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Selective Synthesis of *cis*- and *trans*-2-(Methyl/phenyl)-3-(trifluoromethyl)aziridines and Their Regio- and Stereospecific Ring Opening

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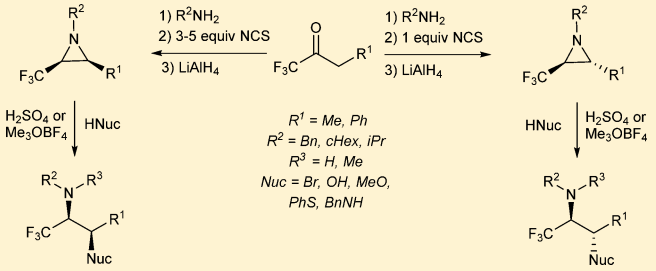
Supporting Information

ABSTRACT: A convenient and stereoselective approach toward *cis*- and *trans*-1-alkyl-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines was developed starting from the corresponding α,α,α-trifluoroketones via imination, α-chlorination, and hydride-induced ring closure. The reactivity of these newly synthesized nonactivated α-CF_3-aziridines was evaluated by applying *N*-protonation or *N*-alkylation to effect regio- and stereospecific aziridine ring opening by oxygen, halogen, sulfur, and nitrogen nucleophiles. Furthermore, nonactivated α-CF_3-aziridines were easily transformed into their activated analogues by replacing the *N*-benzyl protecting group with a *N*-tosyl group, rendering these α-CF_3-aziridines much more susceptible to nucleophilic ring opening.



INTRODUCTION

During the past few decades, fluorine has demonstrated its potential to induce important effects on several biological properties (lipophilicity, basicity) of bioactive compounds.[1] In that respect, the search for new synthetic methods for the preparation of fluorine-containing drug candidates and agrochemicals has increased exponentially over the years.[2] In particular, the incorporation of a CF_3 group has gained a great deal of interest, as witnessed by the many recently published reviews on the synthesis and applications of CF_3-containing organic structures.[3]

Because of their high ring strain, aziridines are versatile substrates for the synthesis of functionalized amines.[4] An interesting subclass of these three-membered ring structures is 2-(trifluoromethyl)aziridines, which combine the pronounced reactivity of aziridines with the biological properties of fluoride substituents. As a result, trifluoromethylated aziridines are often employed as eligible substrates in the synthesis of fluorinated building blocks.[5] However, the pathways toward the stereoselective synthesis of 2-substituted 3-(trifluoromethyl)aziridines remain scarce,[6,7] and most of these methods use diazo compounds (ethyl diazoacetate[6a,b] or (trifluoromethyl)diazomethane[6c−e]) or require drastic conditions.[7]

In this report, a novel stereoselective approach toward *cis*- and *trans*-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines is described. In addition, ring-opening reactions of these trifluoromethylated aziridines with versatile nucleophiles were evaluated successfully, leading to a broad range of new trifluoromethyl-containing building blocks. Whereas the ring opening of 1-alkyl-2-(trifluoromethyl)aziridines has been the topic of previous studies,[5a,b,8] the aptitude of 2-substituted 1-alkyl-3-(trifluoromethyl)aziridines toward further elaboration remains mainly unexplored.[5c,d,9]

RESULTS AND DISCUSSION

The proposed synthetic approach is based on the reductive cyclization of mono- and dichlorinated imines to provide a diastereoselective entry to novel 2-substituted 3-(trifluoromethyl)aziridines, followed by assessment of the eligibility of the latter aziridines as building blocks in organic chemistry by means of different ring-opening strategies. The synthesis of 1-alkyl-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines was initiated from the commercially available trifluoromethyl ketones 1,1,1-trifluorobutan-2-one (**1**) and 1,1,1-trifluoro-3-phenylpropan-2-one (**2**) (Scheme 1). The corresponding trifluoromethylated imines **3a−e** were easily prepared from ketones **1** and **2** using $TiCl_4$ (0.5 equiv) in the presence of 3 equiv of the appropriate primary amine R^2NH_2 (R^2 = Bn, *c*Hex, *i*Pr) in Et_2O.[10] These imines **3a−e** were then selectively α-chlorinated under reflux conditions in cyclohexane to give their α,α-dichlorinated (**4a−e**) and α-monochlorinated (**6a−e**) analogues using 3−5 and 1 equiv of NCS, respectively. Subsequently, the reduction of dichloroimines **4a−e** with 2 equiv of $LiAlH_4$ in Et_2O under reflux gave rise to *cis*-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines **5a−e** as the major diastereomers in excellent yields (57−93%) and high diastereoselectivities ((94−97):(3−6)) (Table 1).

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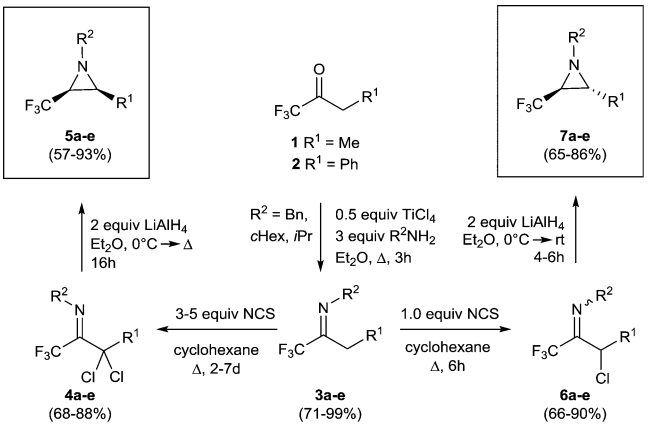
Scheme 1



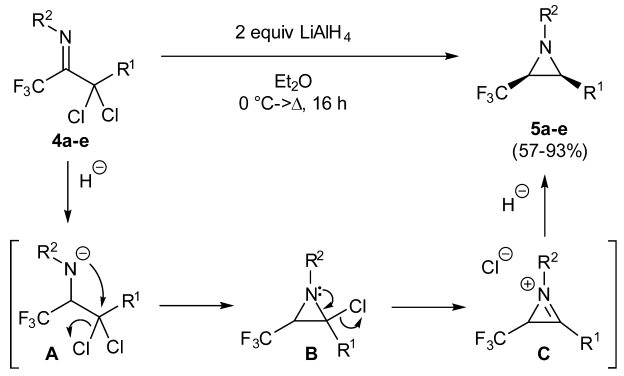
The relative stereochemistry of *cis*-aziridines **5a−e** could be deduced from the vicinal coupling constants between the C2 and C3 protons (J = 6.1−6.6 Hz) in ^{1}H NMR ($CDCl_3$), which is in accordance with literature data.[11] This stereochemical outcome can be rationalized by considering that, after imine reduction and intramolecular displacement of the first chlorine atom in dichloroimines **4** toward 2-chloroaziridines **B**, the subsequent formation of the 1-azirinium chloride intermediate **C** takes place by expulsion of the second chlorine atom.[11,12] This highly reactive intermediate **C** will immediately be captured by the addition of another hydride ion coming in from the opposite side of the CF_3-directing group,[11] i.e., the least sterically hindered side, leading selectively toward *cis*-3-(trifluoromethyl)aziridines **5a−e** (Scheme 2).

On the other hand, the reduction of monochloroimines **6a−e** with 2 equiv of $LiAlH_4$ in Et_2O at room temperature yielded *trans*-3-(trifluoromethyl)aziridines **7a−e** as the major diastereomers, which is in agreement with analogous transformations described in the literature[13] and which can be explained considering complexation of lithium by nitrogen and chlorine toward a cyclic intermediate, followed by diastereoselective hydride transfer to the imine. Although the yields of *trans*-aziridines **7** (65−86%) were comparable with those of *cis*-aziridines **5**, the stereoselectivity was significantly lower ((78−94):(6−22)). However, the diastereomeric ratio of aziridine **7a** could be enhanced considerably by changing the reaction temperature (Scheme 3 and Table 2). When the temperature was decreased to −40 °C, an excellent diastereomeric ratio of 1:99 (*cis*:*trans*) was achieved (Table 2, entry 4). Each diastereomer **5** and **7** was isolated in pure form by column chromatography on silica gel, before entering a reactivity screening study.

In a second part of this work, the reactivity of the novel aziridines **5a,c** and **7a,c** was evaluated. It is commonly known that nonactivated 1-alkylaziridines are not very prone to undergo ring opening,[14] and thus, prior to ring opening, 1-alkylaziridines are usually activated by adding a Lewis acid[15] or by quaternization of the nitrogen atom.[16] On the other hand, Katagiri et al. have shown that the use of Lewis acids results in the complete recovery of 1-benzyl-2-(trifluoromethyl)aziridine, probably due to the low coordinating ability of the lone pair on the nitrogen atom of trifluoromethylated aziridines.[5b,8c] Indeed, the inductive effect of the trifluoromethyl group renders the nitrogen less basic. Hence, the present study focused instead on *N*-protonation and *N*-alkylation in order to activate 3-(trifluoromethyl)aziridines **5** and **7**.

Protonation of *cis*-aziridines **5a,c** and *trans*-aziridines **7a,c** allowed for smooth stereospecific ring-opening reactions toward the *syn* and *anti* products **8−13**, respectively (Scheme 4 and Table 3), providing access to a wide range of interesting

Scheme 2



Scheme 3

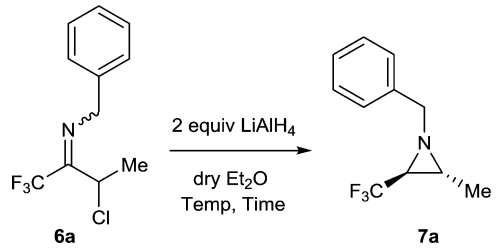


Table 2. Effect of Temperature on the Diastereomeric Ratio of *trans*-Aziridine 7a

entry	temp (°C)	time (h)	yield (%)[a]	*cis*:*trans*[b]
1	0 → Δ	16	70	12:88
2	0 → room temp	4	79	7:93
3	0	4	63	3:97
4	−40	5	78	1:99

[a]Crude yield (purity >85% based on GC). [b]Based on ^{1}H NMR or GC analysis of the reaction mixture.

Table 1. Stereoselective Synthesis of *cis*- and *trans*-3-(Trifluoromethyl)aziridines 5 and 7

compd	R^1	R^2	yield (%)[a]	*cis*:*trans*[b]	compd	R^1	R^2	yield (%)[a]	*cis*:*trans*[b]
5a	Me	Bn	87	94:6	**7a**	Me	Bn	79	7:93
5b	Me	*c*Hex	65	96:4	**7b**	Me	*c*Hex	67	18:82
5c	Ph	Bn	93	96:4	**7c**	Ph	Bn	86	17:83
5d	Ph	*c*Hex	57	95:5	**7d**	Ph	*c*Hex	82	22:78
5e	Ph	*i*Pr	81	97:3	**7e**	Ph	*i*Pr	65	6:94

[a]Crude yield (purity >85% based on GC). [b]Based on ^{1}H NMR or GC analysis of the reaction mixture.

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Scheme 4

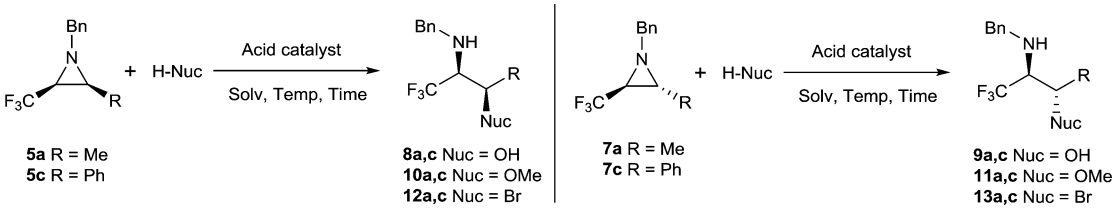


Table 3. Ring Opening of *cis*-Aziridines 5a,c and *trans*-Aziridines 7a,c with Sulfuric Acid or Hydrogen Bromide

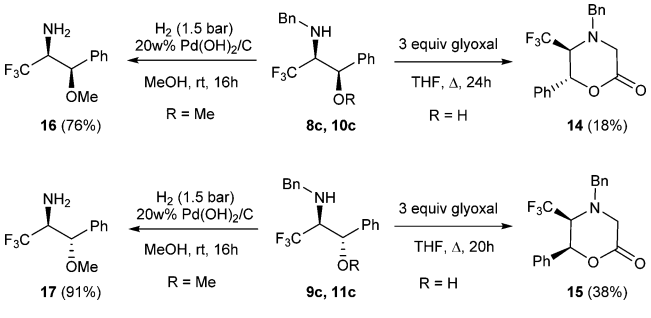
entry	aziridine	R	HNuc	acid catalyst	solvent	temp (°C)	time (h)	product	yield (%)[a]
1	**5a**	Me	H_2O	H_2SO_4	CH_3CN/H_2O (1/1)	Δ	1	**8a**	89
2	**5c**	Ph	H_2O	H_2SO_4	CH_3CN/H_2O (1/1)	Δ	1	**8c**	95
3	**5a**	Me	MeOH	H_2SO_4	CH_3CN/MeOH (1/1)	Δ	1	**10a**	50
4	**5c**	Ph	MeOH	H_2SO_4	CH_3CN/MeOH (1/1)	Δ	1	**10c**	75
5	**5a**	Me	HBr[b]		CH_3CN	0 → room temp	1	**12a**	88
6	**5c**	Ph	HBr[b]		CH_3CN	0 → room temp	1	**12c**	82
7	**7a**	Me	H_2O	H_2SO_4	CH_3CN/H_2O (1/1)	Δ	1	**9a**	83
8	**7c**	Ph	H_2O	H_2SO_4	CH_3CN/H_2O (1/1)	Δ	1	**9c**	89
9	**7a**	Me	MeOH	H_2SO_4	CH_3CN/MeOH (1/1)	Δ	1	**11a**	52
10	**7c**	Ph	MeOH	H_2SO_4	CH_3CN/MeOH (1/1)	Δ	1	**11c**	78
11	**7a**	Me	HBr[b]		CH_3CN	0 → room temp	1	**13a**	86
12	**7c**	Ph	HBr[b]		CH_3CN	0 → room temp	1	**13c**	82

[a]Isolated yields. [b]5 equiv (48% in H_2O).

trifluoromethylated functionalized β-amines through exclusive nucleophilic attack at the C2 position.[5b,8c] The stereocontrol of nucleophile-induced ring opening of *cis*- and *trans*-aziridines **5a,c** and **7a,c** implies an S_N2 mechanism, yielding the single *syn* and *anti* diastereomer, respectively.[5c,9a,17] Catalytic amounts of H_2SO_4 were shown to be sufficient to obtain the desired trifluoromethylated β-amino alcohols **8a,c** and **9a,c** and β-amino ethers **10a,c** and **11a,c** after 1 h under reflux (Table 3, entries 1−4 and 7−10). Trifluoromethylated β-bromo amines **12a,c** and **13a,c** were obtained efficiently by stirring aziridines **5a,c** and **7a,c** in CH_3CN in the presence of 5 equiv of HBr (48% in H_2O) at room temperature (Table 3, entries 5, 6, 11, and 12), without formation of β-amino alcohols **8a,c** and **9a,c** as side products.

With this method in hand, the synthetic potential of amino alcohols **8c** and **9c** and amino ethers **10c** and **11c** was further evaluated (Scheme 5). In that respect, *trans*- and *cis*-4-benzyl-6-phenyl-5-(trifluoromethyl)morpholin-2-ones **14** and **15** were prepared starting from *syn*- and *anti*-2-benzylamino-3,3,3-trifluoro-1-phenylpropan-1-ols **8c** and **9c** upon treatment with 3 equiv of glyoxal in THF under reflux.[18] The relative stereochemistry as established in morpholinones **14** and **15** can be considered as an indirect proof for the observed stereoselectivity in the S_N2 ring opening of the aziridine substrates **5** and **7**. These types of morpholin-2-ones are of biological interest, for example as potential T-type Ca^{2+} channel blockers or tachykinin receptor antagonists.[19] Unfortunately, the isolated yields were very low (18% and 38% after purification, respectively). Analysis of the crude reaction mixtures by ^{19}F NMR ($CDCl_3$) showed that the desired morpholin-2-ones **14** and **15** were only formed in 21% and 60% yield, respectively, probably due to the reduced nucleophilic character of the nitrogen atom caused by the strong electron-withdrawing effect of the trifluoromethyl group.[5b,8c] On the other hand, this electronic effect enabled smooth debenzylation of *syn*- and *anti*-*N*-benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amines **10c** and **11c** under a hydrogen atmosphere (1.5 bar) catalyzed by $Pd(OH)_2/C$ (20% w/w) in methanol at room temperature, giving rise to *syn*- and *anti*-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amines **16** and **17** in good to high yields (76−91%).

Scheme 5



As an alternative to protonation, alkylation is often used to induce ring-opening reactions of nonactivated aziridines.[16] In that respect, the strong methylating agent trimethyloxonium tetrafluoroborate (Me_3OBF_4) was selected, as this reagent had already proven its potential in the methylation of other CF_3-containing azaheterocyclic compounds.[8c,20] The desired *syn*- and *anti*-*N*-benzyl-*N*-methyl-3-phenyl-1,1,1-trifluoropropan-2-amines **18**, **21** and **19**, **22** were isolated after treatment of aziridines **5c** and **7c** with 1.5 equiv of Me_3OBF_4 in anhydrous acetonitrile, followed by addition of 1.1−2 equiv of a nucleophile ($BnNH_2$ or PhSH), albeit in quite low yields (17−50%) (Scheme 6). Several side products were detected, mainly due to ring opening by H_2O or *N*-methyl-*N*-benzylamine. The ring opening of *cis*-1-benzyl-2-phenyl-3-(trifluoromethyl)aziridine **5c** with thiophenol led to *syn*-*N*-benzyl-1,1,1-trifluoro-3-phenyl-3-(phenylthio)propan-2-amine **20** as the main product (47%). The corresponding non-methylated secondary amine **23** was also detected after reaction

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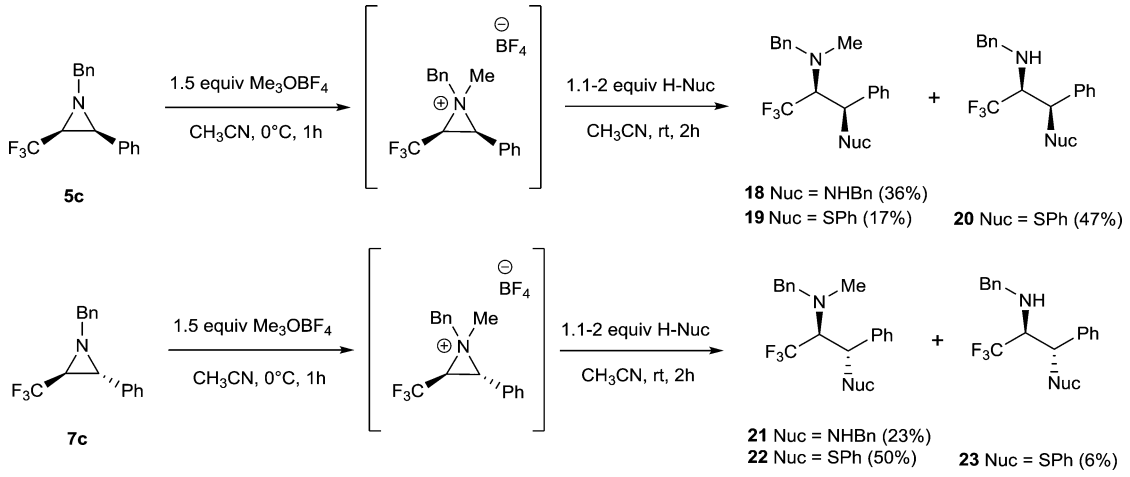
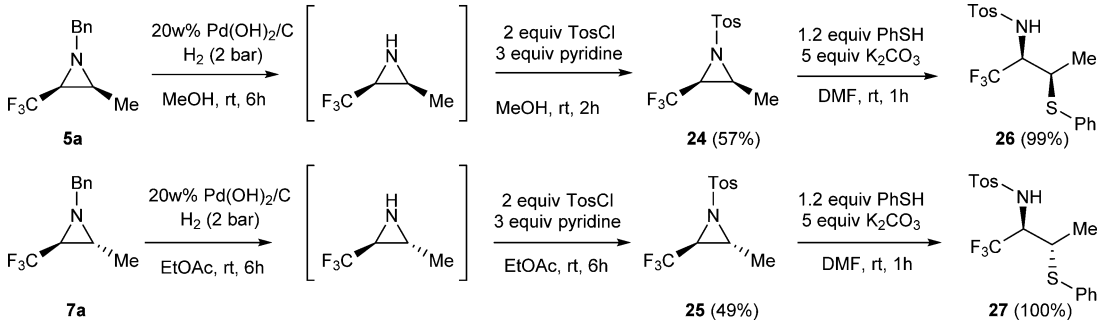
Scheme 6



Scheme 7



of *trans*-1-benzyl-2-phenyl-3-(trifluoromethyl)aziridine **7c** with PhSH, but in smaller amounts (6%, purity >83% based on ^{19}F NMR). When benzylamine was used as a nucleophile, these *N*-demethylated products were not observed.

In a third part of this work, the nonactivated 1-benzyl-3-(trifluoromethyl)aziridines **5a** and **7a** were converted into their activated analogues *cis*- and *trans*-1-tosyl-2-methyl-3-(trifluoromethyl)aziridines **24** and **25**, respectively, by initial removal of the *N*-benzyl group with $Pd(OH)_2/C$ (20% w/w) under a hydrogen atmosphere (2 bar) (Scheme 7). The free amino group of this aziridine was trapped by adding 2 equiv of TosCl in the presence of 3 equiv of pyridine, yielding the *N*-tosyl-protected aziridines **24** and **25** in moderate yields (49−57%). As expected, these activated aziridines **24** and **25** are very susceptible toward ring opening, which was demonstrated by the (near) quantitative (99−100%) ring opening with 1.2 equiv of PhSH in DMF to afford *syn*- and *anti*-*N*-tosyl-1,1,1-trifluoro-3-(phenylthio)butan-2-amines **26** and **27** without the need for initial aziridine activation toward aziridinium intermediates.[6a,14a,21]

CONCLUSION

In summary, a new, stereoselective synthetic pathway toward *cis*- and *trans*-1-alkyl-2-(methyl/phenyl)-3-(trifluoromethyl)-azirdines was accomplished, starting from commercially available trifluoromethyl ketones. Acidic activation of these trifluoromethylated aziridines led smoothly to a variety of regio- and stereospecific ring-opening products using different nucleophiles such as bromide, water, and methanol. The synthetic scope of the thus obtained trifluoromethylated building blocks was evaluated by the synthesis of 5-(trifluoromethyl)morpholin-2-ones and the removal of the *N*-benzyl group through hydrogenation toward free primary amines. Ring opening induced by aziridine *N*-alkylation was shown to be more sluggish and side products were formed, although also in this case the desired α-CF_3-amines could be isolated in acceptable yields. Finally, the nonactivated 3-(trifluoromethyl)aziridines were easily transformed into their activated analogues by replacing the *N*-benzyl protecting group with a *N*-tosyl group, and the resulting aziridines were subjected to regio- and stereoselective ring opening by thiophenol in quantitative yields. This study clearly demonstrated the potential of 2-(methyl/phenyl)-3-(trifluoromethyl)-aziridines as versatile building blocks in organic chemistry.

EXPERIMENTAL SECTION

^{1}H NMR spectra were recorded at 300, 400, or 500 MHz with $CDCl_3$ as solvent and TMS as a reference. ^{13}C NMR spectra were recorded at 75, 100, or 125 MHz with $CDCl_3$ as solvent and TMS as reference. ^{19}F NMR spectra were recorded at 282 or 376 MHz with $CDCl_3$ as solvent and $CFCl_3$ as reference. Peak assignments were performed with the use of ^{1}H−^{13}C HSQC, HMBC, and NOESY 2D-NMR.

Synthesis of 1,1,1-Trifluoroimines 3. Imines **3** were prepared according to a literature method.[10a,b] The assigned (*E*)-stereochemistry corresponds with that of similar ketimines reported in the literature.[22]

*(E)-N-(1,1,1-Trifluoro-2-butylidene)benzylamine (**3a**):* yellow oil; yield 78% (2.6 g); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.19 (3H, t, J = 7.7 Hz), 2.54 (2H, q, J = 7.7 Hz), 4.73 (2H, s), 7.24−7.38 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 10.6 (CH_3), 20.7 (CH_2), 54.5 (CH_2), 120.3 (q, J = 279.2 Hz, C), 127.2 (CH), 127.6 (2 × CH), 128.7 (2 × CH), 138.3 (C), 161.6 (q, J = 31.2 Hz, C); ^{19}F NMR (282 MHz,

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$CDCl_3$) δ −72.7 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1681, ν_{max} 1353, 1192, 1120, 1049, 933, 732, 696; MS (ES+) m/z (%) 216 (M + 1, 100); GC-MS (EI) m/z (%) 215 (M^+, 7), 146 (14), 91 ($C_7H_7^+$, 100), 65 (8); HRMS (ES-TOF) calcd for $C_{11}H_{13}F_3N$ 216.0995 $[M + H]^+$, found 216.1000.

*(E)-N-(1,1,1-Trifluoro-2-butylidene)cyclohexylamine (**3b**):* colorless oil; yield 85% (2.8 g); ^1H NMR (300 MHz, $CDCl_3$) δ 1.14−1.84 (13H, m), 2.42 (2H, q, J = 7.7 Hz), 3.48 (1H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 11.5 (CH_3), 19.9 (CH_2), 24.2 (2 × CH_2), 25.4 (CH_2), 33.1 (2 × CH_2), 59.3 (CH), 120.2 (q, J = 279.2 Hz, C), 158.0 (q, J = 31.2 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −72.6 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1679, ν_{max} 2932, 1451, 1344, 1192, 1151, 1117, 962; GC-MS (EI) m/z (%) 207 (M^+, 8), 192 (10), 178 (61), 164 (40), 138 (57), 126 (36), 83 (100), 67 (19), 55 (71), 41 (31); HRMS (ES-TOF) calcd for $C_{10}H_{17}F_3N$ 208.1308 $[M + H]^+$, found 208.1311.

*(E)-N-(1,1,1-Trifluoro-3-phenylpropan-2-ylidene)benzylamine (**3c**):* spectral data are in accordance with the literature;[23] yellow oil; yield 85% (4.1 g); ^1H NMR (300 MHz, $CDCl_3$) δ 3.92 (2H, s), 4.70 (2H, s), 7.16−7.35 (10H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 33.6 (CH_2), 55.7 (CH_2), 120.3 (q, J = 279.2 Hz, C), 127.5 (2 × CH), 127.9 (2 × CH), 128.5 (2 × CH), 128.8 (2 × CH), 129.3 (2 × CH), 133.9 (C), 138.1 (C), 158.2 (q, J = 31.2 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −72.0 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1681, ν_{max} 1496, 1454, 1354, 1336, 1195, 1176, 1124, 1090, 1072, 731, 714, 694; MS (ES+) m/z (%) 278 (M + 1, 100); GC-MS (EI) m/z (%) 277 (M^+, 19), 199 (11), 186 (8), 167 (8), 91 (100), 65 (10); HRMS (ES-TOF) calcd for $C_{16}H_{15}F_3N$ 278.1151 $[M + H]^+$, found 278.1151.

*(E)-N-(1,1,1-Trifluoro-3-phenylpropan-2-ylidene)cyclohexylamine (**3d**):* orange oil; yield 71% (2.0 g); ^1H NMR (300 MHz, $CDCl_3$) δ 1.15−1.31 (3H, m), 1.46−1.82 (7H, m), 3.52−3.61 (1H, m), 3.80 (2H, s), 7.13−7.36 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 24.2 (2 × CH_2), 25.4 (CH_2), 32.8 (2 × CH_2), 32.9 (CH_2), 60.4 (CH), 120.0 (q, J = 279.2 Hz, C), 127.0 (CH), 128.3 (2 × CH), 128.9 (2 × CH), 134.8 (C), 161.6 (q, J = 32.3 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −73.6 (3F, s); IR (ATR, cm^{-1}): $\nu_{C=N}$ 1677, ν_{max} 2931, 2857, 1453, 1332, 1175, 1122, 1093, 1032, 966, 735, 708, 694, 645; GC-MS (EI) m/z (%) 269 (M^+, 63), 226 (14), 200 (21), 191 (59), 178 (100), 118 (88), 91 (96), 83 (83), 67 (13), 55 (61), 41 (28); HRMS (ES-TOF) calcd for $C_{15}H_{19}F_3N$ 270.1464 $[M + H]^+$, found 270.1472.

*(E)-N-(1,1,1-Trifluoro-3-phenylpropan-2-ylidene)isopropylamine (**3e**).* orange oil; yield 95% (2.8 g); ^1H NMR (500 MHz, $CDCl_3$) δ 1.13 (6H, d, J = 6.2 Hz), 3.79 (2H, s), 3.90 (1H, septet, J = 6.2 Hz), 7.14−7.33 (5H, m); ^{13}C NMR (125 MHz, $CDCl_3$) δ 22.8 (2 × CH_3), 32.8 (CH_2), 52.0 (CH), 120.0 (q, J = 279.4 Hz, C), 127.1 (2 × CH), 128.2 (CH), 129.0 (2 × CH), 134.6 (C), 154.5 (q, J = 32.0 Hz, C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −72.2 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1681, ν_{max} 2974, 1496, 1455, 1333, 1176, 1129, 1065, 1030, 733, 702, 647; GC-MS (EI) m/z (%) 229 (M^+, 27), 214 (20), 172 (18), 160 (17), 151 (41), 118 (85), 91 (100), 65 (12), 43 (23).

Synthesis of 3,3-Dichloro-1,1,1-trifluoroimines 4. As a representative example, the synthesis of (*E*)-*N*-(3,3-dichloro-1,1,1-trifluoro-2-butylidene)benzylamine (**4a**) is described. To a solution of (*E*)-*N*-(1,1,1-trifluoro-2-butylidene)benzylamine (**3a**; 4.65 mmol, 1.0 equiv) in cyclohexane (6 mL) was added NCS (13.95 mmol, 3.0 equiv), and the mixture was stirred for 2 days under reflux. After the reaction mixture was cooled, the solid residues were filtered off. Concentration under reduced pressure afforded the crude product, which was purified by vacuum distillation, yielding (*E*)-*N*-(3,3-dichloro-1,1,1-trifluoro-2-butylidene)benzylamine (**4a**).

*(E)-N-(3,3-Dichloro-1,1,1-trifluoro-2-butylidene)benzylamine (**4a**):* colorless liquid; bp 60−63 °C (1.7 mbar); yield 80% (1.1 g); ^1H NMR (300 MHz, $CDCl_3$) δ 2.36 (3H, s), 4.96 (2H, s), 7.30−7.40 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 36.0 (CH_3), 55.9 (CH_2), 81.9 (C), 117.1 (q, J = 290.8 Hz, C), 127.7 (3 × CH), 128.8 (2 × CH), 137.7 (C), 152.8 (q, J = 28.8 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −59.9 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1671, ν_{max} 1290, 1198, 1166, 1136, 1003, 753, 732, 695, 661; GC-MS (EI) m/z (%) 283/285 (M^+, 3), 248 (3), 186 (5), 91 (100).

*(E)-N-(3,3-Dichloro-1,1,1-trifluoro-2-butylidene)cyclohexylamine (**4b**):* colorless liquid; bp 41−44 °C (1.5 mbar); yield 79% (1.1 g); ^1H NMR (300 MHz, $CDCl_3$) δ 1.32−1.80 (10H, m), 2.29 (3H, s), 3.73−3.84 (1H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 23.6 (2 × CH_2), 25.5 (CH_2), 33.0 (2 × CH_2), 36.0 (CH_3), 60.8 (CH), 82.0 (C), 117.1 (q, J = 290.8 Hz, C), 149.9 (q, J = 27.7 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −58.8 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1668, ν_{max} 2936, 2859, 1452, 1380, 1291, 1202, 1169, 1138, 997, 753, 662; GC-MS (EI) m/z (%) 275/277 (M^+, 0.5), 240/242 (44), 178 (11), 83 (100), 55 (33), 41 (13).

*(E)-N-(1,1-Dichloro-3,3,3-trifluoro-1-phenylpropan-2-ylidene)-benzylamine (**4c**):* white crystals: mp 54−58 °C (MeOH); yield 74% (1.0 g); ^1H NMR (300 MHz, $CDCl_3$) δ 5.10 (2H, d, J = 1.5 Hz), 7.36−7.45 (8H, m), 7.58−7.62 (2H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 55.9 (CH_2), 88.2 (C), 116.9 (q, J = 291.5 Hz, C), 125.9 (2 × CH), 127.3 (3 × CH), 128.6 (4 × CH), 129.6 (CH), 137.6 (C), 139.2 (C) 151.4 (q, J = 28.2 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −58.9 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1667, ν_{max} 1492, 1374, 1265, 1178, 1159, 1143, 827, 753, 744, 713, 697, 638; MS (ES+) m/z 346/348 (M + 1, 60); HRMS (ES-TOF) calcd for $C_{16}H_{13}Cl_2F_3N$ 346.0372 $[M + H]^+$, found 346.0377.

*(E)-N-(1,1-Dichloro-3,3,3-trifluoro-1-phenylpropan-2-ylidene)-cyclohexylamine (**4d**):* white crystals: mp 62−64 °C (EtOH); yield 68% (860 mg); ^1H NMR (300 MHz, $CDCl_3$) δ 1.32−1.84 (10H, m), 3.85−3.96 (1H, m), 7.36−7.43 (3H, m), 7.53−7.59 (2H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 23.5 (2 × CH_2), 25.5 (CH_2), 33.1 (2 × CH_2), 61.4 (CH), 88.3 (C), 117.0 (q, J = 291.1 Hz, C), 125.7 (2 × CH), 128.6 (2 × CH), 129.4 (CH), 139.6 (C), 148.5 (q, J = 27.7 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −57.7 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1672, ν_{max} 2940, 2859, 1449, 1270, 1199, 1187, 1135, 1072, 808, 754, 716, 707, 692; GC-MS (EI) m/z (%) 337/339 (M^+, 1), 303/305 (9), 221 (19), 178 (22), 83 (100), 55 (42), 41 (13).

*(E)-N-(1,1-Dichloro-3,3,3-trifluoro-1-phenylpropan-2-ylidene)-isopropylamine (**4e**):* colorless liquid; yield 88% (1.2 g); ^1H NMR (500 MHz, $CDCl_3$) δ 1.30 (6H, d, J = 6.0 Hz), 4.23 (1H, septet × d J = 2.6, 6.0 Hz), 7.37−7.35 (3H, m), 7.54−7.58 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 23.4 (2 × CH_3), 53.9 (d, J = 2.2 Hz, CH), 88.3 (C), 117.2 (q, J = 291.7 Hz, C), 125.8 (2 × CH), 128.7 (2 × CH), 129.6 (CH), 139.7 (C), 148.6 (q, J = 27.9 Hz, C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −57.8 (3F, d, J = 1.8 Hz); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1674, ν_{max} 2980, 1449, 1366, 1264, 1198, 1140, 1068, 809, 752, 718, 692; GC-MS (EI) m/z (%) 337/339 (M^+, 1), 303 (9), 221 (19), 178 (22), 83 (100), 55 (42), 41 (13).

Synthesis of *cis*-1-Alkyl-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines 5. As a representative example, the synthesis of *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**) is described. To an ice-cooled solution of *N*-(3,3-dichloro-1,1,1-trifluoro-2-butylidene)benzylamine (**4a**; 3.52 mmol, 1.0 equiv) in dry diethyl ether (20 mL) was carefully added $LiAlH_4$ (7.0 mmol, 2.0 equiv). The cooling bath was removed, and the mixture was stirred overnight under reflux. After it was cooled, the reaction mixture was quenched by portionwise addition of water at 0 °C. The formed salts were filtered off over Celite and were washed with diethyl ether (2 × 5 mL). The combined organic phases were washed with brine (15 mL), dried over K_2CO_3, and concentrated in vacuo. The crude mixture was purified by column chromatography on silica gel to yield *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**).

*cis-1-Benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**):* colorless liquid; yield 52% (390 mg); R_f 0.01 (petroleum ether/Et_2O 98/2); ^1H NMR (300 MHz, $CDCl_3$) δ 1.34 (3H, d, J = 5.0 Hz), 1.91 (1H, ~quintet, J = 5.5 Hz), 2.04 (1H, ~quintet, J = 6.6 Hz), 3.59 (1H, d, J = 14.6 Hz), 3.64 (1H, d, J = 14.6 Hz), 7.28−7.38 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 13.2 (CH_3), 38.8 (CH), 41.7 (q, J = 38.1 Hz, CH), 63.8 (CH_2), 125.0 (q, J = 273.5 Hz, C), 127.4 (CH), 127.9 (2 × CH), 128.5 (2 × CH), 137.7 (C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −64.2 (3F, d, J = 6.6 Hz); IR (ATR, cm^{-1}) ν_{max} 2937, 1454, 1440, 1401, 1291, 1137, 1095, 1046, 1029, 875, 843, 733, 696; MS (ES+) m/z 216 (M+1, 100); GC-MS (EI) m/z (%) 215 (M^+, 13), 200 (12), 124 (91), 91 (100), 65 (11), 51 (4), 41 (2); HRMS (ES-TOF) calcd for $C_{11}H_{13}F_3N$ 216.0995 $[M + H]^+$, found 216.1002.

*cis-1-Cyclohexyl-2-methyl-3-(trifluoromethyl)aziridine (**5b**):* colorless oil; yield 29% (66 mg); R_f 0.03 (petroleum ether/Et_2O 99/1); ^1H

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NMR (500 MHz, $CDCl_3$) δ 1.10−1.57 (6H, m), 1.31 (3H, d × q, J = 1.3, 5.9 Hz), 1.57−1.62 (1H, m), 1.74−1.85 (4H, m), 1.88 (1H, ∼quintet, J = 6.5 Hz); ^{13}C NMR (125 MHz, $CDCl_3$) δ 13.7 (CH_3), 24.5 (CH_2), 24.6 (CH_2), 25.8 (CH_2), 31.8 (CH_2), 32.2 (CH_2), 37.5 (CH), 41.2 (q, J = 38.1 Hz, CH), 68.9 (CH), 125.0 (q, J = 273.6 Hz, C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −64.7 (3F, d, J = 6.3 Hz); IR (ATR, cm^{-1}) ν_{max} 2929, 2856, 2360, 1292, 1146, 735; GC-MS (EI) m/z (%) 207 (M^+, 7), 192 (32), 178 (13), 164 (82), 126 (100), 106 (19), 83 (31), 67 (26), 55 (58), 41 (26); HRMS (ES-TOF) calcd for $C_{10}H_{17}F_3N$ 208.1308 $[M + H]^+$, found 208.1312.

*cis-1-Benzyl-2-phenyl-3-(trifluoromethyl)aziridine (**5c**):* yellow oil; yield 79% (0.7 g); R_f 0.10 (petroleum ether/Et_2O 99/1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.74 (1H, ∼quintet, J = 6.1 Hz), 3.06 (1H, d, J = 6.6 Hz), 3.71 (1H, d, J = 13.2 Hz), 3.92 (1H, d, J = 13.2 Hz), 7.24−7.43 (10H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 44.1 (q, J = 38.1 Hz, CH), 45.0 (CH), 63.9 (CH_2), 124.4 (q, J = 275.8 Hz, C), 127.7 (CH), 127.8 (CH), 127.9 (2 × CH), 128.2 (2 × CH), 128.5 (2 × CH), 128.7 (2 × CH), 134.3 (C), 137.4 (C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −65.4 (3F, d, J = 5.3 Hz); IR (ATR, cm^{-1}) ν_{max} 3064, 1497, 1448, 1384, 1295, 1181, 1136, 1074, 887, 739, 697; GC-MS (EI) m/z (%) 277 (M^+, 33), 186 (100), 159 (90), 109 (39), 91 (42), 77 (5), 65 (8), 51 (4); MS (ES+) m/z 278 (M+1, 100); HRMS (ES-TOF) calcd for $C_{16}H_{15}F_3N$ 278.1157 $[M + H]^+$, found 278.1163.

*cis-1-Cyclohexyl-2-phenyl-3-(trifluoromethyl)aziridine (**5d**):* white crystals: mp 42−47 °C; yield 50% (120 mg); R_f 0.16 (petroleum ether/Et_2O 99/1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.16−1.38 (4H, m), 1.49−1.66 (3H, m), 1.78−1.92 (4H, m), 2.27 (1H, ∼quintet, J = 6.1 Hz), 2.91 (1H, d, J = 6.1 Hz), 7.26−7.41 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) δ 24.2 (CH_2), 24.3 (CH_2), 25.9 (CH_2), 31.7 (CH_2), 32.2 (CH_2), 43.4 (q, J = 38.1 Hz, CH), 44.1 (CH), 68.1 (CH), 124.4 (q, J = 274.6 Hz, C), 127.5 (CH), 127.8 (2 × CH), 128.1 (2 × CH), 135.1 (C); ^{19}F NMR (282 MHz, $CDCl_3$) δ −66.1 (3F, d, J = 6.6 Hz); IR (ATR, cm^{-1}) ν_{max} 2932, 1458, 1443, 1372, 1294, 1182, 1151, 1138, 1115, 901, 747, 700, 691; MS (ES+) m/z 270 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{15}H_{19}F_3N$ 270.1464 $[M + H]^+$, found 270.1471.

*cis-1-Isopropyl-2-phenyl-3-(trifluoromethyl)aziridine (**5e**):* yellow oil; yield 75% (0.7 g); R_f 0.11 (petroleum ether/Et_2O 99/1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.25 (6H, d, J = 6.3 Hz), 1.86 (1H, septet, J = 6.3 Hz), 2.25 (1H, ∼quintet, J = 6.1 Hz), 2.90 (1 H, d, J = 6.3 Hz), 7.23−7.33 (3H, m), 7.38−7.42 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 21.5 (CH_3), 21.9 (CH_3), 43.9 (q, J = 38.1 Hz, CH), 44.5 (CH), 61.1 (CH), 124.3 (q, J = 274.2 Hz, C), 127.4 (CH), 127.7 (2 × CH), 128.1 (2 × CH), 134.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −65.6 (3F, d, J = 5.6 Hz); IR (ATR, cm^{-1}) ν_{max} 2970, 2359, 1446, 1384, 1343, 1295, 1191, 1129, 1088, 981, 898, 772, 742, 700, 692; GC-MS (EI) m/z (%) 228/229 (M^+, 89), 186 (84), 159 (100), 118 (19), 109 (43), 89 (13), 77 (6), 51 (4), 43 (5); HRMS (ES-TOF) calcd for $C_{12}H_{15}F_3N$ 230.1151 $[M + H]^+$, found 230.1160.

Synthesis of 3-Chloro-1,1,1-trifluoroimines 6. As a representative example, the synthesis of *N*-(3-chloro-1,1,1-trifluoro-2-butylidene)benzylamine (**6a**) is described. To a solution of *N*-(1,1,1-trifluoro-2-butylidene)benzylamine (**3a**; 4.65 mmol, 1.0 equiv) in cyclohexane (10 mL) was added NCS (4.65 mmol, 1.0 equiv), and the resulting mixture was stirred for 6 h under reflux. After the reaction mixture was cooled, the solid residues were filtered off. Concentration under reduced pressure afforded *N*-(3-chloro-1,1,1-trifluoro-2-butylidene)benzylamine (**6a**), which was used without further purification (purity >90%, ^{19}F NMR).

*N-(3-Chloro-1,1,1-trifluoro-2-butylidene)benzylamine (**6a**):* yellow oil; yield 78% (0.9 g); isomer ratio *E*:*Z* 51:49; ^{1}H NMR (300 MHz, $CDCl_3$) minor isomer δ 1.74 (3H, d, J = 6.6 Hz), 4.84 (1H, q, J = 6.6 Hz), 4.92 (2H, s), 7.27−7.40 (5H, m); major isomer δ 1.84 (3H, d × d, J = 1.1, 7.2 Hz), 4.96 (2H, d, J = 1.1 Hz), 4.97 (1H, q, J = 7.2 Hz), 7.27−7.40 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) $\delta_{MINOR\text{-}isomer}$ 21.0 (CH_3), 53.5 (CH), 56.1 (CH_2), 119.6 (q, J = 280.4 Hz, C), 127.4, 127.6, 127.7, 128.7, or 128.9 (CH), 138.7 (C), 155.0 (q, J = 27.7 Hz, C); major isomer δ 21.2 (CH_3), 45.6 (CH), 54.8 (CH_2), 117.3 (q, J = 290.8 Hz, C), 127.4, 127.6, 127.7, 128.7, or 128.9 (CH), 137.6 (C), 156.0 (q, J = 31.2 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) minor isomer δ −64.4 (3F, s); major isomer δ −69.6 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1670, ν_{max} 1454, 1343, 1297, 1275, 1187, 1128, 1030, 949, 732, 696; GC-MS (EI) m/z (%) 249/251 (M^+, 6), 214 (4), 91 (100), 65 (6).

*N-(3-Chloro-1,1,1-trifluoro-2-butylidene)cyclohexylamine (**6b**):* yellow liquid; yield 72% (250 mg); isomer ratio *E*:*Z* 76:24; ^{1}H NMR (300 MHz, $CDCl_3$) minor isomer δ 1.25−1.86 (10H, m), 1.67 (3H, d, J = 6.6 Hz), 3.69−3.79 (1H, m), 4.76 (1H, q, J = 6.6 Hz); major isomer δ 1.25−1.86 (10H, m), 1.77 (3H, d, J = 7.2 Hz), 3.77−3.86 (1H, m), 4.90 (1H, q, J = 7.2 Hz); ^{13}C NMR (75 MHz, $CDCl_3$) minor isomer δ 21.1 (CH_3), 25.4 (2 × CH_2), 25.6 (CH_2), 32.4 (CH_2), 33.3 (CH_2), 53.5 (CH), 61.2 (CH), 119.6 (q, J = 280.4 Hz, C), 151.8 (q, J = 27.7 Hz, C); major isomer δ 21.8 (CH_3), 23.8 (CH_2), 24.1 (2 × CH_2), 33.0 (CH_2), 33.3 (CH_2), 45.1 (d, J = 10.4 Hz, CH), 60.0 (CH), 117.4 (q, J = 290.8 Hz, C), 153.2 (q, J = 31.2 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) minor isomer δ −64.4 (3F, s); major isomer δ −69.2 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1667, ν_{max} 2934, 2859, 1450, 1298, 1275, 1182, 1139, 1126, 1022, 970, 684; GC-MS (EI) m/z (%) 241/243 (M^+,0.5), 206 (100), 83 (36), 55 (26), 41 (10).

*N-(3-Chloro-1,1,1-trifluoro-3-phenylprop-2-ylidene)benzylamine (**6c**):* yellow oil; yield 84% (470 mg); isomer ratio *E*:*Z* 73:27; ^{1}H NMR (300 MHz, $CDCl_3$) minor isomer δ 4.95 (2H, m), 5.84 (1H, s), 7.18−7.45 (5H, m); major isomer δ 4.60 (2H, d × d, J = 1.4, 16.3 Hz), 4.87 (2H, d × d, J = 1.4, 16.3 Hz), 6.00 (1H, s), 7.18−7.45 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) minor isomer δ 56.3 (CH_2), 61.1 (CH), 117.1 (q, J = 291.3 Hz, C), 127.5 (2 × CH), 128.0 (2 × CH), 128.6 (2 × CH), 128.7 (2 × CH), 128.8 (2 × CH), 135.5 (C), 138.0 (C), 153.8 (q, J = 27.6 Hz, C); major isomer δ 51.8 (CH), 55.9 (CH_2), 119.4 (q, J = 279.9 Hz, C), 126.5 (2 × CH), 127.4 (2 × 2 × CH), 127.7 (2 × CH), 128.6 (2 × CH), 129.1 (2 × CH), 134.2 (C), 137.3 (C), 154.5 (q, J = 32.7 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) minor isomer δ −62.3 (3F, s); major isomer δ −70.5 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1682, ν_{max} 1496, 1454, 1337, 1277, 1193, 1178, 1128, 1093, 1070, 732, 694; GC-MS (EI) m/z (%) 311/313 (M^+, 2), 276 (25), 198 (6), 178 (7), 125 (20), 91 (100), 65 (8).

*N-(3-Chloro-1,1,1-trifluoro-3-phenylprop-2-ylidene)cyclohexylamine (**6d**):* colorless oil; yield 89% (250 mg); isomer ratio *E*:*Z* 77:23; ^{1}H NMR (300 MHz, $CDCl_3$) minor isomer δ 1.21−1.85 (10H, m), 3.67−3.77 (1H, m), 5.77 (1H, s), 7.31−7.46 (5H, m); major isomer δ 1.21−1.85 (10H, m), 3.73−3.85 (1H, m), 5.92 (1H, s), 7.31−7.46 (5H, m); ^{13}C NMR (75 MHz, $CDCl_3$) minor isomer δ 23.8, 23.9, 25.4, 25.5, 31.7, 32.4, or 33.3 (5 × CH_2), 61.1 (CH), 61.6 (CH), 117.2 (q, J = 291.9 Hz, C), 126.4, 127.8, 128.6, 128.8 (5 × CH), 135.9 (C), 150.7 (q, J = 27.7 Hz, C); major isomer δ 23.8, 23.9, 25.4, 25.5, 31.7, 32.4, or 33.3 (5 × CH_2), 51.2 (CH), 60.6 (CH), 119.5 (q, J = 280.4 Hz, C), 126.4, 127.8, 128.6, 128.8 (5 × CH), 135.2 (C), 152.4 (q, J = 32.3 Hz, C); ^{19}F NMR (282 MHz, $CDCl_3$) minor isomer δ −61.9 (3F, s); major isomer δ −70.5 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1679, ν_{max} 2933, 2857, 1449, 1277, 1190, 1142, 1125, 1095, 730, 713, 693; GC-MS (EI) m/z (%) 303/305 (M^+, 3), 268 (35), 178 (19), 125 (13), 83 (100), 55 (42), 41 (13).

*N-(3-Chloro-1,1,1-trifluoro-3-phenylprop-2-ylidene)isopropylamine (**6e**):* yellow oil; yield 66% (235 mg); isomer ratio *E*:*Z* 75:25; ^{1}H NMR (400 MHz, $CDCl_3$) minor isomer δ 1.22 (3H, d, J = 6.1 Hz), 1.26 (3H, d, J = 6.1 Hz), 4.11 (1H, septet × d, J = 2.5, 6.1 Hz), 5.74 (1H, s), 7.25−7.41 (5H, m); major isomer δ 0.88 (3H, d, J = 6.1 Hz), 1.16 (3H, d, J = 6.1 Hz), 4.01 (1H, septet, J = 6.1 Hz), 5.85 (1H, s), 7.25−7.41 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) minor isomer δ 21.7 (CH_3), 22.5 (CH_3), 53.5 (CH), 61.1 (CH), 117.3 (q, J = 291.4 Hz, C), 126.3, 127.7, 128.6, or 128.8 (5 × CH), 135.8 (C), 150.7 (q, J = 27.1 Hz, C); major isomer δ 22.7 (CH_3), 23.6 (CH_3), 51.2 (CH), 52.3 (CH), 119.6 (q, J = 280.0 Hz, C), 126.3, 127.7, 128.6, or 128.8 (5 × CH), 135.0 (C), 152.1 (q, J = 32.0 Hz, C); ^{19}F NMR (376 MHz, $CDCl_3$) minor isomer δ −61.5 (3F, s); major isomer δ −70.3 (3F, s); IR (ATR, cm^{-1}) $\nu_{C=N}$ 1681, ν_{max} 2978, 2935, 1450, 1364, 1276, 1189, 1130, 1038, 939, 712, 694; GC-MS (EI) m/z (%) 263/265 (M^+, 8), 228 (72), 186 (31), 151 (14), 138 (51), 125 (100), 117 (25), 91 (21), 43 (51).

Synthesis of *trans*-1-Alkyl-2-(methyl/phenyl)-3-(trifluoromethyl)aziridines 7. As a representative example, the synthesis of *trans*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**7a**) is described. To an ice-cooled solution of *N*-(3-chloro-1,1,1-trifluoro-2-butylidene)-

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benzylamine (**6a**; 4.0 mmol, 1.0 equiv) in dry diethyl ether (20 mL) was carefully added $LiAlH_4$ (8.0 mmol, 2.0 equiv). The cooling bath was removed, and the mixture was stirred for 4−6 h at room temperature. The reaction was quenched by portionwise addition of water at 0 °C. The formed salts were filtered off over Celite and were washed with diethyl ether (2 × 5 mL). The combined organic phases were washed with brine (15 mL), dried over K_2CO_3, and concentrated in vacuo. The crude mixture was purified by column chromatography on silica gel to yield *trans*-1-benzyl-2-methyl-3-(trifluoromethyl)-aziridine (**7a**).

*trans-1-Benzyl-2-methyl-3-(trifluoromethyl)aziridine (**7a**):* yellow oil; yield 48% (123 mg); R_f 0.07 (petroleum ether/Et_2O 99/1); ^1H NMR (400 MHz, $CDCl_3$) δ 1.33 (3H, d, J = 6.0 Hz), 1.94 (1H, br s), 2.49 (1H, br s), 3.66 (1H, d, J = 14.0 Hz), 3.78 (1H, d, J = 14.0 Hz), 7.23−7.35 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 10.2 (CH_3), 35.2 (CH), 43.7 (q, J = 39.0 Hz, CH), 54.4 (CH_2), 124.3 (q, J = 269.9 Hz, C), 127.2 (CH), 127.8 (2 × CH), 128.5 (2 × CH), 138.5 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.7 (3F, d, J = 5.0 Hz); IR (ATR, cm^{-1}) ν_{max} 2930, 1140, 1352, 1283, 1139, 1122, 1088, 847, 731, 696, 694; GC-MS (EI) m/z (%) 214/215 (M^+, 15), 200 (15), 124 (91), 91 (100), 65 (10), 51 (4), 41 (2); HRMS (ES-TOF) calcd for $C_{11}H_{13}F_3N$ 216.0995 $[M + H]^+$, found 216.1005.

*trans-1-Cyclohexyl-2-methyl-3-(trifluoromethyl)aziridine (**7b**):* yellow oil; yield 67% (670 mg); R_f 0.06 (petroleum ether/Et_2O 99/1); ^1H NMR (400 MHz, $CDCl_3$) δ 1.14−1.29 (3H, m), 1.33 (3H, d, J = 6.0 Hz), 1.36−1.47 (2H, m), 1.59−1.64 (1H, m), 1.70−1.85 (5H, m), 1.90−2.00 (1H, m), 2.42 (1H, br s); ^{13}C NMR (100 MHz, $CDCl_3$) δ 10.1 (CH_3), 24.5 (CH_2), 24.8 (CH_2), 25.8 (CH_2), 32.6 (CH_2), 33.1 (CH_2), 35.0 (q, J = 2.2 Hz, CH), 42.1 (q, J = 38.9 Hz, CH), 58.8 (CH), 124.4 (q, J = 272.5 Hz, C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.8 (3F, d, J = 5.3 Hz); IR (ATR, cm^{-1}) ν_{max} 2931, 2858, 1449, 1283, 1256, 1139, 1123, 1090, 878, 844, 684; GC-MS (EI) m/z (%) 207 (M^+, 10), 192 (29), 178 (12), 164 (100), 126 (92), 106 (19), 82 (34), 67 (30), 55 (61), 41 (31); HRMS (ES-TOF) calcd for $C_{10}H_{17}F_3N$ 208.1308 $[M + H]^+$, found 208.1310.

*trans-1-Benzyl-2-phenyl-3-(trifluoromethyl)aziridine (**7c**):* yellow oil; yield 50% (1.3 g); R_f 0.08 (petroleum ether/Et_2O 99/1); ^1H NMR (400 MHz, $CDCl_3$) δ 2.78 (1H, br s), 3.24 (1H, br s), 3.51 (1H, br s), 3.67 (1H, br s), 7.14−7.43 (10H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 41.6 (q, J = 39.3 Hz, CH), 43.6 (CH), 55.3 (CH_2), 124.3 (q, J = 274.1 Hz, C), 127.2 (2 × CH), 128.0 (CH), 128.3 (3 × CH), 128.5 (3 × CH), 130.1 (CH), 131.0 (C), 138.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.7 (3F, s); IR (ATR, cm^{-1}) ν_{max} 3031, 1455, 1282, 1189, 1139, 1107, 852, 732, 696; GC-MS (EI) m/z (%) 277 (M^+, 33), 186 (100), 172 (9), 159 (78), 109 (32), 91 (45), 77 (9), 65 (7), 51 (5); HRMS (ES-TOF) calcd for $C_{16}H_{15}F_3N$ 278.1157 $[M + H]^+$, found 278.1154.

*trans-1-Cyclohexyl-2-phenyl-3-(trifluoromethyl)aziridine (**7d**):* white crystals: mp 98−100 °C; yield 48% (460 mg); R_f 0.05 (petroleum ether/Et_2O 100/1); ^1H NMR (400 MHz, $CDCl_3$) δ 1.10−1.20 (3H, m), 1.33−1.83 (8H, m), 2.72 (1H, br s), 3.54 (1H, br s), 7.28−7.40 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.1 (CH_2), 24.5 (CH_2), 25.8 (CH_2), 32.0 (CH_2), 32.5 (CH_2), 40.0 (br s, CH), 43.1 (CH), 58.0 (CH), 124.4 (q, J = 273.5 Hz, C), 128.3 (5 × CH), 129.9 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.0 (3F, s); IR (ATR, cm^{-1}) ν_{max} 2936, 2857, 1459, 1282, 1254, 1184, 1158, 1141, 1112, 1084, 865, 740, 700, 686; GC-MS (EI) m/z (%) 269 (M^+, 71), 226 (33), 186 (100), 172 (16), 159 (31), 118 (17), 109 (18), 91 (16), 83 (24), 55 (31), 41 (14); HRMS (ES-TOF) calcd for $C_{15}H_{19}F_3N$ 270.1470 $[M + H]^+$, found 270.1476.

*trans-1-Isopropyl-2-phenyl-3-(trifluoromethyl)aziridine (**7e**):* yellow oil; yield 45% (97 mg); R_f 0.06 (petroleum ether/Et_2O 99/1); ^1H NMR (400 MHz, $CDCl_3$) δ 0.84 (3H, br s), 1.15 (3H, d, J = 6.3 Hz), 2.03 (1H, br s), 2.71 (1H, m), 3.56 (1 H, br s), 7.29−7.38 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 21.5 (CH_3), 22.3 (CH_3), 40.4 (br signal, CH), 43.6 (CH), 50.6 (CH), 124.4 (q, J = 273.5 Hz, C), 128.4 (3 × CH), 128.5 (CH), 130.0 (CH), 131.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.0 (3F, s); IR (ATR, cm^{-1}) ν_{max} 2972, 1461, 1442, 1344, 1283, 1256, 1193, 1130, 1084, 997, 868, 840, 762, 730, 698, 685; GC-MS (EI) m/z (%) 229 (M^+, 90), 186 (87), 159 (100), 118 (23), 109 (43), 91 (17), 77 (8), 51 (7), 41 (8); HRMS (ES-TOF) calcd for $C_{12}H_{15}F_3N$ 230.1151 $[M + H]^+$, found 230.1150.

Synthesis of *syn*- and *anti*-Benzylamino Alcohols 8 and 9. As a representative example, the synthesis of *syn*-3-benzylamino-4,4,4-trifluorobutan-2-ol (**8a**) is described. To an ice-cooled solution of *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**; 0.47 mmol, 1.0 equiv) in acetonitrile (0.5 mL) and H_2O (0.5 mL) were added four drops of H_2SO_4. The mixture was stirred for 1 h under reflux conditions, and after it was cooled, the reaction mixture was neutralized with $NaHCO_3$(aq) and extracted with EtOAc (3 × 5 mL). The combined organic phases were washed with brine (2 × 5 mL), dried over K_2CO_3, and concentrated in vacuo, yielding *syn*-3-benzylamino-4,4,4-trifluorobutan-2-ol (**8a**) without the need for extra purification steps (purity >95%, ^{19}F NMR).

*syn-3-Benzylamino-4,4,4-trifluorobutan-2-ol (**8a**):* orange oil; yield 89% (97 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.27 (3H, d × q, J = 1.0, 6.0 Hz), 1.81 (1H, br s), 2.87 (1H, q × d, J = 6.0, 7.7 Hz), 2.90 (1H, br s), 3.86 (1H, d, J = 12.7 Hz), 3.89 (1H, ∼quintet, J = 6.0 Hz), 4.13 (1H, d, J = 12.7 Hz), 7.27−7.37 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 20.3 (CH_3), 52.6 (CH_2), 63.6 (q, J = 25.5 Hz, CH), 64.7 (q, J = 7.8 Hz, CH), 126.7 (q, J = 285.8 Hz, C), 127.6 (CH), 128.5 (2 × CH), 128.6 (2 × CH), 139.1 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.9 (3F, d, J = 7.7 Hz); IR (ATR, cm^{-1}) ν_{NH} 3066, ν_{OH} 3366, ν_{max} 1454, 1376, 1261, 1132, 1072, 886, 869, 743, 716, 698; MS (ES+) m/z 234 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{11}H_{15}F_3NO$ 234.1100 $[M + H]^+$, found 234.1103.

*syn-2-Benzylamino-3,3,3-trifluoro-1-phenylpropan-1-ol (**8c**):* white crystals: mp 66−70 °C; yield 95% (95 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 2.02 (1H, br s), 3.26 (1H, q × d, J = 4.8, 7.6 Hz), 3.34 (1H, br s), 3.70 (1H, d, J = 12.9 Hz), 3.92 (1H, d, J = 12.9 Hz), 4.87 (1H, d, J = 4.8 Hz), 7.14−7.18 (2H, m), 7.23−7.39 (8H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 52.5 (CH_2), 63.9 (q, J = 25.7 Hz, CH), 70.2 (q, J = 2.2 Hz, CH), 126.26 (q, J = 285.3 Hz, C), 126.30 (2 × CH), 127.4 (CH), 128.0 (CH), 128.3 (2 × CH), 128.4 (2 × CH), 128.5 (2 × CH), 138.7 (C), 140.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.2 (3F, d, J = 7.6 Hz); IR (ATR, cm^{-1}) ν_{OH} 3216, ν_{NH} 3318, ν_{max} 1494, 1476, 1454, 1371, 1352, 1272, 1229, 1195, 1152, 1129, 1103, 932, 863, 846, 748, 706, 698, 660; MS (ES+) m/z 296 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{16}H_{17}F_3NO$ 296.1257 $[M + H]^+$, found 296.1268.

*anti-3-Benzylamino-4,4,4-trifluorobutan-2-ol (**9a**):* white crystals: mp 39−41 °C; yield 83% (90 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.16 (3H, d × q, J = 1.1, 6.5 Hz), 1.64 (1H, br s), 2.61 (1H, br s), 3.28 (1H, q × d, J = 4.2, 7.9 Hz), 3.83 (1H, d, J = 12.8 Hz), 3.97−4.07 (1H, m), 4.12 (1H, d, J = 12.8 Hz), 7.28−7.38 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 17.9 (q, J = 1.2 Hz, CH_3), 52.6 (CH_2), 62.5 (q, J = 25.8 Hz, CH), 64.6 (q, J = 2.1 Hz, CH), 126.5 (q, J = 285.7 Hz, C), 127.6 (CH), 128.4 (2 × CH), 128.6 (2 × CH), 139.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.2 (3F, d, J = 7.9 Hz); IR (ATR, cm^{-1}) ν_{NH} 3276, ν_{OH} 3168, ν_{max} 2360, 2340, 1455, 1389, 1269, 1229, 1163, 1140, 1124, 1092 1070, 1058, 1018, 962, 927, 895, 853, 752, 698; MS (ES+) m/z 234 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{11}H_{15}F_3NO$ 234.1100 $[M + H]^+$, found 234.1104.

*anti-2-Benzylamino-3,3,3-trifluoro-1-phenylpropan-1-ol (**9c**):* colorless oil; yield 89% (93 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.54 (1H, br s), 3.23 (1H, d, J = 7.3 Hz), 3.46 (1H, q × d, J = 5.4, 7.5 Hz), 3.74 (1H, d, J = 13.0 Hz), 3.99 (1H, d, J = 13.0 Hz), 4.88 (1H, d, J = 5.4 Hz), 7.19−7.36 (10H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 52.4 (CH_2), 63.2 (q, J = 25.8 Hz, CH), 71.3 (q, J = 2.2 Hz, CH), 126.0 (q, J = 285.3 Hz, C), 126.9 (2 × CH), 127.5 (CH), 128.32 (2 × CH), 128.34 (CH), 128.4 (2 × CH), 128.6 (2 × CH), 138.9 (C), 139.2 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −69.6 (3F, d, J = 7.5 Hz); IR (ATR, cm^{-1}) ν_{OH} 3360, ν_{NH} 3032, ν_{max} 1495, 1454, 1376, 1347, 1256, 1153, 1122, 1081, 1041, 1028, 876, 735, 697; MS (ES+) m/z 296 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{16}H_{17}F_3NO$ 296.1257 $[M + H]^+$, found 296.1262.

Synthesis of *syn*- and *anti*-Amino Ethers 10 and 11. As a representative example, the synthesis of *syn*-*N*-benzyl-1,1,1-trifluoro-3-methoxybutan-2-amine (**10a**) is described. To an ice-cooled solution of *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**; 0.47 mmol,

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1.0 equiv) in acetonitrile (0.5 mL) and MeOH (0.5 mL) were added four drops of H_2SO_4. The mixture was stirred for 1 h under reflux conditions, and after it was cooled, the reaction mixture was neutralized with $NaHCO_3$ (aq) and extracted with EtOAc (3 × 5 mL). The combined organic phases were washed with brine (2 × 5 mL), dried over K_2CO_3, and concentrated in vacuo. The crude mixture was purified by column chromatography over silica to yield pure *syn*-*N*-benzyl-1,1,1-trifluoro-3-methoxybutan-2-amine (**10a**).

*syn-N-Benzyl-1,1,1-trifluoro-3-methoxybutan-2-amine (**10a**):* yellow oil; yield 50% (57 mg); R_f 0.17 (petroleum ether/Et_2O 98/2); ^1H NMR (400 MHz, $CDCl_3$) δ 1.21 (3H, d, J = 6.3 Hz), 2.00 (1H, br s), 2.89 (1H, q × d, J = 2.9, 7.7 Hz), 3.31 (3H, s), 3.61 (1H, q × d, J = 2.9, 6.3 Hz), 3.85 (1H, d, J = 13.2 Hz), 4.06 (1H, d, J = 13.2 Hz), 7.22−7.38 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 16.5 (CH_3), 52.4 (CH_2), 56.8 (CH_3), 62.3 (q, J = 25.9 Hz, CH), 74.3 (q, J = 2.3 Hz, CH), 126.6 (q, J = 286.2 Hz, C), 127.2 (CH), 128.36 (2 × CH), 128.42 (2 × CH), 139.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.1 (3F, d, J = 7.7 Hz); IR (ATR, cm^{-1}) ν_{NH} 3370, ν_{max} 2934, 1467, 1454, 1374, 1263, 1195, 1151, 1129, 1097, 1051, 849, 743, 719, 698; MS (ES+) m/z 248 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{12}H_{17}F_3NO$ 248.1257 $[M + H]^+$, found 248.1263.

*syn-N-Benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**10c**):* colorless oil; yield 75% (83 mg); R_f 0.12 (petroleum ether/Et_2O 98/2); ^1H NMR (400 MHz, $CDCl_3$) δ 2.18 (1H, br s), 3.13 (1H, m), 3.30 (3H, s), 3.61 (1H, d, J = 13.0 Hz), 3.78 (1H, d, J = 13.0 Hz), 4.52 (1H, d, J = 3.0 Hz), 7.02−7.07 (2H, m), 7.17−7.21 (3H, m), 7.31−7.42 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 52.4 (CH_2), 57.4 (CH_3), 63.6 (q, J = 26.1 Hz, CH), 80.1 (q, J = 2.4 Hz, CH), 126.2 (q, J = 285.9 Hz, C), 126.9 (2 × CH), 127.0 (CH), 128.1 (CH), 128.2 (4 × CH), 128.4 (2 × CH), 138.5 (C), 139.6 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.5 (3F, d, J = 7.8 Hz); IR (ATR, cm^{-1}) ν_{NH} 3370, ν_{max} 2936, 2889, 1454, 1259, 1202, 1122, 1102, 1076, 1028, 820, 742, 697; MS (ES+) m/z 310 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{17}H_{19}F_3NO$ 310.1413 $[M + H]^+$, found 310.1419.

*anti-N-Benzyl-1,1,1-trifluoro-3-methoxybutan-2-amine (**11a**):* yellow oil; yield 52% (59 mg); R_f 0.08 (petroleum ether/Et_2O 98/2); ^1H NMR (400 MHz, $CDCl_3$) δ 1.27 (3H, d × q, J = 0.9, 6.4 Hz), 1.71 (1H, br s), 3.21 (3H, s), 3.30 (1H, q × d, J = 3.8, 7.9 Hz), 3.60 (1H, q × d, J = 3.8, 6.4 Hz), 3.87 (1H, d, J = 13.3 Hz), 4.02 (1H, d, J = 13.3 Hz), 7.23−7.37 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.8 (q, J = 1.4 Hz, CH_3), 52.6 (CH_2), 56.7 (CH_3), 60.1 (q, J = 25.9 Hz, CH), 75.2 (q, J = 2.2 Hz, CH), 126.3 (q, J = 284.0 Hz, C), 127.3 (CH), 128.4 (2 × CH), 128.5 (2 × CH), 139.6 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.5 (3F, d, J = 7.9 Hz); IR (ATR, cm^{-1}) ν_{NH} 3351, ν_{max} 2933, 1454, 1383, 1257, 1139, 1089, 1044, 1029, 848, 739, 698; MS (ES+) m/z 248 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{12}H_{17}F_3NO$ 248.1257 $[M + H]^+$, found 248.1265.

*anti-N-Benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**11c**):* yellow crystals: mp 40−42 °C; yield 78% (85 mg); R_f 0.12 (petroleum ether/Et_2O 98/2); ^1H NMR (400 MHz, $CDCl_3$) δ 1.33 (1H, br s), 3.22 (3H, s), 3.35−3.44 (1H, m), 3.68 (1H, d, J = 13.3 Hz), 3.86 (1H, d, J = 13.3 Hz), 4.36 (1H, d, J = 6.4 Hz), 7.04−7.08 (2H, m), 7.15−7.25 (3H, m), 7.29−7.41 (2H, m), 7.35−7.40 (3H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 52.8 (CH_2), 57.1 (CH_3), 62.9 (q, J = 26.1 Hz, CH), 82.5 (q, J = 1.5 Hz, CH), 126.2 (q, J = 284.3 Hz, C), 127.1 (CH), 127.9 (2 × CH), 128.2 (2 × CH), 128.3 (2 × CH), 128.5 (2 × CH), 128.6 (CH), 137.1 (C), 139.3 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.8 (3F, d, J = 7.2 Hz); IR (ATR, cm^{-1}) ν_{NH} 3346, ν_{max} 2943, 1468, 1456, 1381, 1354, 1261, 1159, 1149, 1128, 1110, 1092, 1076, 955, 827, 756, 699, 679; MS (ES+) m/z 310 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{17}H_{19}F_3NO$ 310.1413 $[M + H]^+$, found 310.1417. Anal. Calcd for $C_{17}H_{18}F_3NO$: C: 66.01; H: 5.87; N: 4.53. Found: C: 66.22; H: 5.71; N: 4.54.

Synthesis of *syn*- and *anti*-β-Bromoamines 12 and 13. As a representative example, the synthesis of *syn*-*N*-benzyl-3-bromo-1,1,1-trifluorobutan-2-amine (**12a**) is described. To an ice-cooled solution of *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)aziridine (**5a**; 0.47 mmol, 1.0 equiv) in acetonitrile (0.6 mL) was added HBr (2.35 mmol, 5.0 equiv, 48% in H_2O). The cooling bath was removed, and the mixture was stirred for 1 h at room temperature. The reaction mixture was poured into Et_2O (2 mL) and neutralized with $NaHCO_3$(aq) at 0 °C. The aqueous layer was extracted with Et_2O (3 × 10 mL), dried over K_2CO_3, and concentrated in vacuo, affording pure *syn*-*N*-benzyl-3-bromo-1,1,1-trifluorobutan-2-amine (**12a**) without extra purification steps (purity >93%, ^{19}F NMR).

*syn-N-Benzyl-3-bromo-1,1,1-trifluorobutan-2-amine (**12a**):* yellow oil; yield 88% (122 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.75 (3H, d, J = 6.8 Hz), 1.98 (1H, br s), 3.01−3.11 (1H, m), 3.92 (1H, d × d, J = 5.1, 13.1 Hz), 4.09 (1H, d × d, J = 3.3, 13.1 Hz), 4.48 (1H, q × d, J = 2.6, 6.8 Hz), 7.27−7.40 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.1 (CH_3), 46.4 (q, J = 2.6 Hz, CH), 51.7 (CH_2), 62.3 (q, J = 26.8 Hz, CH), 125.6 (q, J = 287.5 Hz, C), 127.5 (CH), 128.46 (2 × CH), 128.52 (2 × CH), 139.1 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.5 (3F, d, J = 6.9 Hz); IR (ATR, cm^{-1}) ν_{NH} 2924, ν_{max} 2868, 1466, 1454, 1264, 1150, 1128, 1077, 958, 846, 745, 714, 698; MS (ES+) m/z 296/298 (M+1, 100); HRMS (ES-TOF) calcd for $C_{11}H_{14}BrF_3N$ 296.0256 $[M + H]^+$, found 296.0262.

*syn-N-Benzyl-3-bromo-1,1,1-trifluoro-3-phenylpropan-2-amine (**12c**):* orange oil; yield 82% (115 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 2.10 (1H, br s), 3.37−3.43 (1H, m), 3.81 (1H, d, J = 12.9 Hz), 4.02 (1H, d, J = 12.9 Hz), 5.23 (1H, d, J = 3.7 Hz), 7.17−7.34 (8H, m), 7.48−7.52 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 51.7 (q, J = 2.4 Hz, CH), 52.1 (CH_2), 64.3 (q, J = 26.6 Hz, CH), 125.3 (q, J = 287.8 Hz, C), 127.3 (CH), 128.27 (2 × CH), 128.33 (2 × CH), 128.36 (2 × CH), 128.41 (2 × CH), 128.7 (CH), 138.8 (C), 139.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.4 (3F, d, J = 6.9 Hz); IR (ATR, cm^{-1}) ν_{NH} 3031, ν_{max} 1454, 1251, 1202, 1144, 1118, 1078, 1029, 820, 766, 744, 694, 626; MS (ES+) m/z 358/360 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{16}H_{16}BrF_3N$ 358.0413 $[M + H]^+$, found 358.0424.

*anti-N-Benzyl-3-bromo-1,1,1-trifluorobutan-2-amine (**13a**):* colorless oil; yield 86% (118 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.72 (3H, d × q, J = 0.9, 7.0 Hz), 1.75 (1H, br s), 3.49 (1H, ∼quintet × d, J = 2.9, 7.5 Hz), 3.95 (1H, d × d, J = 5.8, 12.9 Hz), 4.09 (1H, d × d, J = 5.8, 12.9 Hz), 4.48 (1H, q × d, J = 2.9, 7.0 Hz), 7.26−7.43 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 20.5−20.6 (m, CH_3), 45.7 (q, J = 1.8 Hz, CH), 53.4 (CH_2), 64.1 (q, J = 26.7 Hz, CH), 125.4 (q, J = 286.2 Hz, C), 127.5 (CH), 128.47 (2 × CH), 128.50 (2 × CH), 139.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.5 (3F, d, J = 7.5 Hz); IR (ATR, cm^{-1}) ν_{NH} 2927 ν_{max} 2856, 1473, 1454, 1330, 1252, 1138, 1092, 1029, 744, 698; MS (ES+) m/z 296/298 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{11}H_{14}BrF_3N$ 296.0256 $[M + H]^+$, found 296.0270.

*anti-N-Benzyl-3-bromo-1,1,1-trifluoro-3-phenylpropan-2-amine (**13c**):* yellow oil; yield 82% (105 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.57 (1H, br s), 3.73−3.82 (1H, m), 3.92 (1H, d, J = 13.0 Hz), 4.08 (1H, d, J = 13.0 Hz), 5.24 (1H, d, J = 4.5 Hz), 7.27−7.49 (10H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 49.1−49.2 (m, CH), 53.1 (CH_2), 65.2 (q, J = 26.2 Hz, CH), 125.3 (q, J = 286.9 Hz, C), 127.4 (CH), 128.4 (6 × CH), 128.9 (3 × CH), 136.8 (C), 139.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.1 (3F, d, J = 7.0 Hz); IR (ATR, cm^{-1}) ν_{NH} 3031, ν_{max} 2926, 1471, 1454, 1339, 1249, 1152, 1120, 1029, 733, 696, 659. No accurate MS spectrum could be recorded due to the inherent reactivity of this compound.

Synthesis of *trans*- and *cis*-4-Benzyl-6-phenyl-5-(trifluoromethyl)morpholin-2-ones 14 and 15. As a representative example, the synthesis of *trans*-4-benzyl-6-phenyl-5-(trifluoromethyl)-morpholin-2-one (**14**) is described. To a stirred solution of *syn*-2-benzylamino-3,3,3-trifluoro-1-phenylpropan-1-ol (**8c**; 0.17 mmol, 1 equiv) in THF (0.6 mL) was added glyoxal (0.51 mmol, 3 equiv, 40% in H_2O), and the resulting mixture was heated under reflux for 24 h. After it was cooled, the reaction mixture was poured into H_2O (3 mL) and extracted with Et_2O (3 × 5 mL). The combined organic phases were washed with brine, dried over $MgSO_4$, and concentrated in vacuo. The crude product was purified by column chromatography on silica gel to yield *trans*-4-benzyl-6-phenyl-5-(trifluoromethyl)-morpholin-2-one (**14**).

*trans-4-Benzyl-6-phenyl-5-(trifluoromethyl)morpholin-2-one (**14**):* white crystals: mp 88−93 °C; yield 18% (10 mg); R_f 0.27 (petroleum ether/Et_2O 4/1); ^1H NMR (400 MHz, $CDCl_3$) δ 3.51 (1H, q × d, J = 3.7, 7.9 Hz), 3.61 (1H, d × q, J = 1.7, 18.0 Hz), 3.75 (1H, d × q, 1.4, 18.0 Hz), 3.86 (1H, d, J = 13.2 Hz), 3.90 (1H, d, J =

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13.2 Hz), 5.62 (1H, d, J = 3.7 Hz), 6.98−7.03 (2H, m), 7.19−7.31 (5H, m), 7.40−7.45 (3H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 49.3 (CH_2), 59.7 (CH_2), 61.4 (q, J = 26.5 Hz, CH), 77.6 (m, CH), 126.0 (q, J = 289.8 Hz, C), 126.2 (2 × CH), 128.1 (CH), 128.7 (2 × CH), 128.8 (2 × CH), 128.9 (2 × CH), 129.0 (CH), 135.8 (C), 137.3 (C), 167.2 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −68.8 (3F, d, J = 7.9 Hz); IR (ATR, cm^{-1}) $\nu_{C=O}$ 1763, ν_{max} 2923, 1456, 1308, 1272, 1258, 1241, 1225, 1183, 1167, 1128, 1101, 1014, 862, 764, 736, 697; MS (ES+) m/z 336 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{18}H_{17}F_3NO_2$ 336.1206 [M + H]$^+$, found 336.1222.

*cis-4-Benzyl-6-phenyl-5-(trifluoromethyl)morpholin-2-one (**15**):* white crystals: mp 157−163 °C; yield 38% (20 mg); R_f 0.08 (petroleum ether/Et_2O 4/1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.70 (1H, q × d, J = 3.7, 8.0 Hz), 3.71−3.74 (2H, m), 4.00 (1H, d, J = 13.4 Hz), 4.08 (1H, d, J = 13.4 Hz), 5.80−5.84 (1H, m), 7.30−7.43 (10H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 49.4 (CH_2), 59.5 (d, J = 1.5 Hz, CH_2), 60.7 (q, J = 24.9 Hz, CH), 79.2 (CH), 125.568 (2 × CH), 125.573 (q, J = 291.5 Hz, C), 128.3 (CH), 128.5 (2 × CH), 128.65 (CH), 128.72 (2 × CH), 128.9 (2 × CH), 133.7 (C), 135.8 (C), 166.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −62.8 (3F, d, J = 7.9 Hz); IR (ATR, cm^{-1}) $\nu_{C=O}$ 1739, ν_{max} 2958, 1454, 1405, 1367, 1320, 1268, 1246, 1170, 1147, 1126, 1095, 1064, 871, 743, 734, 699; MS (ES+) m/z 336 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{18}H_{17}F_3NO_2$ 336.1206 [M + H]$^+$, found 336.1202. Anal. Calcd for $C_{18}H_{16}F_3NO_2$: C, 64.47; H, 4.81; N, 4.18. Found: C, 64.18; H, 4.67; N, 4.08.

Synthesis of *syn*- and *anti*-1,1,1-Trifluoro-3-methoxy-3-phenylpropan-2-amines 16 and 17. As a representative example, the synthesis of *syn*-*N*-benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**16**) is described. Hydrogen gas was bubbled through a stirred solution of *syn*-*N*-benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**10c**; 0.12 mmol, 1 equiv) and Pd/$(OH)_2$/C (20% w/w) in MeOH (1 mL) for 16 h. After the solids were filtered off and the solvent evaporated, pure *syn*-*N*-benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**16**) was obtained (purity >90%, ^{19}F NMR).

*syn-N-Benzyl-1,1,1-trifluoro-3-methoxy-3-phenylpropan-2-amine (**16**):* white crystals; yield 76% (20 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.20 (2H, br s), 3.29−3.38 (1H, m), 3.31 (3H, s), 4.51 (1H, d, J = 3.2 Hz), 7.32−7.43 (5H, m); ^{19}F NMR (376 MHz, $CDCl_3$) δ −74.3 (3F, br s); IR (ATR, cm^{-1}) ν_{NH} 3401, ν_{max} 2934, 1259, 1152, 1123, 1102, 1076, 760, 702, 623; MS (ES+) m/z 220 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{10}H_{13}F_3NO$ 220.0944 [M + H]$^+$, found 220.0940. No accurate ^{13}C NMR spectrum could be recorded due to poor solubility of this compound in deuterated solvents.

*anti-1,1,1-Trifluoro-3-methoxy-3-phenylpropan-2-amine (**17**):* yellow oil; yield 91% (38 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.60 (2H, br s), 3.25 (3H, s), 3.60 (1H, q × d, J = 5.9, 7.5 Hz), 4.38 (1H, d, J = 5.9 Hz), 7.33−7.43 (5H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 57.0 (CH_3), 58.1 (q, J = 27.3 Hz, CH), 82.0 (q, J = 1.5 Hz, CH), 125.6 (q, J = 282.0 Hz, C), 127.9 (2 × CH), 128.6 (2 × CH), 128.7 (CH), 136.5 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −73.4 (3F, d, J = 7.5 Hz); IR (ATR, cm^{-1}) ν_{NH} 3392, ν_{max} 2945, 2086, 1260, 1185, 1137, 1090, 759, 698; MS (ES+) m/z 220 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{10}H_{13}F_3NO$ 220.0944 [M + H]$^+$, found 220.0941.

Synthesis of *syn*- and *anti*-N^1,N^3-Dibenzyl-3,3,3-trifluoro-N^3-methyl-1-phenylpropane-1,2-diamines 18 and 21. As a representative example, the synthesis of *syn*-N^1,N^3-dibenzyl-3,3,3-trifluoro-N^3-methyl-1-phenylpropane-1,2-diamine (**18**) is described. To a stirred solution of *cis*-1-benzyl-2-phenyl-3-(trifluoromethyl)-aziridine (**5c**; 0.36 mmol, 1 equiv) in dry acetonitrile (1 mL) was added Me_3OBF_4 (0.54 mmol, 1.5 equiv) at 0 °C. The reaction mixture was kept at this temperature for 1 h, and $BnNH_2$ (0.72 mmol, 2 equiv) was added. After it was stirred for 2 h at room temperature, the reaction mixture was quenched by careful addition of H_2O (2 mL) and extracted with Et_2O (3 × 5 mL). The combined organic phases were washed with brine (5 mL), dried over K_2CO_3, and concentrated in vacuo. The crude mixture was purified by column chromatography on silica gel, yielding *syn*-N^1,N^3-dibenzyl-3,3,3-trifluoro-N^3-methyl-1-phenylpropane-1,2-diamine (**18**).

*syn-N^1,N^3-Dibenzyl-3,3,3-trifluoro-N^3-methyl-1-phenylpropane-1,2-diamine (**18**):* yellow oil; yield 36% (50 mg); R_f 0.12 (petroleum ether/Et_2O 95/5); ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.29 (3H, broad signal), 3.06 (1H, br s), 3.38 (1H, d, J = 13.4 Hz), 3.38−3.50 (1H, m), 3.66 (1H, d, J = 13.4 Hz), 3.88 (1H, d, J = 13.5 Hz), 3.85 (1H, d, J = 10.0 Hz), 3.94 (1H, d, J = 13.5 Hz), 7.16−7.44 (15H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 36.1 (CH_3), 50.4 (CH_2), 58.9 (CH_2), 59.8 (CH), 70.3 (q, J = 22.9 Hz, CH), 126.8 (q, J = 293.9 Hz, C), 127.1 (CH), 127.4 (CH), 128.0 (CH), 128.3 (2 × CH), 128.4 (2 × CH), 128.45 (2 × CH), 128.53 (2 × CH), 128.7 (2 × CH), 129.0 (2 × CH), 138.8 (C), 139.0 (C), 139.9 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −61.7 (3F, d, J = 8.0 Hz); IR (ATR, cm^{-1}) ν_{NH} 3313, ν_{max} 2857, 1453, 1244, 1165, 1116, 1079, 1026, 742, 696; MS (ES+) m/z 399 (M + 1, 100). HRMS (ES-TOF) calcd for $C_{24}H_{26}F_3N_2$ 399.2043 [M + H]$^+$, found 399.2038.

*anti-N^1,N^3-Dibenzyl-3,3,3-trifluoro-N^3-methyl-1-phenylpropane-1,2-diamine (**21**):* white crystals: mp 67−69 °C; yield 23% (23 mg); R_f 0.13 (petroleum ether/Et_2O 95/5); ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.17 (3H, q, J = 1.6 Hz), 3.39−3.46 (1H, m), 3.46 (1H, d, J = 13.2 Hz), 3.62 (2H, br d, J = 13.6 Hz), 3.72 (1H, d, J = 13.9 Hz), 4.01 (1H, d, J = 9.5 Hz), 6.59 (2H, d, J = 6.6 Hz), 7.04−7.41 (13H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 36.1 (CH_3), 51.2 (CH_2), 60.8 (CH_2), 60.9 (CH), 69.4 (q, J = 23.2 Hz, CH), 126.8 (CH), 126.9 (CH), 127.4 (CH), 127.85 (q, J = 294.0 Hz, C), 127.91 (2 × CH), 128.0 (2 × CH), 128.1 (2 × CH), 128.2 (2 × CH), 128.3 (2 × CH), 128.4 (2 × CH), 138.8 (C), 140.0 (C), 141.3 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −62.6 (3F, d, J = 8.1 Hz, C); IR (ATR, cm^{-1}) ν_{NH} 3029, ν_{max} 2848, 1453, 1248, 1139, 1119, 1062, 750, 731, 700; MS (ES+) m/z 399 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{24}H_{26}F_3N_2$ 399.2043 [M + H]$^+$, found 399.2041.

Synthesis of *syn*- and *anti*-*N*-Benzyl-*N*-methyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amines 19 and 22 and *syn*-*N*-Benzyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine 20. As a representative example, the synthesis of *syn*-*N*-benzyl-*N*-methyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine (**19**) is described. To a stirred solution of *cis*-1-benzyl-2-phenyl-3-(trifluoromethyl)aziridine (**5c**; 0.36 mmol, 1 equiv) in dry acetonitrile (1 mL) was added Me_3OBF_4 (0.54 mmol, 1.5 equiv) at 0 °C. The reaction mixture was kept at this temperature for 1 h, and PhSH (0.40 mmol, 1.1 equiv) was added. After it was stirred for 2 h at room temperature, the reaction mixture was quenched by careful addition of H_2O (2 mL) and extracted with Et_2O (3 × 5 mL). The combined organic phases were washed with brine (5 mL), dried over K_2CO_3, and concentrated in vacuo. The crude mixture was purified by column chromatography on silica gel, yielding *syn*-*N*-benzyl-*N*-methyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine (**19**).

*syn-N-Benzyl-N-methyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine (**19**):* white crystals: mp 111−115 °C; yield 17% (25 mg); R_f 0.25 (petroleum ether/Et_2O 200/1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.55 (3H, q, J = 1.7 Hz), 3.77 (1H, d × q, J = 7.3, 10.8 Hz), 3.99 (1H, d, J = 13.6 Hz), 4.12 (1H, d, J = 13.6 Hz), 4.65 (1H, d, J = 10.8 Hz), 7.01−7.15 (10H, m), 7.29−7.40 (3H, m), 7.54−7.59 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 36.2 (CH_3), 54.3 (CH), 60.5 (CH_2), 68.6 (q, J = 23.3 Hz, CH), 126.9 (q, J = 291.7 Hz, C), 127.3 (2 × CH), 127.5 (CH), 127.9 (2 × CH), 128.3 (2 × CH), 128.4 (2 × CH), 128.8 (2 × CH), 129.0 (2 × CH), 133.7 (C), 134.5 (2 × CH), 137.0 (C), 138.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −62.9 (3F, d, J = 7.3 Hz); IR (ATR, cm^{-1}) ν_{max} 2884, 1438, 1362, 1234, 1175, 1106, 1064, 885, 852, 750, 731, 689; MS (ES+) m/z 402 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{23}H_{23}F_3NS$ 402.1498 [M + H]$^+$, found 402.1494.

*syn-N-Benzyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine (**20**):* white crystals: mp 59−61 °C; yield 47% (65 mg); R_f 0.11 (petroleum ether/Et_2O 200/1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.14 (1H, br s), 3.48−3.60 (1H, m), 3.87 (1H, d, J = 12.9 Hz), 4.08 (1H, d, J = 12.9 Hz), 4.44 (1H, d, J = 5.8 Hz), 7.13−7.33 (15H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 52.7 (CH_2), 54.7 (CH), 63.3 (q, J = 26.3 Hz, CH), 126.2 (q, J = 286.8 Hz, C), 127.3 (CH), 127.5 (2 × CH), 128.3 (2 × CH), 128.35 (2 × CH), 128.38 (2 × CH), 128.41 (2 × CH), 128.8 (2 × CH), 132.8 (2 × CH), 133.9 (C), 139.1 (C), 140.0 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −70.4 (3F, d, J = 7.1 Hz); IR (ATR, cm^{-1}) ν_{NH} 3353, ν_{max} 2920, 1456, 1357, 1243, 1175, 1155, 1110, 1086,

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851, 745, 734, 698, 690; MS (ES+) m/z 388 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{22}H_{21}F_3NS$ 388.1341 $[M + H]^+$, found 388.1344.

*anti-N-Benzyl-N-methyl-3-phenyl-3-phenylthio-1,1,1-trifluoropropan-2-amine (**22**):* colorless oil; yield 50% (74 mg); R_f 0.26 (petroleum ether/Et_2O 200/1); ^1H NMR (400 MHz, $CDCl_3$) δ 2.11 (3H, q, J = 1.7 Hz), 3.66−3.82 (3H, m), 4.41 (1H, d, J = 8.9 Hz), 6.75−6.81 (2H, m), 7.12−7.24 (13H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 36.2 (CH_3), 52.9 (CH), 60.8 (CH_2), 68.6 (q, J = 24.7 Hz, CH), 126.9 (CH), 127.1 (CH), 127.2 (q, J = 296.5 Hz, C), 127.9 (CH), 128.04 (2 × CH), 128.07 (2 × CH), 128.3 (2 × CH), 128.7 (2 × CH), 128.8 (2 × CH), 133.5 (C), 133.7 (2 × CH), 138.7 (C), 139.7 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −62.8 (3F, d, J = 8.0 Hz); IR (ATR, cm^{-1}) ν_{max} 2812, 1454, 1246, 1161, 1145, 1108, 1057, 1021, 744, 692; MS (ES+) m/z 402 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{23}H_{23}F_3NS$ 402.1498 $[M + H]^+$, found 402.1496.

Synthesis of *cis*- and *trans*-2-methyl-1-tosyl-3-(trifluoromethyl)aziridines 24 and 25. As a representative example, the synthesis of *cis*-2-methyl-1-tosyl-3-(trifluoromethyl)aziridine (**24**) is described. To a solution of *cis*-1-benzyl-2-methyl-3-(trifluoromethyl)-aziridine (**5a**; 0.23 mmol, 1 equiv) was added $Pd(OH)_2/C$ (20% w/w) in MeOH (1 mL). This solution was stirred for 6 h at room temperature under a hydrogen atmosphere (2 bar). After the catalyst was filtered off over a filter plug, pyridine (0.69 mmol, 3 equiv) and TosCl (0.46 mmol, 2 equiv) were added at 0 °C. The reaction was stopped after stirring for 6 h at room temperature by addition of H_2O (5 mL) and Et_2O (5 mL), and the mixture was extracted with Et_2O (3 × 5 mL). The combined organic phases were washed with 1 M HCl (8 mL), $NaHCO_3$(aq) (8 mL), and brine (8 mL), dried over $MgSO_4$, and concentrated in vacuo. The crude mixture was purified by column chromatography on silica gel, yielding *cis*-2-methyl-1-tosyl-3-(trifluoromethyl)aziridine (**24**).

*cis-2-Methyl-1-tosyl-3-(trifluoromethyl)aziridine (**24**):* white crystals: mp 72−77 °C; yield 57% (351 mg); R_f 0.27 (petroleum ether/Et_2O 9/1); ^1H NMR (400 MHz, $CDCl_3$) δ 1.41 (3H, d × q, J = 1.1, 5.9 Hz), 2.46 (3H, s), 3.06−3.22 (2H, m), 7.37 (2H, d, J = 8.2 Hz), 7.83 (2H, d, J = 8.2 Hz); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.0 (CH_3), 21.7 (CH_3), 38.2 (CH), 41.3 (q, J = 40.1 Hz, CH), 122.8 (q, J = 275.0 Hz, C), 128.0 (2 × CH), 129.3 (2 × CH), 134.0 (C), 145.4 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −65.4 (3F, d, J = 5.8 Hz); IR (ATR, cm^{-1}) ν_{max} 2923, 1598, 1438, 1400, 1332, 1285, 1156, 1141, 1090, 1048, 1032, 892, 836, 820, 742, 673; MS (ES+) m/z 280 (M + 1, 100), 297 (M + NH_4, 85); HRMS (ES-TOF) calcd for $C_{11}H_{13}F_3NO_2S$ 280.0614 $[M + H]^+$, found 280.0614.

*trans-2-Methyl-1-tosyl-3-(trifluoromethyl)aziridine (**25**):* colorless oil; yield 49% (87 mg); R_f 0.15 (petroleum ether/Et_2O 95/5); ^1H NMR (400 MHz, $CDCl_3$) δ 1.79 (3H, d, J = 6.0 Hz), 2.43 (3H, s), 3.05 (1H, q × d, J = 3.9, 6.0 Hz), 3.32 (1H, q × d, J = 3.9, 5.0 Hz), 7.31−7.34 (2H, m), 7.81−7.85 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.9 (CH_3), 21.7 (CH_3), 42.4 (q, J = 2.3 Hz, CH), 43.9 (q, J = 40.9 Hz, CH), 122.2 (q, J = 273.3 Hz, C), 127.6 (2 × CH), 129.8 (2 × CH), 136.5 (C), 144.9 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.6 (3F, d, J = 5.0 Hz); IR (ATR, cm^{-1}) ν_{max} 2926, 1447, 1342, 1333, 1281, 1241, 1154, 1124, 1090, 1033, 1006, 914, 846, 820, 813, 710, 691, 681; MS (ES+) m/z 280 (M + 1, 100); HRMS (ES-TOF) calcd for $C_{11}H_{13}F_3NO_2S$ 280.0614 $[M + H]^+$, found 280.0620.

Synthesis of *syn*- and *anti*-*N*-Tosyl-3-phenylthio-1,1,1-trifluorobutan-2-amines 26 and 27. As a representative example, the synthesis of *syn*-*N*-tosyl-3-phenylthio-1,1,1-trifluorobutan-2-amine (**26**) is described. To a solution of *cis*-2-methyl-1-tosyl-3-(trifluoromethyl)aziridine (**24**; 0.18 mmol, 1 equiv) and K_2CO_3 (0.9 mmol, 5 equiv) in DMF (2 mL) was added PhSH (0.22 mmol, 1.2 equiv). This suspension was stirred for 1 h at room temperature. The reaction was stopped by addition of H_2O (3 mL) and extracted with Et_2O (5 × 5 mL). The combined organic phases were washed with brine (2 × 8 mL), dried over $MgSO_4$, and concentrated in vacuo to yield *syn*-*N*-tosyl-3-phenylthio-1,1,1-trifluorobutan-2-amine (**26**) (purity >97%, ^{19}F NMR).

*syn-N-Tosyl-3-phenylthio-1,1,1-trifluorobutan-2-amine (**26**):* white crystals: mp 82−86 °C; yield 99% (67 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.38 (3H, d, J = 7.2 Hz), 2.41 (3H, s), 3.60 (1H, q × d, J = 2.6, 7.2 Hz), 4.09 (1H, d × q × d, J = 2.6, 7.7, 9.7 Hz), 5.49 (1H, d, J = 9.7 Hz), 7.22−7.33 (5H, m), 7.38−7.44 (2H, m), 7.71−7.75 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 19.7 (CH_3), 21.6 (CH_3), 43.8 (CH), 58.7 (q, J = 30.1 Hz, CH), 124.0 (q, J = 283.6 Hz, C), 127.0 (2 × CH), 128.1 (CH), 129.1 (2 × CH), 129.6 (2 × CH), 132.6 (C), 133.2 (2 × CH), 137.7 (C), 143.9 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.7 (3F, d, J = 7.7 Hz); IR (ATR, cm^{-1}) ν_{NH} 3252 ν_{max} 2921, 1450, 1394, 1332, 1287, 1265, 1228, 1184, 1168, 1152, 1088, 1051, 915, 814, 742, 688, 662; MS (ES+) m/z 407 (M + NH_4, 100); HRMS (ES-TOF) calcd for $C_{17}H_{19}F_3NO_2S_2$ 390.0804 $[M + H]^+$, found 390.0803.

*anti-N-Tosyl-3-phenylthio-1,1,1-trifluorobutan-2-amine (**27**):* white crystals: mp 166−169 °C; yield 100% (28 mg); ^1H NMR (400 MHz, $CDCl_3$) δ 1.35 (3H, d × d, J = 0.9, 7.2 Hz), 2.42 (3H, s), 3.52 (1H, q × d, J = 2.8, 7.2 Hz), 4.18 (1H, d × q × d, J = 2.8, 7.7, 9.7 Hz), 5.36 (1H, d, J = 9.7 Hz), 7.19−7.52 (8H, m), 7.75−7.79 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ 16.2 (CH_3), 21.6 (CH_3), 44.3 (CH), 57.5 (q, J = 29.5 Hz, CH), 124.3 (q, J = 284.4 Hz, C), 127.1 (2 × CH), 128.1 (CH), 129.3 (2 × CH), 129.6 (2 × CH), 132.6 (2 × CH), 133.4 (C), 137.8 (C), 143.8 (C); ^{19}F NMR (376 MHz, $CDCl_3$) δ −71.2 (3F, d, J = 7.7 Hz); IR (ATR, cm^{-1}) ν_{NH} 3290 ν_{max} 2977, 1441, 1363, 1329, 1261, 1183, 1152, 1136, 1093, 1056, 1000, 908, 755, 676, 666; MS (ES+) m/z 407 (M + NH_4, 100); HRMS (ES-TOF) calcd for $C_{17}H_{19}F_3NO_2S_2$ 390.0804 $[M + H]^+$, found 390.0798.

■ ASSOCIATED CONTENT

Ⓢ Supporting Information

Figures giving ^1H and ^{13}C NMR spectra for all new compounds. This material is available free of charge via the Internet at http://pubs.acs.org.

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Notes

The authors declare no competing financial interest.

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