X-Ray diffraction daya: $C_{17}H_{15}ClFNS$; $M$ 319.81; triclinic crystals; $a$ = 9.3132(14), $b$ = 10.5343(17), $c$ = 16.389(2) Å; α = 108.493(11), β = 90.368(11), γ = 93.082(11)°; $V$ = 1522.2(4) Å$^3$; $Z$ = 4; $d$ = 1.395 g/cm$^3$; space group $P$-1; Mo$K_\alpha$, λ = 0.71073 Å; temperature 133 K; $R_{all}$ = 0.0500, $wR_2$ = 0.0849; 21350 reflections (5109 independent reflections with $R_{int}$ = 0.0373); STOE IPDS II diffractometer.

**3-Methoxy-2-(3-methoxypropyl)-2-phenyl-2*H*-1,4-benzoxazine (IVa), 2-(3-chloropropyl)-3-methoxy-2-phenyl-2*H*-1,4-benzoxazine (IVb), 2-(3-methoxypropyl)-2-phenyl-2*H*-1,4-benzoxazin-3(4*H*)-one (Va), and 2-(3-chloropropyl)-2-phenyl-2*H*-1,4-benzoxazin-3(4*H*)-one (Vb).** *a*. A mixture of 0.130 g (0.406 mmol) of azirinobenzoxazocine **Ia** and 2 ml of methanol was heated for 1.5 h under reflux. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography on silica gel to isolate individual compounds **IVa**, **IVb**, **Va**, and **Vb**.

*b*. A mixture of 0.2 g (0.625 mmol) of azirinobenzoxazocine **Ia** and 2 ml of trifluoroacetic acid was stirred for 2 h at room temperature. The solution was evaporated under reduced pressure, and the residue was subjected to column chromatography to isolate 160 mg (85%) of amide **Vb**.

Compound **IVa**. Yield 160 mg (50%), mp 69–70°C (from hexane–$Et_2O$). IR spectrum ($CHCl_3$): ν 1610 cm$^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.36–1.50 m (1H), 1.51–1.65 m (1H), 2.46–2.58 m (1H), 2.72–2.84 m (1H), 3.30 s (6H, $OCH_3$), 3.34–3.40 m (2H), 7.22–7.34 m (5H), 7.46–7.53 m (3H), 7.77–7.82 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 22.6 ($CH_2$), 31.9 ($CH_2$), 51.6 (OMe), 58.4 (OMe), 72.3 ($OCH_2$), 80.8 (**C**Ph), 110.9, 120.3, 124.3, 125.3, 126.0, 127.7, 128.2, 140.4, 140.6, 150.8, 167.0 (C=N). Found, %: C 73.39; H 6.93; N 4.67. $C_{19}H_{21}NO_3$. Calculated, %: C 73.29; H 6.80; N 4.50.

Compound **IVb**. Yield 80 mg (24%), mp 75–76°C (from hexane–$Et_2O$). IR spectrum ($CHCl_3$): ν 1610 cm$^{-1}$

(C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.56–1.71 m (1H), 1.72–1.86 m (1H), 2.53–2.65 m (1H), 2.82–2.94 m (1H), 3.33 s (3H, $OCH_3$), 3.52–3.60 m (2H), 7.30–7.42 m (5H), 7.47–7.52 m (3H), 7.79–7.83 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 25.9 ($CH_2$), 32.7 ($CH_2$), 44.9 ($CH_2$), 51.8 (OMe), 80.5 (**C**Ph), 111.0, 120.3, 124.4, 125.4, 125.9, 127.9, 128.4, 140.1, 140.5, 150.9, 166.6 (C=N). Found, %: C 68.47; H 5.86; N 4.45. $C_{18}H_{18}ClNO_2$. Calculated, %: C 68.46; H 5.74; N 4.44.

Compound **Va**. Yield 20 mg (6%), mp 138–140°C (from $Et_2O$). IR spectrum ($CHCl_3$), ν, $cm^{-1}$: 1700 (C=O), 3400 (NH). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.76–1.96 m (2H), 2.15–2.27 m (1H), 2.38–2.51 m (1H), 3.32 s (3H, OMe), 3.39–3.47 m (2H), 6.65–6.73 m (1H), 6.85–6.93 m (1H), 6.95–7.03 m (1H), 7.09–7.15 m (1H), 7.20–7.30 m (3H), 7.48–7.53 m (2H), 8.38 br.s (1H, NH). $^{13}$C NMR spectrum ($CDCl_3$), δ, ppm: 24.0 ($CH_2$), 36.8 ($CH_2$), 58.4 ($OCH_3$), 72.5 ($OCH_2$), 84.3 (**C**Ph), 115.4, 117.3, 122.3, 124.0, 125.4, 126.2, 127.9, 128.3, 139.0, 143.2, 167.7 (C=O). Found, %: C 73.02; H 6.42; N 4.73. $C_{18}H_{19}NO_3$. Calculated, %: C 72.71; H 6.44; N 4.71.

Compound **Vb**. Yield 20 mg (6%), mp 126–128°C (from hexane–$Et_2O$). IR spectrum ($CHCl_3$), ν, $cm^{-1}$: 1700 (C=O), 3390 (NH). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 2.00–2.12 m (2H), 2.24–2.34 m (1H), 2.49–2.54 m (1H), 3.55–3.62 m (2H), 6.77–6.80 m (1H), 6.89–6.95 m (1H), 6.98–7.04 m (1H), 7.13–7.15 m (1H), 7.22–7.32 m (3H), 7.50–7.52 m (2H), 9.47 br.s (1H, NH). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 27.3 ($CH_2$), 37.6 ($CH_2$), 45.0 ($CH_2$), 84.1 (**C**Ph), 115.6, 117.4, 122.5, 124.2, 125.4, 126.1, 128.2, 128.5, 138.6, 143.0, 167.7 (C=O). Found, %: C 67.71; H 5.30; N 4.52. $C_{17}H_{16}ClNO_2$. Calculated, %: C 67.66; H 5.34; N 4.64.

**General procedure for the reactions of azirinobenzoxazocine Ia with amines.** A solution of 0.2 g (0.625 mmol) of azirinobenzoxazocine **Ia** and 1.875 mmol of the corresponding amine in 2 ml of DMSO was heated for 2 h on an oil bath (100°C). The mixture was poured into water and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. The residue was purified by column chromatography on silica gel to isolate compounds **VIa**–**VIc**.

**1-Benzyl-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzoxazine (VIa).** Yield 80 mg (36%), mp 155–157°C (from hexane–$Et_2O$). IR spectrum ($CHCl_3$): ν 1610 $cm^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.53–1.83 m (2H), 2.30–2.47 m (2H), 3.22–3.40 m (2H), 4.99 and 5.14 (2H, *AB* system, C**H**$_2$Ph, $J$ = 14.5 Hz), 6.77–6.88 m (3H), 7.00–7.05 m (1H), 7.18–7.53 m (10H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 18.9, 35.6, 47.2, 51.2, 76.0 (**C**Ph), 115.7, 122.3, 122.7, 123.4, 127.0, 127.3, 127.98, 128.04, 128.6, 128.7, 136.5, 137.7, 140.3, 144.8, 155.9 (C=N). Found, %: C 81.27; H 6.10; N 7.90. $C_{24}H_{22}N_2O$. Calculated, %: C 81.33; H 6.26; N 7.90.

**1-(4-Chlorophenylmethyl)-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzoxazine (VIb).** Yield 55 mg (23%), mp 205–205.5°C (from $Et_2O$). IR spectrum ($CHCl_3$): ν 1615 $cm^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.52–1.81 m (2H), 2.28–2.44 m (2H), 3.23–3.33 m (2H), 5.00 s (2H, C**H**$_2$Ph), 6.75–6.85 m (3H), 6.98–7.01 m (1H), 7.19–7.28 m (3H), 7.34–7.48 m (6H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 18.9, 35.5, 47.3, 50.7, 75.9 (**C**Ph), 115.8, 122.3, 122.8, 123.4, 126.9, 128.0, 128.1, 128.7, 130.1, 133.1, 136.2, 136.2, 140.2, 144.8, 155.7 (C=N). Found, %: C 73.96; H 5.47; N 7.13. $C_{24}H_{21}ClN_2O$. Calculated, %: C 74.12; H 5.44; N 7.20.

**1-Isobutyl-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzoxazine (VIc).** Yield 45 mg (23%), mp 115–117°C (from $Et_2O$). IR spectrum ($CHCl_3$): ν 1620 $cm^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.08 d (6H, $CH_3$, $J$ = 6.5 Hz), 1.60–1.82 m (2H), 2.29–2.43 m (3H), 3.23–3.30 m (1H), 3.38–3.44 m (2H), 3.89 q (1H, CH, $J$ = 6.5 Hz), 6.70–6.80 m (3H), 6.96–6.99 m (1H), 7.18–7.28 m (3H), 7.40–7.45 m (2H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 19.2, 20.48 ($CH_3$), 20.52 ($CH_3$), 26.2 (CH), 35.5, 49.0, 55.9, 75.8 (**C**Ph), 115.6, 122.2, 122.3, 123.3, 127.0, 127.9, 128.0, 140.5, 144.6, 155.8 (C=N). Found, %: C 78.80; H 7.48; N 8.67. $C_{21}H_{24}N_2O$. Calculated, %: C 78.72; H 7.55; N 8.74.

**2-(1,4-Dichloro-1-phenylbutyl)-1,3-benzoxazole (VII), 2-[(*Z*)-4-chloro-1-phenylbut-1-en-1-yl]-1,3-benzoxazole (VIIIa), and 2-[(*E*)-4-chloro-1-phenylbut-1-en-1-yl]-1,3-benzoxazole (VIIIb).** A mixture of 0.2 g (0.625 mmol) of azirinobenzoxazine **Ia**, 0.1 g (0.613 mmol) of $ZnCl_2 \cdot 1.5H_2O$, and 5 ml of methylene chloride was vigorously stirred for 1 h at room temperature. The mixture was filtered from $ZnCl_2$, the solvent was removed from the filtrate under reduced pressure, and the residue was separated by column chromatography using hexane–ethyl acetate as eluent to isolate compounds **VII**, **VIIIa**, and **VIIIb**.

Compound **VII**. Yield 135 mg (68%), viscous liquid. IR spectrum ($CHCl_3$): ν 1610 $cm^{-1}$ (C=N). $^1$H NMR

spectrum ($CDCl_3$), δ, ppm: 1.82–1.96 m (1H), 2.06–2.20 m (1H), 2.84–3.03 m (2H), 3.58–3.63 m (2H), 7.37–7.43 m (5H), 7.47–7.53 m (3H), 7.81–7.84 m (1H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 27.8, 40.7, 44.5, 70.5 (**C**Ph), 111.0, 120.7, 124.7, 125.9, 126.4, 128.5, 128.6, 139.4, 140.4, 151.0, 165.5 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{otn}$, %): 323 (1) $[M + 4]^+$, 321 (8) $[M + 2]^+$, 319 (12) $[M]^+$, 286 (33) $[M + 2 - Cl]^+$, 284 (100) $[M - Cl]^+$, 283 (8), 248 (22), 242 (7), 233 (5), 220 (20), 207 (30), 180 (3), 146 (3), 133 (11), 129 (17), 115 (18), 103 (19), 91 (13), 77 (20).

Compound **VIIIa**. Yield 14 mg (8%), viscous liquid. $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 3.27 q (2H, $CH_2$, $J$ = 6.7 Hz), 3.81 t (2H, $CH_2$, $J$ = 6.7 Hz), 6.47 t (1H, CH, $J$ = 6.7 Hz), 7.37–7.44 m (7H), 7.53–7.56 m (1H), 7.79–7.83 m (1H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 33.2, 43.9, 110.7, 120.3, 124.5, 125.4, 128.19, 128.22, 128.4, 131.8, 137.3 (=CH), 138.7, 141.4, 150.2, 162.0 (C=N).

Compound **VIIIb**. Yield 5 mg (3%), mp 59–60°C (from hexane–$Et_2O$). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 2.72 q (2H, $CH_2$, $J$ = 6.5 Hz), 3.66 t (2H, $CH_2$, $J$ = 6.5 Hz), 7.19 t (1H, CH, $J$ = 6.5 Hz), 7.32–7.53 m (8H), 7.71–7.74 m (1H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 32.5, 43.2, 110.3, 120.3, 124.3, 125.1, 128.3, 128.6, 129.7, 132.6, 134.6, 135.2 (=CH), 142.0, 150.5, 163.5 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{rel}$, %): 285 (6) $[M + 2]^+$, 283 (18) $[M]^+$, 248 (100) $[M - Cl]^+$, 246 (11), 234 (7), 233 (12), 131 (16), 115 (20), 77 (7). Found, %: C 71.88; H 5.03; N 5.03. $C_{17}H_{14}ClNO$. Calculated, %: C 71.96; H 4.97; N 4.94.

**2-(1,4-Dichloro-1-phenylbutyl)-1,3-benzothiazole (IX).** A mixture of 0.2 g (0.595 mmol) of azirinobenzothiazocine **Ib**, 0.1 g (0.613 mmol) of $ZnCl_2 \cdot 1.5H_2O$, and 5 ml of methylene chloride was vigorously stirred for 1 h at room temperature. The mixture was filtered from $ZnCl_2$, the solvent was removed from the filtrate under reduced pressure, and the residue was subjected to column chromatography using hexane–ethyl acetate as eluent to isolate 140 mg (70%) of compound **IX**. $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.88–2.16 m (2H), 2.90–3.11 m (2H), 3.59–3.64 m (2H), 7.34–7.61 m (7H), 7.86 d (1H, $J$ = 8.0 Hz), 8.07 d (1H, $J$ = 8.0 Hz). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 28.3, 41.5, 44.6, 76.1 (**C**Ph), 121.5, 123.7, 125.6, 126.2, 126.6, 128.37, 128.40, 136.0, 141.8, 152.7, 175.0 (C=N). Mass spectrum (CI, $NH_3$) *m*/*z* ($I_{rel}$, %): 340 (11) $[M + 4 + H]^+$, 338 (65) $[M + 2 + H]^+$, 337 (22) $[M + 2]^+$, 336 (100) $[M + H]^+$, 304 (14), 302 (40), 300 (9).

**2-(4-Chloro-1-methoxy-1-phenylbutyl)-1,3-benzothiazole (X).** A solution of 0.1 g (0.297 mmol) of azirinobenzothiazocine **Ib** in 1 ml of methanol was heated for 30 min under reflux. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel. Yield 55 mg (55%), mp 144–146°C (decomp., from hexane–$Et_2O$). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.68–1.80 m (2H), 2.66–2.78 m (1H), 2.88–3.00 m (1H), 3.35 s (3H, $OCH_3$), 3.56–3.62 m (2H), 7.25–7.40 m (4H), 7.44–7.50 m (1H), 7.54–7.60 m (2H), 7.84–7.88 m (1H), 8.01–8.05 m (1H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 26.3, 32.0, 45.1, 51.0 ($OCH_3$), 83.2 (**C**Ph), 121.6, 123.2, 125.0, 125.7, 126.2, 127.7, 128.4, 135.7, 141.9, 152.9, 177.1 (C=N). Found, %: C 65.22; H 5.44; N 4.07. $C_{18}H_{18}ClNOS$. Calculated, %: C 65.15; H 5.47; N 4.22.

**2-(3-Hydroxypropyl)-2-phenyl-2*H*-1,4-benzothiazin-3(4*H*)-one (XI).** A mixture of 0.2 g (0.595 mmol) of azirinobenzothiazocine **Ib** and 2 ml of trifluoroacetic acid was stirred for 2 h at temperature. The solution was evaporated, 5 ml of methanol and 0.13 g (2.32 mmol) of potassium hydroxide were added to the residue, and the mixture was heated for 2 h under reflux. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography using hexane–ethyl acetate as eluent to isolate 130 mg (73%) of compound **XI** with mp 142–143°C (from hexane–$Et_2O$). IR spectrum ($CHCl_3$), ν, $cm^{-1}$: 1700 (C=O), 3390 (NH), 3630 (OH). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.53–1.81 m (3H, $CH_2$, OH), 2.22–2.42 m (2H), 3.61–3.63 m (2H), 6.67–6.70 m (1H), 6.92–6.97 m (1H), 7.03–7.09 m (1H), 7.14–7.25 m (3H), 7.33–7.36 m (1H), 7.51–7.54 m (1H), 8.24 s (1H, NH). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 28.3 ($CH_2$), 34.7 ($CH_2$), 55.1 (**C**Ph), 62.5 ($CH_2OH$) 116.4, 119.8, 123.7, 126.6, 127.2, 127.6, 127.8, 128.3, 135.9, 137.9, 169.1 (C=O). Found, %: C 68.33; H 5.77; N 4.67. $C_{17}H_{17}NO_2S$. Calculated, %: C 68.20; H 5.72; N 4.68.

**Reaction of azirinobenzoxazocine Ic with methanol.** A mixture of 0.095 g (0.313 mmol) of azirinobenzoxazocine **Ic** and 2 ml of methanol was heated for 2 h under reflux. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography on silica gel to isolate 50 mg (53%) of compound **Va** and 30 mg (32%) of compound **Vb**.

**Reaction of azirinobenzoxazocine Ic with zinc(II) chloride.** A mixture of 0.108 g (0.355 mmol) of azirinobenzoxazocine **Ic**, 0.1 g (0.613 mmol) of $ZnCl_2 \cdot 1.5H_2O$, and 5 ml of methylene chloride was

vigorously stirred for 1 h at room temperature. The mixture was filtered from $ZnCl_2$, the solvent was removed from the filtrate under reduced pressure, and the residue was recrystallized from hexane–diethyl ether to isolate 101 mg (93%) of compound **Vb**.

**General procedure for the reactions of azirinobenzoxazocine Ic with anhydrous zinc(II) chloride and amines.** A mixture of 0.1 g (0.735 mmol) of anhydrous $ZnCl_2$, 0.1 g (0.329 mmol) of azirinobenzoxazocine **Ic**, and 5 ml of methylene chloride was stirred for 30 min at room temperature under argon. The solvent was removed under reduced pressure, 5 ml of anhydrous DMSO and a solution of 1.65 mmol of the corresponding amine in 5 ml of anhydrous DMSO were added, and the mixture was heated for 15 min at 100°C, cooled, poured into a saturated aqueous solution of $Na_2CO_3$, and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. Compounds **VI** were separated from amide **Vb** by column chromatography on silica gel. Yield, %: 68 (**VIa**), 25 (**Vb**); 63 (**VIc**), 36 (**Vb**); 64 (**VId**), 12% (**Vb**).

**1-[2-(3,4-Dimethoxyphenyl)ethyl)-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzoxazine (VId).** IR spectrum ($CHCl_3$): ν 1615 $cm^{-1}$ (C=N). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.53–1.75 m (2H), 2.23–2.38 m (2H), 3.07–3.35 m (4H), 3.47–3.54 m (1H), 3.90 s (6H, $CH_3O$), 4.09–4.19 m (1H), 6.75–7.02 m (7H), 7.18–7.28 m (5H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 19.0, 32.4, 35.3, 48.4, 50.0, 55.8 ($OCH_3$), 55.9 ($OCH_3$), 75.6 (**C**Ph), 111.2, 112.1, 115.7, 120.8, 122.2, 122.4, 123.3, 126.9, 127.9, 128.0, 132.1, 140.3, 144.7, 147.5, 148.9, 155.2 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{rel}$, %): 428 (11) $[M]^+$, 342 (26), 320 (14), 265 (18), 264 (100), 224 (4), 164 (12), 105 (14), 77 (10).

**General procedure for the reactions of azirinobenzothiazocine Id with anhydrous zinc(II) chloride and amines.** A mixture of 0.1 g (0.735 mmol) of anhydrous $ZnCl_2$, 0.1 g (0.313 mmol) of azirinobenzothiazocine **Id**, and 5 ml of methylene chloride was stirred for 45 min at room temperature under argon. The solvent was removed under reduced pressure, 5 ml of anhydrous DMSO and a solution of 1.565 mmol of the corresponding amine in 5 ml of anhydrous DMSO were added, and the mixture was heated for 15 min at 100°C, cooled, poured into a saturated aqueous solution of $Na_2CO_3$, and extracted with ethyl acetate. The extract was washed with water and dried over $Na_2SO_4$, the solvent was removed under reduced pressure, and the residue was subjected to column chromatography to isolate compound **XIIIa** or **XIIIb**.

**1-Benzyl-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzothiazine (XIIIa).** Yield 60 mg (52%), mp 130–131°C (from $Et_2O$). IR spectrum ($CHCl_3$): ν 1600 $cm^{-1}$ (C=N). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.60–1.75 m (2H), 2.18–2.29 m (1H), 2.36–2.43 m (1H), 3.40–3.45 m (2H), 5.02 and 5.20 (2H, *AB* system, C**H**$_2$Ph, $J$ = 14.3 Hz), 6.71 t (1H, $J$ = 6.7 Hz), 6.98–7.20 m (6H), 7.33–7.60 m (7H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 19.3, 36.1, 46.4 (**C**Ph), 47.8, 52.1, 119.7, 121.3, 123.8, 126.4, 126.6, 127.1, 127.2, 127.5, 127.7, 128.4, 128.5, 138.2, 140.9, 145.0, 154.7 (C=N). Found, %: C 77.69; H 5.98; N 7.65. $C_{24}H_{22}N_2S$. Calculated, %: C 77.80; H 5.98; N 7.56.

**1-Isobutyl-4a-phenyl-2,3,4,4a-tetrahydro-1*H*-pyrido[3,2-*b*][1,4]benzothiazine (XIIIb).** Yield 55 mg (52%). IR spectrum ($CHCl_3$): ν 1600 $cm^{-1}$ (C=N). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.04 d (3H, $CH_3$, $J$ = 6.7 Hz), 1.07 d (3H, $CH_3$, $J$ = 6.7 Hz), 1.65–1.74 m (2H), 2.15–2.25 m (1H), 2.36–2.50 m (2H), 3.45–3.51 m (3H), 3.67–3.74 m (1H), 6.64–6.69 m (1H), 6.97–7.18 m (6H), 7.41 d (2H, $J$ = 7.6 Hz). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 19.6, 20.4 ($CH_3$), 20.6 ($CH_3$), 26.4 (CH), 36.1, 46.2 (**C**Ph), 49.8, 57.0, 119.4, 120.9, 123.6, 126.3, 126.5, 127.0, 127.5, 127.7, 141.2, 145.2, 154.6 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{rel}$, %): 336 (11) $[M]^+$, 281 (5), 280 (30), 236 (5), 223 (5), 203 (6), 133 (17), 121 (19), 119 (83), 117 (72), 105 (26), 97 (18), 91 (26), 71 (49), 69 (32).

**2-(4-Chloro-1-methoxy-1-phenylbutyl)-1,3-benzoxazole (XIV).** Metallic sodium, 70 mg, was dissolved in 5 ml of methanol, a solution of 0.12 g (0.4 mmol) of dichloride **VII** in 5 ml of methanol was added, and the mixture was heated for 30 min under reflux. The solvent was removed under reduced pressure, the residue was treated with water and extracted with ethyl acetate, and the extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. By column chromatography (eluent hexane–ethyl acetate) we isolated 90 mg (76%) of compound **XIV** with mp 74–75°C (from hexane). IR spectrum ($CHCl_3$): ν 1610 $cm^{-1}$ (C=N). $^1H$ NMR spectrum ($CDCl_3$), δ, ppm: 1.39–1.66 m (2H), 2.35–2.45 m (1H), 2.64–2.74 m (1H), 3.13 s (3H, $OCH_3$), 3.30–3.43 m (2H), 7.11–7.21 m (5H), 7.29–7.32 m (3H), 7.61–7.63 m (1H). $^{13}C$ NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 25.9, 32.7, 44.9, 51.8 ($OCH_3$), 80.5 (**C**Ph), 111.0, 120.4, 124.5, 125.4, 125.9, 127.9, 128.4, 140.1, 140.5,

150.9, 166.6 (C=N). Found, %: C 68.42; H 5.74; N 4.46. $C_{18}H_{18}ClNO_2$. Calculated, %: C 68.46; H 5.74; N 4.44.

**General procedure for the reactions of compound VII with amines.** A solution of 0.14 g (0.437 mmol) of dichloride **VII** and 1.313 mmol of the corresponding amine in 5 ml of DMSO was heated for 2 h at 100°C on an oil bath. After cooling, the mixture was poured into water and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography on silica gel to isolate compound **XVa** or **XVb**.

**2-(1-Benzyl-2-phenylpyrrolidin-2-yl)-1,3-benzoxazole (XVa).** Yield 130 mg (83%). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.95–2.25 m (3H), 2.38–2.48 m (1H), 3.13–3.25 m (3H, $CH_2$, C**H**Ph), 4.29 m (1H, C**H**Ph), 7.29–7.59 m (13H), 7.84–7.86 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 21.7, 41.4, 50.3, 54.3, 71.7 (**C**Ph), 110.9, 120.3, 124.3, 124.9, 126.6, 126.7, 127.4, 128.1, 128.3, 128.4, 139.9, 140.7, 142.8, 150.8, 167.2 (C=N). Mass spectrum (EI), *m*/*z* ($I_{rel}$, %): 354 (33) $[M]^+$, 235 (19), 156 (30), 104 (23) $[NCH_2Ph]^+$, 91 (100) $[CH_2Ph]^+$, 81 (31), 69 (73).

**2-[1-(4-Chlorobenzyl)-2-phenylpyrrolidin-2-yl]-1,3-benzoxazole (XVb).** Yield 90 mg (53%). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.98–2.10 m (1H), 2.12–2.23 m (2H), 2.38–2.47 m (1H), 3.14–3.19 m (2H), 3.22 and 4.22 (2H, *AB* system, C**H**$_2$C$_6$H$_4$Cl, $J$ = 14.2 Hz), 7.30–7.48 m (11H), 7.50–7.59 m (1H), 7.83–7.87 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 21.7, 41.4, 50.2, 53.6, 71.8 (**C**Ph), 110.8, 120.3, 124.3, 125.0, 126.5, 127.5, 128.4, 129.4, 132.4, 138.4, 140.7, 142.6, 150.8, 167.1 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{rel}$, %): 390 (19), 389 (15), 388 (52) $[M]^+$, 344 (4), 270 (9), 249 (23) $[M - NCH_2C_6H_4Cl]^+$, 235 (40), 222 (37), 127 (33), 125 (100) $[CH_2C_6H_4Cl]^+$, 103 (11), 89 (19), 77 (15). Found: $[M + H]^+$ 389.1415. $C_{24}H_{22}ClN_2O$. Calculated: $[M + H]^+$ 389.1415.

**2-(1-Benzyl-2-phenylpyrrolidin-2-yl)-1,3-benzothiazole (XVI).** A solution of 0.14 g (0.416 mmol) of dichloride **IX** and 0.22 g (2.056 mmol) of benzylamine in 2 ml of DMSO was heated for 5 h at 100°C on an oil bath. After cooling, the mixture was poured into water and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography on silica gel to isolate 50 mg (32%) of compound **XVI**. $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 2.03–2.18 m (2H), 2.68–2.99 m (4H), 3.28 and 3.69 (2H, *AB* system, C**H**$_2$Ph, $J$ = 13.4 Hz), 7.31–7.53 m (12H), 7.95 d (1H, $J$ = 8.0 Hz), 8.07 d (1H, $J$ = 8.0 Hz). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 22.6, 42.5, 51.2, 55.4, 74.2 (**C**Ph), 121.5, 123.1, 124.7, 125.7, 126.8, 127.4, 128.0, 128.1, 128.2, 128.4, 135.4, 139.7, 141.5, 154.0, 179.7 (C=N). Mass spectrum (CI, $NH_3$), *m*/*z* ($I_{otn}$, %): 372 (28) $[M + 2]^+$, 371 (100) $[M + H]^+$. Found: $[M + H]^+$ 371.1576. $C_{24}H_{23}N_2S$. Calculated: $[M + H]^+$ 371.1576.

**General procedure for the reactions of compound Ia with zinc(II) chloride and amines.** A mixture of 0.2 g (0.625 mmol) of azirinobenzoxazocine **Ia**, 0.1 g (0.735 mmol) of $ZnCl_2$, and 5 ml of methylene chloride was stirred for 1 h at room temperature. The inorganic salt was filtered off, the solvent was removed from the filtrate under reduced pressure, and a solution of 1.875 mmol of the corresponding amine in 5 ml of DMSO was added to the residue. The mixture was heated at 100°C (oil bath) for 2, 3, or 4 h in the reaction with 2-phenylethanamine, 2-methylpropan-1-amine, and 4-methoxyaniline, respectively. After cooling, the mixture was poured into water and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography on silica gel to isolate compound **XVc**, **XVd**, or **XVe**.

**2-[2-Phenyl-1-(2-phenylethyl)pyrrolidin-2-yl]-1,3-benzoxazole (XVc).** Yield 110 mg (48%). IR spectrum ($CHCl_3$): ν 1610 cm$^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 2.00–2.10 m (2H), 2.22–2.42 m (2H), 2.54–2.60 m (1H), 2.83–2.88 m (2H), 3.05–3.10 m (1H), 3.15–3.25 m (1H), 3.54–3.62 m (1H), 7.17–7.35 m (12H), 7.45–7.50 m (1H), 7.75–7.85 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 21.9, 35.9, 41.5, 50.5, 52.2, 71.8 (**C**Ph), 110.8, 120.1, 124.2, 124.8, 125.9, 126.5, 127.1, 128.2, 129.0, 130.3, 136.6, 140.4, 142.9, 150.7, 167.4 (C=N). Mass spectrum (EI, 70 eV), *m*/*z* ($I_{rel}$, %): 368 (6) $[M]^+$, 284 (3), 279 (10), 278 (20), 277 (100) $[M - CH_2Ph]^+$, 248 (33), 234 (5), 208 (5), 105 (12), 91 (14), 77 (10).

**2-[1-(4-Methoxyphenyl)-2-phenylpyrrolidin-2-yl]-1,3-benzoxazole (XVd).** Yield 90 mg (39%), mp 138–139°C (from $Et_2O$). IR spectrum ($CHCl_3$): ν 1615 cm$^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.99–2.10 m (1H), 2.14–2.22 m (1H), 2.44–2.53 m (1H), 3.12–3.22 m (1H), 3.65 s (3H, $OCH_3$),

3.80–3.85 m (2H), 6.54–6.63 m (4H), 7.29–7.44 m (6H), 7.54–7.57 m (2H), 7.71–7.75 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 22.9, 46.5, 50.7, 55.5, 70.3 (**C**Ph), 110.6, 114.1, 114.7, 120.2, 124.0, 124.8, 127.3, 127.8, 127.9, 139.8, 140.8, 141.2, 150.7, 151.2, 168.4 (C=N). Found, %: C 71.88; H 5.03; N 5.03. $C_{17}H_{14}ClNO$. Calculated, %: C 71.96; H 4.97; N 4.94.

**2-(1-Isobutyl-2-phenylpyrrolidin-2-yl)-1,3-benzoxazole (XVe).** Yield 60 mg (30%). IR spectrum ($CHCl_3$): ν 1610 cm$^{-1}$ (C=N). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 0.81 d (3H, $CH_3$, $J$ = 6.7 Hz), 1.10 d (3H, $CH_3$, $J$ = 6.7 Hz), 1.75–1.87 m (1H), 1.95–2.09 m (3H), 2.18–2.28 m (1H), 2.44 q (1H, $J$ = 9.3 Hz), 2.55 t (1H, $J$ = 11.8 Hz), 3.05–3.10 m (1H), 3.38–3.45 m (1H), 7.29–7.43 m (7H), 7.51–7.54 m (1H), 7.80–7.83 m (1H). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 20.3 ($CH_3$), 21.4 ($CH_3$), 22.0 ($CH_2$), 27.5 (CH), 50.2 ($CH_2$), 57.9 ($CH_2$), 71.9 (**C**Ph), 110.8, 120.2, 124.1, 124.7, 126.8, 127.2, 128.1, 140.7, 143.2, 150.7, 167.5 (C=N). Mass spectrum (CI, $NH_3$), $m/z$ ($I_{rel}$, %): 322 (23) $[M + 2]^+$, 321 (100) $[M + H]^+$, 274 (4) $[M - CH(CH_3)_2]^+$. Found: $[M + H]^+$ 321.1961. $C_{21}H_{25}N_2O$. Calculated: $[M + H]^+$ 321.1961.

**2-(3-Hydroxypropyl)-2-phenyl-2*H*-1,4-benzoxazin-3(4*H*)-one (XVII) and 3-(3-oxo-2-phenyl-3,4-dihydro-2*H*-1,4-benzoxazin-2-yl)propyl acetate (XVIII).** A mixture of 130 mg (0.431 mmol) of amide **Vb**, 0.13 g (2.32 mmol) of potassium hydroxide, and 5 ml of methanol was heated for 1 h under reflux. The precipitate was filtered off, the solvent was removed from the filtrate under reduced pressure, and the residue was treated with water and extracted with ethyl acetate. The extract was washed with water and a saturated solution of sodium chloride and dried over $Na_2SO_4$. The solvent was removed under reduced pressure, and the residue was subjected to column chromatography using hexane–ethyl acetate as eluent to isolate compounds **XVII** and **XVIII**.

Compoundd **XVII**. Yield 60 mg (49%), mp 134–135°C (from $Et_2O$). IR spectrum ($CHCl_3$), ν, cm$^{-1}$: 1700 (C=O), 3405 (NH), 3630 (OH). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.79–1.91 m (3H, $CH_2$, OH), 2.15–2.24 m (1H), 2.47–2.57 m (1H), 3.67–3.71 m (2H), 6.72–6.75 m (1H), 6.86–6.92 m (1H), 6.97–7.02 m (1H), 7.11–7.14 m (1H), 7.23–7.31 m (3H), 7.48–7.51 m (2H), 8.91 s (1H, NH). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 27.3 ($CH_2$), 36.3 ($CH_2$), 62.5 ($CH_2OH$), 84.5 (**C**Ph), 115.5, 117.4, 122.4, 124.2, 125.4, 126.1, 128.1, 128.4, 138.9, 143.1, 167.6 (C=O). Found, %: C 72.17; H 6.18; N 4.96. $C_{17}H_{17}NO_3$. Calculated, %: C 72.07; H 6.05; N 4.94.

Compound **XVIII**. Yield 60 mg (43%), mp 150–152°C (from $Et_2O$). IR spectrum ($CHCl_3$), ν, cm$^{-1}$: 1695, 1740 (C=O); 3310 (NH). $^1$H NMR spectrum ($CDCl_3$), δ, ppm: 1.82–1.95 m (2H, $CH_2$), 2.04 s (3H, $CH_3$), 2.14–2.24 m (1H), 2.42–2.52 m (1H), 4.10–4.14 m (2H), 6.75–6.78 m (1H), 6.88–7.03 m (2H), 7.10–7.14 m (1H), 7.27–7.29 m (3H), 7.49–7.52 m (2H), 9.23 s (1H, NH). $^{13}$C NMR spectrum ($CDCl_3$), $\delta_C$, ppm: 20.9 ($CH_3$), 23.3 ($CH_2$), 36.6 ($CH_2$), 64.3 ($CH_2O$), 84.2 (**C**Ph), 115.5, 117.4, 122.4, 124.1, 125.4, 126.1, 128.1, 128.4, 138.7, 143.0, 167.5 (C=O), 171.1 (C=O). Found, %: C 70.17; H 5.88; N 4.14. $C_{19}H_{19}NO_4$. Calculated, %: C 70.14; H 5.89; N 4.30.

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