Diastereoselective Synthesis of β-Amino-α-(trifluoromethyl) Alcohols from Homochiral α-Dibenzylamino Aldehydes

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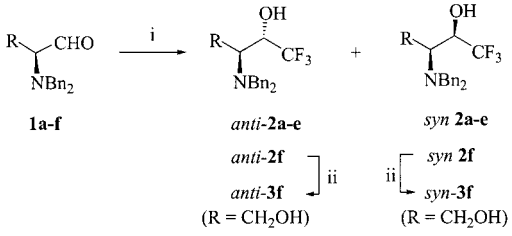
Homochiral α-dibenzylamino aldehydes, prepared from the corresponding α-amino acids, react with trimethyl(trifluoromethyl)silane in THF at 0 °C to afford, in good yields and *dr*, β-amino-α-(trifluoromethyl) alcohols; *anti* diastereomers were formed as major products in the trifluoromethylation reaction whereas *syn* diastereomers were obtained as single isomers in a two-step procedure. Swern oxidation of the mixtures formed in the trifluoromethylation leads to the corresponding α-dibenzylamino trifluoromethyl ketones which undergo diastereoselective reduction with sodium borohydride.

Organofluorine compounds have recently become of great interest in industrial, medicinal and synthetic organic chemistry.[1] In particular, β-amino fluoroalkyl alcohols are used as peptidometics[2] as well as chiral auxiliaries or as ligands in asymmetric synthesis.[2] One of the most popular methods of preparation of this kind of compounds consists of nucleophilic addition to enantiopure α-amino aldehyde derivatives. In this way, trimethyl(trifluoromethyl)silane ($TMSCF_3$) adds to *N*-Boc- or *N*-phenoxyacetyl-protected α-amino aldehydes in the presence of tetrabutylammonium fluoride (TBAF) or CsF to give β-amino-α-(trifluoromethyl) alcohols in moderate yields and variable diastereomeric ratio (*dr*).[4,5] The system $TMSCF_3$/TBAF also reacts with Garner's aldehyde leading to a mixture of diastereomeric fluorinated amino alcohols.[6] *anti*-Peptidyl amino trifluoromethyl alcohols are obtained as major diastereomers by reaction of peptidyl amino aldehydes with CF_3I/Zn in DMF at −20 °C.[7]

A different approach to this type of compound is based on the diastereoselective reduction of α-amino trifluoromethyl ketones. These oxo derivatives have been prepared by acylation of α-aminoalkyllithium reagents with trifluoroacetamide derivatives[8] or by nucleophilic ring opening of oxirans obtained by epoxidation of 1-trifluoromethyl enol ethers. The nucleophiles used in the ring opening vary from dialkylamines[9,10] to sodium azide[11] or dimethylaluminum amides,[12] and either *syn* or *anti* diastereoisomers can be obtained as the major product depending on the reducing agent.

Some other methods such as condensation of fluoral with nitroalkanes[13] or carboxylic acids[14] have been used in the preparation of β-amino trifluoromethyl alcohols, and recently a nice enantioselective three-component condensation of dibenzylamine, 3,3,3-trifluorolactic aldehyde and a boronic acid yields the fluorinated amino alcohol in excellent *ee*.[15]

We were interested in the use of Ruppert's reagent ($TMSCF_3$) as a trifluoromethylation agent because of the mild reaction conditions that promote the addition. Thus, the reaction of homochiral dibenzylamino aldehydes **1a**−**f**[16] with an excess (1.5 equiv.) of $TMSCF_3$ and a catalytic amount of TBAF (0.05 equiv.) in THF at 0 °C afforded, in good yields and *dr*, a mixture of β-amino-α-(trifluoromethyl) alcohols **2a**−**f** where the *anti* diastereomer was formed as the major component with *syn* as the minor one (Scheme 1 and Table 1).



Scheme 1. Reagents and conditions: (i) 1. $TMSCF_3$/TBAF, THF, 0 °C; 2. NH_4Cl/H_2O; (ii) TBAF (1 equiv.), THF, 0 °C

The yields decreased to 40% for the α-amino aldehyde derived from D-phenylglycine. The L-serinal derivative **1f** afforded a mixture of **2f** and the corresponding deprotected **3f** under the described reaction conditions. In this case, the reaction mixture was treated with additional TBAF to give

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Table 1. Stereoselective addition of $TMSCF_3$ to α-dibenzylamino aldehydes **1a**−**f**

Entry	**1**[a]	*t* [h]	**2**	Yield (%)[b]	*anti*/*syn*[c]
1	**1a**	2	**2a**	74	80:20
2	**1b**	3	**2b**	63	84:16
3	**1c**	3	**2c**	81	72:28
4	**1d**	2	**2d**	72	76:24
5	***ent*-1e**	3	***ent*-2e**	40	46:54
6[d]	**1f**	2	**3f**	52	62:38

[a] Reactions were run with 1.5 equiv. of Ruppert's reagent. [b] Numbers correspond to the combined yield of pure and isolated diastereoisomers. [c] The diastereomeric ratio was determined by integration of the signals of ^{19}F NMR spectra of the reaction mixture. [d] The reaction mixture was treated with TBAF before workup.

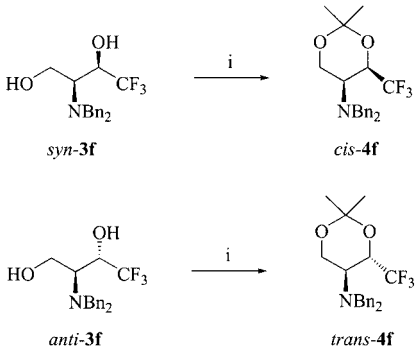
total deprotection of the products, allowing the isolation of **3f** in 52% yield.

The diastereoselectivity was not significantly affected by the nature of the alkyl substituent, varying from 84:16 for **1b** to 72:28 for **1c**, but compound **1f**, which has an additional oxygen atom in the chain, led to a mixture of diastereomers in only 62:38 ratio. The change of the alkyl substituent to a phenyl group (*ent*-**2e**) inverted the diastereoselectivity. In this case, the *syn* diastereoisomer was obtained as the major component although with very low *dr*, and racemization of the starting α-amino aldehyde was observed during the reaction.

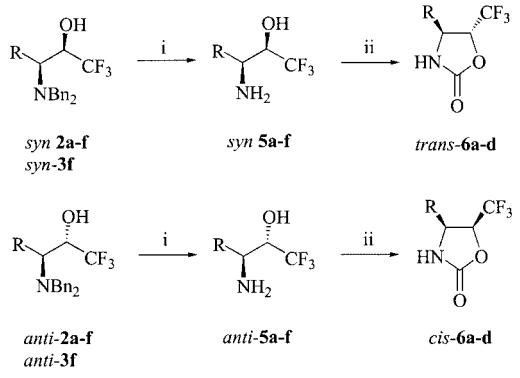
The stereochemistry of fluorinated amino alcohols was initially assigned on the basis of their ^1H NMR characteristics. In fact, for all the compounds the chemical shift for the methine proton at C-2 in the *anti* diastereomer is higher than that of the *syn* isomer (see Exp. Sect.). In addition, the vicinal coupling constants between protons at C-2 and C-3 are larger for *syn* diastereomers than for *anti* ones. These data are coincident with those described for related 1,2-amino alcohols.[17] The stereochemistry was also confirmed from ^1H NMR spectroscopic data of cyclic derivatives. For instance, dibenzylamino-1,3-diols *syn*- and *anti*-**3f** were easily purified by flash chromatography and transformed into dioxanes *cis*- and *trans*-**4f**, respectively, by reaction with 2,2-dimethoxypropane (Scheme 2). As previously described,[18] the coupling constant for protons at C-4 and C-5 for *cis*-**4f** (J = 3.6 Hz) was smaller than for the same protons in *trans*-**4f** (J = 9.3 Hz).

In the same way, diastereomers *syn*- and *anti*-**2a**−**d** were transformed, after separation, into oxazolidinones *trans*- and *cis*-**6a**−**d**. To this end, compounds **2a**−**e** and **3f** were debenzylated by hydrogenolysis on Pearlman's catalyst to *syn*- and *anti*-**5a**−**f**. Both diastereomers of amino alcohols **5a**−**d** were treated with triphosgene and diisopropylethylamine in CH_2Cl_2 leading to oxazolidinones **6a**−**d** (Scheme 3). As expected, the vicinal coupling constants of 4-H and 5-H for *cis*-**6a**−**d** were larger than those of the *trans* diastereoisomers.[19]

The enantiomeric purity of debenzylated amino alcohols **5a**−**f** was determined as Mosher's amides by reaction with (+)-R-MTPA and DCC in CH_3CN,[20] and integration of



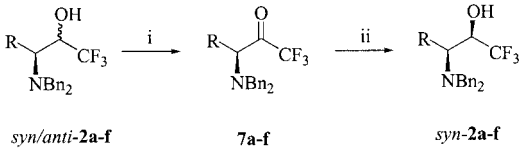
Scheme 2. Reagents and conditions: (i) DMP, TsOH, H_2O, 60 °C



Scheme 3. Reagents and conditions: (i) H_2, $Pd(OH)_2/C$, MeOH; (ii) $(CCl_3O)_2CO$, DIPEA, CH_2Cl_2, 0 °C to room temp.

the signals of ^{19}F NMR spectra. All the compounds provided signals for a single diastereomer except **5e** which appeared as a racemic mixture.

Because the addition of $TMSCF_3$ to α-amino aldehydes leads to the formation of fluorinated *anti*-amino alcohols, we focused on the preparation of the *syn* diastereomers. These compounds were prepared from amino trifluoromethyl alcohols **2a**−**f** in two steps. First, the mixtures of *syn*- and *anti*-**2a**−**f** were transformed into amino trifluoromethyl ketones **7a**−**f** by Swern oxidation in good yields (60−72%); the reduction of ketones **7a**−**f** with excess (4.5 equiv.) sodium borohydride in THF/MeOH at −20 °C afforded *syn*-**2a**−**f** in good yields and excellent *dr* (9:1 to > 49:1) (Scheme 4 and Table 2).



Scheme 4. Reagents and conditions: (i) $(COCl)_2$, DMSO, Et_3N, CH_2Cl_2, −78 °C; (ii) $NaBH_4$, MeOH/THF, −18 °C

The optical rotations of *syn*-**2a**−**f** prepared in this way are coincident with those of the same compounds prepared, as minor diastereoisomers, by trifluoromethylation of α-amino aldehydes **1a**−**f**. This fact indicates that stereochemical

Table 2. Swern oxidation of **2a**−**f** to **7a**−**f** and their $NaBH_4$ reduction

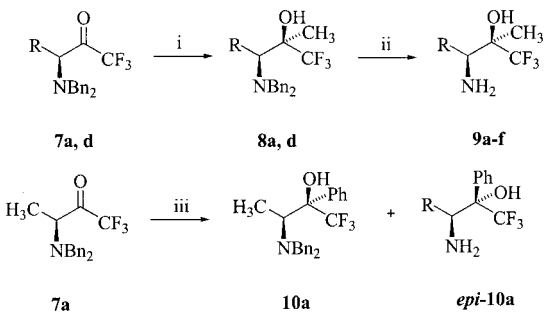
Entry	*syn*/*anti*-**2a**−**f**	**7**, **8** (%)[a]	*t* [h]	**2a**−**f** (%)[a]	*syn*/*anti*[b]
1	*anti*-**2a**	**7a** (72)	1	67	> 98:2
2	*anti*-**2b**	**7b** (60)	1	80	90:10
3	*syn*/*anti*-**2c**	**7c** (69)	0.5	74	> 98:2
4	*syn*/*anti*-**2d**	**7d** (68)	1	84	> 98:2
5	*syn*/*anti*-**2e**	**8e** (61)	1	55	92:8
6	*syn*/*anti*-**2f**	**8f** (63)	0.5	76	90:10

[a] Numbers corresponds to the combined yield of pure and isolated diastereoisomers. [b] The diastereomeric ratio was determined by integration of the signals of ^{19}F NMR spectra of the reaction mixture.

integrity was maintained throughout both the Swern oxidation and the subsequent reduction.

The excellent diastereoselectivity in the reduction of the fluorinated α-dibenzylamino ketones prompted us to test the preparation of fluorinated tertiary amino carbinols. To this end, **7a** and **7d** were treated with 2 equiv. of methylmagnesium bromide in diethyl ether at 0 °C followed by hydrolysis, leading to amino carbinols **8a** and **8d** as single diastereoisomers. Debenzylation by hydrogenolysis yielded enantiopure **9a** and **9d** in good yields. The formation of the *syn* diastereoisomers can be rationalized on the basis of the Felkin−Anh model for the addition process, and the stereochemistry has been established for **8d** by X-ray diffraction analysis[21] (Figure 1). On the contrary, the reaction of **7a** with phenylmagnesium bromide was not so diastereoselective, leading in the same experimental conditions to a mixture (72:28) of diastereomers **10a** and *epi*-**10a** (Scheme 5).

Figure 1. ORTEP representation of X-ray for compound **8d**; for clarity, only H atoms attached to oxygen and C-3 are shown



Scheme 6. Reagents and conditions: (i) MeMgBr, Et_2O, 0 °C. 60% for **8a** and 70% for **8d**; (ii) H_2, $Pd(OH)_2/C$, MeOH, room temp., 65% for **9a** and 85% for **9d**; iii) PhMgBr, Et_2O, 0 °C, 65%, **10a**/*epi*-**10a** = 72:28

Experimental Section

General: The reactions were carried out in oven-dried glassware under argon and using anhydrous solvents. Starting α-(dibenzylamino) aldehydes **1a**−**f** were prepared as described previously.[16] Trimethyl(trifluoromethyl)silane, as 2 M solution in THF, was purchased from Fluka. The ^1H NMR (300 MHz) and ^{13}C NMR (75 MHz) spectra were recorded with Bruker AC 300 or Bruker AMX 300 instruments, using TMS as internal standard. IR spectra were recorded with a Perkin−Elmer Spectrometer Spectrum BX, as film or KBr dispersion. Optical rotations were measured with a Perkin−Elmer 241 Polarimeter in a 1-dm cell. Microanalyses were performed with a Perkin−Elmer 2400-CHN elemental analyzer.

General Procedure for Trifluoromethylation of α-Amino Aldehydes 1: A 2 M solution of trimethyl(trifluoromethyl)silane ($TMSCF_3$) in THF (3.75 mL, 7.5 mmol, 1.5 equiv.) was added to a solution of amino aldehyde **1** (5 mmol, 1 equiv.) and TBAF (79 mg, 0.25 mmol, 0.05 equiv.) in THF (25 mL) cooled to 0 °C under argon. The mixture was stirred at that temperature until the reaction was finished (TLC). Subsequently, TBAF (315 mg, 1 mmol, 0.2 equiv.) was added, the reaction mixture was stirred at room temperature for 1 h and quenched by addition of aqueous saturated ammonium chloride solution (25 mL). The THF was removed and the aqueous phase was extracted with diethyl ether (3 × 15 mL). The combined organic layers were washed with brine and dried with anhydrous $MgSO_4$. The solvents were eliminated under vacuum and the residue was purified by flash chromatography (silica gel; hexane/ethyl acetate, 30:1−50:1).

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-butanol (*syn*-2a): Colorless oil. $[\alpha]_D^{20}$ = +74.4 (*c* = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3280, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.17 (d, *J* = 6.7 Hz, 3 H, C*H*$_3$), 2.96 (dq, ***J* = 9.5,** *J* = 6.7 Hz, 1 H, C*H*N), 3.35 (d, *J* = 13.2 Hz, 2 H, C*H*HPh), 3.72 (m, 1 H, C*H*OH), 3.76 (d, *J* = 13.2 Hz, 2 H, CH*H*Ph), 5.08 (br. s, 1 H, O*H*), 7.20−7.35 (m, 10 H, *H*$_{arom}$) ppm. ^{13}C NMR ($CDCl_3$): δ = 9.3 (*C*H$_3$), 52.6 (*C*HN), 53.1 (*C*H$_2$Ph), 70.2 (q, $^2J_{C,F}$ = 30.1 Hz, *C*HOH), 127.6, 128.7, 129.0 (*C*H$_{arom}$), 137.6 (*C*$_{arom}$) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.41 (d, 3 F, $^3J_{F,H}$ = 6.3 Hz, C*F*$_3$) ppm. $C_{18}H_{20}F_3NO$ (323.3): calcd. C 66.86, H 6.23, N 4.33; found C 66.62, H 6.11, N 4.40.

(2*S*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-butanol (*anti*-2a): Colorless oil. $[\alpha]_D^{20}$ = +27.7 (*c* = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3445, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.20 (d, *J* = 7.0 Hz, 3 H, C*H*$_3$), 2.80 (br. s, 1 H, O*H*), 3.18 (dq, *J* = 7.0, *J* = 3.7 Hz, 1 H, C*H*N), 3.57 (d, *J* = 13.8 Hz, 2 H, C*H*HPh), 3.73 (d, *J* = 13.2 Hz, 2 H, CH*H*Ph), 4.09 (dq, *J* = 8.0, *J* = 3.7 Hz, 1 H, C*H*OH), 7.20−7.40 (m, 10 H, *H*$_{arom}$) ppm. ^{13}C NMR ($CDCl_3$): δ = 8.82 (*C*H$_3$), 52.4 (*C*HN), 54.4 (*C*H$_2$Ph), 71.2 (q, $^2J_{C,F}$ = 29.2 Hz, *C*HOH), 127.1, 128.3, 128.6 (*C*H$_{arom}$), 139.3 (*C*$_{arom}$) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.48 (d, 3 F, $^3J_{F,H}$ = 7.7 Hz, C*F*$_3$) ppm. $C_{18}H_{20}F_3NO$ (323.23): calcd. C 66.86, H 6.23, N 4.33; found C 66.45, H 5.84, N 4.32.

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-methyl-2-pentanol (*syn*-2b): Colorless oil. $[\alpha]_D^{20}$ = +18.2 (*c* = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3380, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.09 (d, *J* = 7.2 Hz, 3 H, C*H*$_3$), 1.10 (d, *J* = 6.9 Hz, 3 H, C*H*$_3$), 2.29 [m, 1 H, C*H*(CH$_3$)$_2$], 2.86 (dd, ***J* = 7.6,** *J* = 4.2 Hz, 1 H, C*H*N), 3.60 (d,

J = 13.1 Hz, 2 H, C*H*HPh), 3.91 (d, J = 13.1 Hz, 2 H, CH*H*Ph), 4.02 (m, 1 H, C*H*OH), 5.38 (br. s, 1 H, OH), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 19.6 (CH_3), 22.3 (CH_3), 27.0 [$CH(CH_3)_2$], 54.4 (CH_2Ph), 60.8 (*C*HN), 66.6 (q, $^2J_{C,F}$ = 30.3 Hz, *C*HOH), 127.6, 128.6, 129.2 (CH_{arom}), 137.8 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.74 (d, 3 F, $^3J_{F,H}$ = 7.5 Hz, CF_3) ppm. $C_{20}H_{24}F_3NO$ (351.4): calcd. C 68.36, H 6.88, N 3.99; found C 68.08, H 6.70, N 4.12.

(2*S*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-methyl-2-pentanol (*anti*-2b): Colorless oil. $[\alpha]_D^{20}$ = +3.8 (c = 0.9, $CHCl_3$). $[\alpha]_D^{20}$ = −22.0 (c = 0.9, MeOH).). IR (film): $\tilde{\nu}$ = 3440, 745, 695 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.97 (d, J = 6.5 Hz, 3 H, CH_3), 1.23 (d, J = 6.6 Hz, 3 H, CH_3), 2.34 [m, 1 H, $CH(CH_3)_2$], 2.75 (dd, J = 9.6, J = 3.9 Hz, 1 H, C*H*N), 3.19 (br. s, 1 H, O*H*), 3.72 (d, J = 13.5 Hz, 2 H, C*H*HPh), 3.78 (d, J = 13.5 Hz, 2 H, CH*H*Ph), 4.05 (m, 1 H, C*H*OH), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 21.1 (CH_3), 22.8 (CH_3), 27.6 [$CH(CH_3)_2$], 55.2 (CH_2Ph), 64.2 (*C*HN), 67.9 (q, $^2J_{C,F}$ = 29.5 Hz, *C*HOH), 127.3, 128.5, 129.2 (CH_{arom}), 139.0 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −73.48 (d, 3 F, $^3J_{F,H}$ = 7.8 Hz, CF_3) ppm. $C_{20}H_{24}F_3NO$ (351.4): calcd. C 68.36, H 6.88, N 3.99; found C 68.22, H 6.80, N 4.08.

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-5-methyl-2-hexanol (*syn*-2c): Colorless oil. $[\alpha]_D^{20}$ = +33.4 (c = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3435, 1150, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.96 (d, J = 6.6 Hz, 3 H, CH_3), 0.98 (d, J = 6.5 Hz, 3 H, CH_3), 1.30 (m, 1 H, C*H*HCHN), 1.82 (m, 2 H, CH*H*CHN and C*H*(CH_3)$_2$], 3.04 (m, 1 H, C*H*N), 3.55 (d, J = 13.2 Hz, 2 H, C*H*HPh), 3.63 (dq, J = 8.3, J = 6.6 Hz, 1 H, C*H*OH), 3.85 (d, J = 13.2 Hz, 2 H, CH*H*Ph), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 22.2 (CH_3), 23.3 (CH_3), 25.5 [$CH(CH_3)_2$], 37.8 (CH_2CHN), 54.2 (CH_2Ph), 54.9 (*C*HN), 70.1(q, $^2J_{C,F}$ = 29.4 Hz, *C*HOH), 127.6, 128.6, 129.0 (CH_{arom}), 137.9 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.26 (d, 3 F, $^3J_{F,H}$ = 6.4 Hz, CF_3) ppm. $C_{21}H_{26}F_3NO$ (365.4): calcd. C 69.02, H 7.17, N 3.83; found C 68.68, H 7.01, N3.70.

(2*S*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-5-methyl-2-hexanol (*anti*-2c): Colorless oil. $[\alpha]_D^{20}$ = −12.3 (c = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3460, 1145, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.51 (d, J = 6.5 Hz, 3 H, CH_3), 0.91 (d, J = 6.5 Hz, 3 H, CH_3), 1.20 (m, 1 H, C*H*HCHN), 1.70 (m, 1 H, CH*H*CHN), 1.85 [m, 1 H, C*H*(CH_3)$_2$], 3.05 (ddd, J = 9.5, J = 4.5, J = 2.0 Hz, 1 H, C*H*N), 3.43 (d, J = 13.6 Hz, 2 H, C*H*HPh), 3.82 (d, J = 13.2 Hz, 2 H, CH*H*Ph), 4.26 (m, 1 H, C*H*OH), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 21.3 (CH_3), 23.6 (CH_3), 24.1 [$CH(CH_3)_2$], 34.5 (CH_2CHN), 54.2 (*C*HN), 54.4 (CH_2Ph), 67.8 (q, $^2J_{C,F}$ = 29.4 Hz, *C*HOH), 127.2, 128.3, 129.1 (CH_{arom}), 139.3 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.50 (d, 3 F, $^3J_{F,H}$ = 8.2 Hz, CF_3) ppm. $C_{21}H_{26}F_3NO$ (365.4): calcd. C 69.02, H 7.17, N 3.83; found C 68.74, H 7.12, N 3.94.

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-phenyl-2-butanol (*syn*-2d): Colorless solid, m.p. 76−77 °C (from hexane). $[\alpha]_D^{20}$ = +30.5 (c = 1.0, $CHCl_3$).). IR (KBr): $\tilde{\nu}$ = 3425, 1270, 1135, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 2.96 (dd, J = 14.6, J = 3.8 Hz, 1 H, CHHCHN), 3.12 (dd, J = 14.6, J = 9.6 Hz, 1 H, CH*H*CHN), 3.37 (m, 3 H, C*H*N and C*H*HN), 3.80 (m, 3 H, C*H*OH and CH*H*N), 5.20 (br. s, 1 H, O*H*), 7.05−7.45 (m, 15 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 34.3 (CH_2CH), 54.0 (CH_2N), 57.7 (*C*HN), 69.2 (q, $^2J_{C,F}$ = 29.4 Hz, *C*HOH), 126.8, 127.6, 128.5, 128.8, 129.1, 129.3 (CH_{arom}), 137.5, 138.9 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.10 (d, 3 F, $^3J_{F,H}$ = 6.0 Hz, CF_3) ppm. $C_{24}H_{24}F_3NO$ (399.4): calcd. C 72.16, H 6.06, N 3.51; found C 71.64, H 5.76, N 3.54.

(2*S*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-phenyl-2-butanol (*anti*-2d): Colorless solid, m.p. 108−110 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = −11.9 (c = 1.0, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3550, 1270, 1140, 1110, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 2.89 (dd, J = 14.4, J = 5.3 Hz, 1 H, C*H*HCHN), 3.08 (dd, J = 14.4, J = 9.2 Hz, 1 H, CH*H*CHN), 3.34 (ddd, J = 9.2, J = 5.3, J = 2.3 Hz, 1 H, C*H*N), 3.54 (d, J = 13.9 Hz, 2 H, C*H*HN), 3.80 (d, J = 13.9 Hz, 2 H, CH*H*N), 4.20 (m, 1 H, C*H*OH), 7.10−7.35 (m, 15H. H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 31.7 (CH_2CH), 54.4 (CH_2N), 58.8 (*C*HN), 68.1 (q, $^2J_{C,F}$ = 29.5 Hz, *C*HOH), 126.2, 127.1, 128.3, 128.7, 129.5 (CH_{arom}), 138.8, 139.1 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.07 (d, 3 F, $^3J_{F,H}$ = 7.6 Hz, CF_3) ppm. $C_{24}H_{24}F_3NO$ (399.4): calcd. C 72.16, H 6.06, N 3.51; found C 71.39, H 5.77, N 3.98.

(2*S*,3*R*)-3-(Dibenzylamino)-1,1,1-trifluoro-3-phenyl-2-propanol (*ent-syn*-2e): Colorless solid, m.p. 104−105 °C (from hexane). IR (KBr): $\tilde{\nu}$ = 3325, 1270, 1160, 770, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 3.07 (d, J = 13.2 Hz, 2 H, C*H*HPh), 3.89 (d, J = 13.2 Hz, 2 H, CH*H*Ph), 3.96 (d, J = 10.3 Hz, 1 H, C*H*N), 4.55 (dq, J = 10.3, J = 5.8 Hz, 1 H, C*H*OH), 7.20−7.50 (m, 15 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 53.4 (CH_2Ph), 61.0 (*C*HN), 67.4 (q, $^2J_{C,F}$ = 29.8 Hz, *C*HOH), 127.7, 128.5, 128.6, 128.8, 129.0, 129.8 (CH_{arom}), 132.0, 137.4 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.49 (d, 3 F, $^3J_{F,H}$ = 6.9 Hz, CF_3) ppm. $C_{23}H_{22}F_3NO$ (385.4): calcd. C 71.67, H 5.75, N 3.63; found C 71.25, H 5.44, N 3.81.

(2*R*,3*R*)-3-(Dibenzylamino)-1,1,1-trifluoro-3-phenyl-2-propanol (*ent-anti*-2e): Colorless solid, m.p. 119−121 °C (from hexane/EtOAc). IR (KBr): $\tilde{\nu}$ = 3455, 1275, 1170, 1140, 765, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 3.11 (d, J = 13.7 Hz, 2 H, C*H*HPh), 3.95 (d, J = 13.7 Hz, 2 H, CH*H*Ph), 4.10 (d, J = 8.0 Hz, 1 H, C*H*N), 4.66 (m, 1 H, C*H*OH), 7.20−7.55 (m, 15 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 54.6 (CH_2Ph), 62.7 (*C*HN), 69.9 (q, $^2J_{C,F}$ = 29.2 Hz, *C*HOH), 127.1, 128.2, 128.3, 128.7, 129.0, 130.0 (CH_{arom}), 132.4, 138.7 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −75.28 (d, 3 F, $^3J_{F,H}$ = 6.6 Hz, CF_3) ppm. $C_{23}H_{22}F_3NO$ (385.4): calcd. C 71.67, H 5.75, N 3.63; found C 71.40, H 5.52, N 3.74.

(2*R*,3*S*)-4-(*tert*-Butyldimethylsilyloxy)-3-(dibenzylamino)-1,1,1-trifluoro-2-butanol (*syn*-2f): Colorless solid, m.p. 89−90 °C (from hexane). $[\alpha]_D^{20}$ = +56.3 (c = 0.8, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3465, 1280, 1165, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.13 (s, 3 H, CH_3Si), 0.15 (s, 3 H, CH_3Si), 0.98 [s, 9 H, $(CH_3)_3C$], 3.09 (ddd, J = 9.5, J = 7.1, J = 3.0 Hz, 1 H, C*H*N), 3.70 (d, J = 13.2 Hz, 2 H, C*H*HPh), 3.88 (dd, J = 11.4, J = 7.1 Hz, 1 H, C*H*HO), 3.91 (m, 1 H, C*H*OH), 3.98 (d, J = 13.2 Hz, 2 H, CH*H*Ph), 4.00 (dd, J = 11.4, J = 3.0 Hz, 1 H, CH*H*O), 5.24 (br. s, 1 H, O*H*), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = −5.9 (CH_3Si), −5.7 (CH_3Si), 18.1 [$C(CH_3)_3$], 25.8 [$(CH_3)_3C$], 54.6 (CH_2Ph), 57.2 (*C*HN), 59.7 ($CH_2OTBDMS$), 65.1 (q, $^2J_{C,F}$ = 30.9 Hz, *C*HOH), 127.5, 128.6, 129.1 (CH_{arom}), 137.9 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.52 (d, 3 F, $^3J_{F,H}$ = 6.3 Hz, CF_3) ppm. $C_{24}H_{34}F_3NO_2Si$ (453.6): calcd. C 63.55, H 7.55, N 3.09; found C 63.16, H 6.90, N 3.22.

(2*S*,3*S*)-4-(*tert*-Butyldimethylsilyloxy)-3-(dibenzylamino)-1,1,1-trifluoro-2-butanol (*anti*-2f): Colorless oil. $[\alpha]_D^{20}$ = +33.1 (c = 1.3, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3430, 1260, 1115, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.13 (s, 3 H, CH_3Si), 0.14 (s, 3 H, CH_3Si), 0.94 [s, 9 H, $(CH_3)_3C$], 3.12 (m, 1 H, C*H*N), 3.86 (m, 4 H, CH_2N), 4.12 (d, J = 5.0 Hz, 2 H, $CH_2OTBDMS$), 4.37 (dq, J = 7.9, J = 3.9 Hz, 1 H, C*H*OH), 7.25−7.50 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = −5.8 (CH_3Si), 17.9 [$C(CH_3)_3$], 25.7 [$(CH_3)_3C$], 55.3 (CH_2Ph), 55.7 (*C*HN), 62.9 ($CH_2OTBDMS$), 71.4 (q, $^2J_{C,F}$ = 29.7 Hz, *C*HOH), 127.2, 128.3, 128.6 (CH_{arom}), 139.1 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.53 (d, 3 F, $^3J_{F,H}$ = 7.6 Hz, CF_3) ppm. $C_{24}H_{34}F_3NO_2Si$ (453.6): calcd. C 63.55, H 7.55, N 3.09; found C 63.22, H 7.04, N 3.18.

(2*S*,3*R*)-2-(Dibenzylamino)-4,4,4-trifluorobutane-1,3-diol (*syn*-3f): Colorless solid, m.p. 106−107 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = +40.2 (*c* = 1.0, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3510, 3310, 1275, 1145, 755, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 3.12 (ddd, *J* = 9.0, *J* = 7.3, *J* = 3.9 Hz, 1 H, C*H*N), 3.74 (d, *J* = 13.1 Hz, 2 H, C*H*HPh), 3.93 (m, 3 H, CH_2OH and C*H*OH), 3.96 (d, *J* = 13.1 Hz, 2 H, C*H*HPh), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 54.4 (CH_2Ph), 57.3 (*C*HN), 59.2 (CH_2OH), 66.2 (q, $^2J_{C,F}$ = 31.1 Hz, *C*HOH), 127.5, 128.6, 129.1 (CH_{arom}), 137.9 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.27 (d, 3 F, $^3J_{F,H}$ = 5.5 Hz, CF_3) ppm. $C_{18}H_{20}F_3NO_2$ (339.3): calcd. C 63.71, H 5.94, N 4.13; found C 63.10, H 5.49, N 4.12.

(2*S*,3*S*)-2-(Dibenzylamino)-4,4,4-trifluorobutane-1,3-diol (*anti*-3f): Colorless solid, m.p. 120−121 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = −24.0 (*c* = 1.0, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3325, 1280, 1165, 1140, 1025, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 2.58 (br. s, 1 H, O*H*), 3.14 (ddd, *J* = 8.2, *J* = 5.0, *J* = 2.5 Hz, 1 H, C*H*N), 3.29 (br. s, 1 H, O*H*), 3.52 (d, *J* = 13.6 Hz, 2 H, C*H*HPh), 3.76 (dd, *J* = 11.1, *J* = 5.0 Hz, 1 H, C*H*HOH), 3.95 (dd, *J* = 11.1, *J* = 8.2 Hz, 1 H, CH*H*OH), 3.96 (d, *J* = 13.6 Hz, 2 H, C*H*HPh), 4.38 (dq, *J* = 7.9, *J* = 2.5 Hz, C*H*OH), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 54.1 (CH_2Ph), 57.1 (*C*HN), 57.9 (CH_2OH), 67.8 (q, $^2J_{C,F}$ = 30.1 Hz, *C*HOH), 127.4, 128.5, 128.9 (CH_{arom}), 138.4 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −78.03 (d, 3 F, $^3J_{F,H}$ = 7.9 Hz, CF_3) ppm. $C_{18}H_{20}F_3NO_2$ (339.3): calcd. C 63.71, H 5.94, N 4.13; found C 63.28, H 5.50, N 3.99.

(2*S*,3*S*)-2-(Dibenzylamino)-4,4,4-trifluoro-1,3-(isopropylidenedioxy)-butane (*trans*-4f): $TsOH{\cdot}H_2O$ (4 mg, 0.02 mmol, 0.02 equiv.) was added to a solution of amino diol *anti*-**3f** (34 mg, 0.1 mmol) in 2,2-dimethoxypropane (1.5 mL) at room temperature. The mixture was stirred at 60 °C for 2 h, and then quenched with an aqueous saturated solution of $NaHCO_3$. The aqueous phase was extracted with ethyl acetate and dried with anhydrous $MgSO_4$. The solvents were eliminated under vacuum and the residue was purified by flash chromatography (silica gel; hexane/ethyl acetate, 10:1) to yield 25 mg of compound *trans*-**4f** (0.065 mmol, 65%) as a colorless oil. $[\alpha]_D^{20}$ = +87.3 (*c* = 0.7, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1600, 1495, 1455, 1380, 1270, 1230, 1105, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.34 (s, 3 H, CH_3), 1.39 (s, 3 H, CH_3), 3.31 (ddd, *J* = 9.3, *J* = 5.6, *J* = 4.2 Hz, 1 H, C*H*N), 3.54 (d, *J* = 14.0 Hz, 2 H, C*H*HPh), 3.78 (dd, *J* = 12.4, *J* = 5.6 Hz, 1 H, C*H*HO), 3.88 (dd, *J* = 12.4, *J* = 4.2 Hz, 1 H, CH*H*O), 3.95 (d, *J* = 14.0 Hz, 2 H, CH*H*Ph), 4.15 (dq, *J* = 9.3, *J* = 6.3 Hz, 1 H, C*H*O), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 22.2 (CH_3), 24.9 (CH_3), 54.2 (*C*HN and CH_2Ph), 57.7 (CH_2O), 67.9 (q, $^2J_{C,F}$ = 30.1 Hz, *C*HO), 100.5 (CO_2), 127.2, 128.3, 128.7 (CH_{arom}), 138.6 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −75.35 (d, 3 F, $^3J_{F,H}$ = 6.5 Hz, CF_3) ppm. $C_{21}H_{24}F_3NO_2$ (379.4): calcd. C 66.48, H 6.38, N 3.69; found C 66.25, H 6.26, N 3.75.

(2*S*,3*R*)-2-(Dibenzylamino)-4,4,4-trifluoro-1,3-(isopropylidene-dioxy)butane (*cis*-4f): This compound was obtained from *syn*-**3f** (34 mg, 0.1 mmol), by the method described for *trans*-**4f**. Yield 24 mg (0.063 mmol, 63%). Colorless oil. $[\alpha]_D^{20}$ = +66.7 (*c* = 0.3, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1600, 1495, 1455, 1285, 1160, 960, 745, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.45 (s, 3 H, CH_3), 1.47 (s, 3 H, CH_3), 2.73 (m, 1 H, C*H*N), 3.55 (d, *J* = 13.9 Hz, 2 H, C*H*HPh), 3.89 (dd, *J* = 13.1, *J* = 3.5 Hz, 1 H, C*H*HO), 4.30 (d, *J* = 13.9 Hz, 2 H, CH*H*Ph), 4.35 (m, 1 H, C*H*O), 4.39 (d, *J* = 13.1 Hz, 1 H, CH*H*O), 7.20−7.45 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 18.3 (CH_3), 28.9 (CH_3), 48.5 (*C*HN), 56.0 (CH_2Ph), 57.9 (CH_2O), 71.6 (q, $^2J_{C,F}$ = 31.3 Hz, *C*HO), 99.8 (CO_2), 126.9, 128.2, 128.8 (CH_{arom}), 139.5 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −74.29 (d, 3 F, $^3J_{F,H}$ = 7.4 Hz, CF_3) ppm. $C_{21}H_{24}F_3NO_2$ (379.4): calcd. C 66.48, H 6.38, N 3.69; found C 66.20, H 6.22, N 3.60.

General Method for the Hydrogenolysis of Dibenzylamino Trifluoroamino Alcohols 2: $Pd(OH)_2/C$ (20%) was added in one portion to a solution of the appropriate dibenzylamino alcohol **2** (1 mmol) in methanol (5 mL). The mixture was stirred under hydrogen and the reaction was monitored by TLC. After completion of the reaction, the catalyst was removed by filtration and washed with methanol. The solution was concentrated under reduced pressure to afford the pure product which was crystallized or purified by sublimation where necessary.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-2-butanol (*syn*-5a): 70% yield. Colorless solid, m.p. 59−60 °C (sublimes). $[\alpha]_D^{20}$ = +13.2 (*c* = 1.0, MeOH). IR (KBr): $\tilde{\nu}$ = 3380, 3110, 1600, 1270, 1175, 880, 705 cm^{-1}. ^1H NMR (CD_3OD): δ = 1.15 (d, *J* = 6.6 Hz, 3 H, CH_3), 3.09 (dq, *J* = 6.6, *J* = 5.4 Hz, 1 H, C*H*N), 3.65 (dq, *J* = 7.5, *J* = 5.4 Hz, 1 H, C*H*OH), 4.87 (br. s, 3 H, NH_2 and O*H*) ppm. ^{13}C NMR (CD_3OD): δ = 19.3 (CH_3), 47.7 (*C*HN), 74.1 (q, $^2J_{C,F}$ = 28.8 Hz, *C*HOH) ppm.^{19}F NMR (CD_3OD): δ = −75.66 (d, 3 F, $^3J_{F,H}$ = 7.4 Hz, CF_3) ppm. $C_4H_8F_3NO$ (143.1): calcd. C 33.57, H 5.63, N 9.79; found C 33.50, H 5.52, N 9.84.

(2*S*,3*S*)-3-Amino-1,1,1-trifluoro-2-butanol (*anti*-5a): 98% yield. Colorless solid, m.p. 62−63 °C (sublimes). $[\alpha]_D^{20}$ = −5.8 (*c* = 1.1, MeOH). IR (KBr): $\tilde{\nu}$ = 3350, 1610, 1275, 1175, 870 cm^{-1}. ^1H NMR (CD_3OD): δ = 1.13 (d, *J* = 6.6 Hz, 3 H, CH_3), 3.14 (dq, *J* = 6.6, *J* = 4.1 Hz, 1 H, C*H*N), 3.87 (dq, *J* = 7.7, *J* = 4.1 Hz, 1 H, C*H*OH), 4.87 (br. s, 3 H, NH_2 and O*H*) ppm. ^{13}C NMR (CD_3OD): δ = 16.8 (CH_3), 47.9 (*C*HN), 73.8 (q, $^2J_{C,F}$ = 29.0 Hz, *C*HOH) ppm.^{19}F NMR (CD_3OD): δ = −75.45 (d, 3 F, $^3J_{F,H}$ = 7.7 Hz, CF_3) ppm. $C_4H_8F_3NO$ (143.1): calcd. C 33.57, H 5.63, N 9.79; found C 33.37, H 5.42, N 9.68.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-4-methyl-2-pentanol (*syn*-5b): 95% yield. Colorless solid, m.p. 78−79 °C (sublimes). $[\alpha]_D^{20}$ = −3.8 (*c* = 1.0, MeOH). IR (KBr): $\tilde{\nu}$ = 3235, 1590, 1510, 1275, 1145 cm^{-1}. ^1H NMR (CD_3OD): δ = 1.05 (d, *J* = 7.0 Hz, 6 H, CH_3), 2.04 [m, 1 H, C*H*(CH_3)$_2$], 3.16 (dd, *J* = 5.2, *J* = 2.2 Hz, 1 H, C*H*N), 4.18 (dq, *J* = 7.8, *J* = 2.2 Hz, 1 H, C*H*OH), 5.03 (br. s, 3 H, NH_2 and O*H*) ppm. ^{13}C NMR (CD_3OD): δ = 18.6 (CH_3), 18.7 (CH_3), 31.5 [*C*H(CH_3)$_2$], 55.9 (*C*HN), 67.7 (q, $^2J_{C,F}$ = 30.5 Hz, *C*HOH) ppm. ^{19}F NMR (CD_3OD): δ = −77.92 (d, 3 F, $^3J_{F,H}$ = 7.5 Hz, CF_3) ppm. $C_6H_{12}F_3NO$ (171.2): calcd. C 42.10, H 7.07, N 8.18; found C 41.90 H, 6.80, N 8.03.

(2*S*,3*S*)-3-Amino-1,1,1-trifluoro-4-methyl-2-pentanol (*anti*-5b): 78% yield. Colorless solid, m.p. 79−80 °C (sublimes). $[\alpha]_D^{20}$ = −4.0 (*c* = 0.9, MeOH). IR (KBr): $\tilde{\nu}$ = 3390, 1275, 1160, 935, 855 cm^{-1}. ^1H NMR (CD_3OD): δ = 0.91 (d, *J* = 6.8 Hz, 3 H, CH_3), 0.99 (d, *J* = 6.9 Hz, 3 H, CH_3), 2.11 [m, 1 H, C*H*(CH_3)$_2$], 2.85 (dd, *J* = 7.3, *J* = 4.3 Hz, 1 H, C*H*N), 3.89 (m, 1 H, C*H*OH), 4.87 (br. s, 3 H, NH_2 and O*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 19.1 (CH_3), 20.0 (CH_3), 29.8 [*C*H(CH_3)$_2$], 58.9 (*C*HN), 68.9 (q, $^2J_{C,F}$ = 28.5 Hz, *C*HOH) ppm. ^{19}F NMR (CD_3OD): δ = −74.26 (d, 3 F, $^3J_{F,H}$ = 7.6 Hz, CF_3) ppm. $C_6H_{12}F_3NO$ (171.2): calcd. C 42.10, H 7.07, N 8.18; found C 41.95, H 6.82, N 7.99.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-5-methyl-2-hexanol (*syn*-5c): 99% yield. Colorless solid, m.p. 94−95 °C. $[\alpha]_D^{20}$ = +2.6 (*c* = 0.6, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3405, 3305, 1275, 1150, 900 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 0.94 (d, *J* = 6.6 Hz, 3 H, CH_3), 0.95 (d, *J* = 6.6 Hz, 3 H, CH_3), 1.38 (m, 2 H, CH_2CHN), 1.67 [m, 1 H, C*H*(CH_3)$_2$], 2.68 (br. s, 3 H, NH_2 and O*H*), 3.32 (m, 1 H, C*H*N), 3.63 (dq, *J* = 7.8, *J* = 1.6 Hz, 1 H, C*H*OH) ppm. ^{13}C NMR

($CDCl_3$): δ = 21.5 (*C*H_3), 22.7 (*C*H_3), 24.4 [*C*H(CH_3)$_2$], 41.0 (*C*H_2), 48.1 (*C*HN), 69.8 (q, $^2J_{C,F}$ = 26.7 Hz, *C*HOH) ppm. ^{19}F NMR ($CDCl_3$): δ = −78.48 (d, 3 F, $^3J_{F,H}$ = 7.8 Hz, C*F*$_3$) ppm. $C_7H_{14}F_3NO$ (185.2): calcd. C 45.40, H 7.62, N 7.56; found C 45.83, H 7.39, N 7.27.

(2*S*,3*S*)-3-Amino-1,1,1-trifluoro-5-methyl-2-hexanol (*anti*-5c): 98% yield. Colorless solid, m.p. 70−71 °C. $[\alpha]_D^{20}$ = −4.2 (*c* = 1.0, $CHCl_3$). IR (KBr): ṽ = 3380, 3300, 1275, 1170, 855 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.90 (d, *J* = 6.6 Hz, 3 H, C*H*$_3$), 0.98 (d, *J* = 6.6 Hz, 3 H, C*H*$_3$), 1.42 (m, 2 H, C*H*$_2$), 1.74 [m, 1 H, C*H*(CH$_3$)$_2$], 2.91 (br. s, 3 H, N*H*$_2$ and O*H*), 3.11 (m, 1 H, C*H*N), 3.89 (dq, *J* = 7.9, *J* = 4.4 Hz, 1 H, C*H*OH) ppm. ^{13}C NMR ($CDCl_3$): δ = 21.0 (*C*H$_3$), 23.6 (*C*H$_3$), 24.4 [*C*H(CH$_3$)$_2$], 40.5 (*C*H$_2$), 49.6 (*C*HN), 71.6 (q, $^2J_{C,F}$ = 28.6 Hz, *C*HOH) ppm. ^{19}F NMR ($CDCl_3$): −74.1 (d, 3 F, $^3J_{F,H}$ = 7.9 Hz, C*F*$_3$) ppm. $C_7H_{14}F_3NO$ (185.2): calcd. C 45.40, H 7.62, N 7.56; found C 45.16, H 7.13, N 7.63.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-4-phenyl-2-butanol (*syn*-5d): 95% yield. Colorless solid, m.p. 116−117 °C. $[\alpha]_D^{20}$ = −5.3 (*c* = 0.9, MeOH). IR (KBr): ṽ = 3415, 1185, 1130, 750, 700 cm^{-1}. ^{1}H NMR (CD_3OD): δ = 3.00 (dd, *J* = 13.6, *J* = 9.4 Hz, 1 H, C*H*HPh), 3.11 (dd, *J* = 13.6, *J* = 6.0 Hz, 1 H, CH*H*Ph), 3.70 (m, 1 H, C*H*N), 3.92 (dq, *J* = 7.6, *J* = 1.8 Hz, 1 H, C*H*OH), 4.89 (br. s, 3 H, O*H* and N*H*$_2$), 7.20−7.50 (m, 5 H, *H*$_{arom}$) ppm. ^{13}C NMR (CD_3OD): δ = 37.2 (*C*H$_2$), 52.8 (*C*HN), 67.2 (q, $^2J_{C,F}$ = 31.3 Hz, *C*HOH), 128.9, 130.4, 130.6 (*C*H$_{arom}$), 136.2 (*C*$_{arom}$) ppm. ^{19}F NMR (CD_3OD): δ = −77.19 (d, 3 F, $^3J_{F,H}$ = 7.1 Hz, C*F*$_3$) ppm. $C_{10}H_{12}F_3NO$ (219.2): calcd. C 54.79, H 5.52, N 6.39; found C 54.45, H 5.32, N 6.22.

(2*S*,3*S*)-3-Amino-1,1,1-trifluoro-4-phenyl-2-butanol (*anti*-5d): 93% yield. Colorless solid, m.p. 123−125 °C. $[\alpha]_D^{20}$ = −42.9 (*c* = 1.0, MeOH). IR (KBr): ṽ = 3350, 3310, 1615, 1263, 1135, 750, 705 cm^{-1}. ^{1}H NMR (CD_3OD): 2.64 (dd, *J* = 13.9, *J* = 10.1 Hz, 1 H, C*H*HPh), 3.11 (dd, *J* = 13.9, *J* = 3.5 Hz, 1 H, CH*H*Ph), 3.30 (m, 1 H, C*H*N), 3.97 (dq, *J* = 7.6, *J* = 5.2 Hz, 1 H, C*H*OH), 4.91 (br. s, 3 H, O*H* and N*H*$_2$), 7.20−7.40 (m, 5 H, *H*$_{arom}$) ppm. ^{13}C NMR (CD_3OD): δ = 38.5 (*C*H$_2$), 54.1 (*C*HN), 73.1 (q, $^2J_{C,F}$ = 28.8 Hz, *C*HOH), 128.0, 129.9, 130.6 (*C*H$_{arom}$), 139.3 (*C*$_{arom}$) ppm. ^{19}F NMR (CD_3OD): δ = −74.48 (d, 3 F, $^3J_{F,H}$ = 7.6 Hz, C*F*$_3$) ppm. $C_{10}H_{12}F_3NO$ (219.2): calcd. C 54.79, H 5.52, N 6.39; found C 53.95, H 5.27, N 6.20.

(2*S*,3*R*)-3-Amino-1,1,1-trifluoro-3-phenyl-2-propanol (*ent-syn*-5e): 90% yield. Colorless solid, m.p. 114−115 °C (from hexane/EtOAc). IR (KBr): ṽ = 3410, 3345, 1165, 1130, 770, 700 cm^{-1}. ^{1}H NMR (CD_3OD): δ = 4.01 (dq, *J* = 7.1, *J* = 5.8 Hz, 1 H, C*H*OH), 4.08 (d, *J* = 5.8 Hz, 1 H, C*H*N), 4.89 (br. s, 3 H, N*H*$_2$ and O*H*), 7.20−7.45 (m, 5 H, *H*$_{arom}$) ppm. ^{13}C NMR (CD_3OD): δ = 56.5 (*C*HN), 74.4 (q, $^2J_{C,F}$ = 28.4 Hz, *C*HOH), 128.6, 129.1, 129.7 (*C*H$_{arom}$), 142.1 (*C*$_{arom}$) ppm. ^{19}F NMR (CD_3OD): δ = −75.38 (d, 3 F, $^3J_{F,H}$ = 7.2 Hz, C*F*$_3$) ppm. $C_9H_{10}F_3NO$ (205.2): calcd. C 52.68, H 4.91, N 6.83; found C 52.50, H 5.10, N 6.72.

(2*R*,3*R*)-3-Amino-1,1,1-trifluoro-3-phenyl-2-propanol (*ent-anti*-5e): 93% yield. Colorless solid, m.p. 142−143 °C (from hexane/EtOAc) (ref.[11] m.p. 142 °C). IR (KBr): ṽ = 3350, 1265, 1165, 1120, 765, 700 cm^{-1}. ^{1}H NMR (CD_3OD): δ = 4.10 (d, *J* = 5.6 Hz, 1 H, C*H*N), 4.21 (d, 1 H, C*H*OH), 4.91 (br. s, 3 H, N*H*$_2$ and O*H*), 7.20−7.45 (m, 5 H, *H*$_{arom}$) ppm. ^{13}C NMR (CD_3OD): δ = 56.8 (*C*HN), 74.2 (q, $^2J_{C,F}$ = 28.5 Hz, *C*HOH), 128.9, 129.4, (*C*H$_{arom}$), 141.7 (*C*$_{arom}$) ppm. ^{19}F NMR (CD_3OD): δ = −74.65 (d, 3 F, $^3J_{F,H}$ = 6.1 Hz, C*F*$_3$) ppm. $C_9H_{10}F_3NO$ (205.2): calcd. C 52.68, H 4.91, N 6.83; found C 52.46, H 5.10, N 6.72.

(2*S*,3*R*)-2-Amino-4,4,4-trifluorobutane-1,3-diol (*syn*-5f): 85% yield. Colorless oil. $[\alpha]_D^{20}$ = +14.8 (*c* = 0.5, MeOH). IR (film): ṽ = 3300, 1275, 1140 cm^{-1}. ^{1}H NMR (CD_3OD): δ = 3.07 (dt, *J* = 6.5, *J* = 3.1 Hz, 1 H, C*H*N), 3.54 (d, *J* = 6.6 Hz, 2 H, C*H*$_2$OH), 4.06 (dq, *J* = 7.9, *J* = 3.1 Hz, C*H*OH), 4.89 (br. s, 4 H, N*H*$_2$ and O*H*) ppm. ^{13}C NMR (CD_3OD): δ = 53.7 (*C*HN), 64.2 (*C*H$_2$OH), 69.7 (q, $^2J_{C,F}$ = 29.7 Hz, *C*HOH) ppm. ^{19}F NMR (CD_3OD): δ = −76.22 (d, 3 F, $^3J_{F,H}$ = 7.6 Hz, C*F*$_3$) ppm. $C_4H_8F_3NO_2$ (159.1): calcd. C 30.20, H 5.07, N 8.80; found C 30.06, H 5.19, N 8.88.

(2*S*,3*S*)-2-Amino-4,4,4-trifluorobutane-1,3-diol (*anti*-5f): 98% yield. Colorless oil. $[\alpha]_D^{20}$ = −16.8 (*c* = 0.9, MeOH). IR (film): ṽ = 3290, 1275, 1170 cm^{-1}. ^{1}H NMR (CD_3OD): δ = 3.09 (m, 1 H, C*H*N), 3.62 (dd, *J* = 11.0, *J* = 7.5 Hz, 1 H, C*H*HOH), 3.80 (dd, *J* = 11.0, *J* = 3.4 Hz, 1 H, CH*H*OH), 4.02 (dq, *J* = 7.7, *J* = 5.7 Hz, C*H*OH), 4.92 (br. s, 4 H, N*H*$_2$ and O*H*) ppm. ^{13}C NMR (CD_3OD): δ = 54.5 (*C*HN), 63.5 (*C*H$_2$OH), 72.7 (q, $^2J_{C,F}$ = 29.4 Hz, *C*HOH) ppm. ^{19}F NMR (CD_3OD): δ = −75.28 (d, 3 F, $^3J_{F,H}$ = 8.0 Hz, C*F*$_3$) ppm. $C_4H_8F_3NO_2$ (159.1): calcd. C 30.20, H 5.07, N 8.80; found C 30.10, H 5.00, N 8.70.

General Procedure for the Preparation of Mosher Amides: (*R*)-(+)-MTPA (24 mg, 0.1 mmol) and DCC (21 mg, 0.1 mmol) were added to a solution of amino alcohol **5a**−**f** (0.1 mmol) in CH_3CN (1 mL) at 0 °C. The mixture was stirred at room temp. for 2−3 h and the precipitated DCU was filtered off. The filtrate was concentrated to yield a residue, which was purified by flash chromatography (silica gel; CH_2Cl_2).

General Procedure for the Preparation of Oxazolidinones 6: Triphosgene (30 mg, 0.1 mmol, 0.5 equiv.) was added to a stirred solution of amino alcohol **5** (0.2 mmol, 1 equiv.) and diisopropylethylamine (87 μL, 0.5 mmol, 2.5 equiv.) in anhydrous CH_2Cl_2 (6 mL) at 0 °C. The reaction solution was allowed to warm to room temperature with stirring for 2−3 h. H_2O (2.5 mL) and CH_2Cl_2 (20 mL) were added to the mixture, and the organic phase was separated, dried with anhydrous $MgSO_4$, concentrated under reduced pressure and chromatographed (silica gel; hexane/EtOAc, 3:1) to afford **6** as pure compounds.

(4*S*,5*R*)-4-Methyl-5-(trifluoromethyl)oxazolidin-2-one (*trans*-6a): 40% yield. Colorless oil. $[\alpha]_D^{20}$ = −28.7 (*c* = 0.94, $CHCl_3$). IR (film): ṽ = 3305, 1775, 1160, 960, 765 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 1.43 (d, *J* = 6.3 Hz, 3 H, C*H*$_3$), 4.05 (dq, *J* = 6.3, *J* = 4.9 Hz, 1 H, C*H*N), 4.39 (m, 1 H, C*H*O), 6.48 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 21.5 (*C*H$_3$), 48.4 (*C*HN), 78.7 (q, $^2J_{C,F}$ = 34.4 Hz, *C*HO), 157.0 (*C*O) ppm.^{19}F NMR ($CDCl_3$): δ = −80.34 (d, 3 F, $^3J_{F,H}$ = 4.9 Hz, C*F*$_3$) ppm. $C_5H_6F_3NO_2$ (169.1): calcd. C 35.51, H 3.58, N 8.28; found C 35.65, H 3.50, N 8.18.

(4*S*,5*S*)-4-Methyl-5-(trifluoromethyl)oxazolidin-2-one (*cis*-6a): 57% yield. Colorless solid, m.p. 103−104 °C (from hexane). $[\alpha]_D^{20}$ = +24.0 (*c* = 0.45, $CHCl_3$). IR (KBr): ṽ = 3295, 1758, 1160, 960, 765 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 1.42 (dd, 3 H, *J* = 6.8, *J* = 2.0 Hz, C*H*$_3$), 4.31 (dq, *J* = 8.5, *J* = 6.8 Hz, 1 H, C*H*N), 4.81 (dq, *J* = 8.5, *J* = 7.1 Hz, 1 H, C*H*O), 6.40 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 15.3 (*C*H$_3$), 49.1 (*C*HN), 75.4 (q, $^2J_{C,F}$ = 33.2 Hz, *C*HO), 157.1 (*C*O) ppm.^{19}F NMR ($CDCl_3$): δ = −73.80 (d, 3 F, $^3J_{F,H}$ = 6.9 Hz, C*F*$_3$) ppm. $C_5H_6F_3NO_2$ (169.1): calcd. C 35.51, H 3.58, N 8.28; found C 35.31, H 3.72, N 8.14.

(4*S*,5*R*)-4-Isopropyl-5-(trifluoromethyl)oxazolidin-2-one (*trans*-6b): 42% yield. Colorless solid, m.p. 67−68 °C (from hexane). $[\alpha]_D^{20}$ = −31.5 (*c* = 0.5, $CHCl_3$). IR (KBr): ṽ = 3280, 1770, 1743, 1235, 1175 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.98 (d, *J* = 6.8 Hz, 3 H, C*H*$_3$), 0.99 (d, *J* = 6.7 Hz, 3 H, C*H*$_3$), 1.84 [m, 1 H, C*H*(CH$_3$)$_2$], 3.68 (m,

1 H, C*H*N), 4.51 (dq, J = 6.3, J = **3.8** Hz, 1 H, C*H*O), 6.95 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 16.9 (*C*H$_3$), 17.3 (*C*H$_3$), 32.3 [*C*H(CH$_3$)$_2$], 58.0 (*C*HN), 75.2 (q, $^2J_{C,F}$ = 34.4 Hz, *C*HO), 157.7 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −80.71 (d, 3 F, $^3J_{F,H}$ = 4.9 Hz, C*F*$_3$) ppm. $C_7H_{10}F_3NO_2$ (197.2): calcd. C 42.64, H 5.11, N 7.10; found C 42.19, H 4.83, N 6.76.

(4*S*,5*S*)-4-Isopropyl-5-(trifluoromethyl)oxazolidin-2-one (*cis*-6b): 57% yield. Colorless solid, m.p. 87−88 °C (from hexane). $[\alpha]_D^{20}$ = +48.7 (c = 0.5, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3285, 1775, 1175, 1020, 770 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 1.00 (d, J = 6.4 Hz, 3 H, C*H*$_3$), 1.06 (d, J = 6.5 Hz, 3 H, C*H*$_3$), 2.08 [m, 1 H, C*H*(CH$_3$)$_2$], 3.84 (m, 1 H, C*H*N), 4.81 (m, 1 H, C*H*O), 7.07 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 20.0 (*C*H$_3$), 27.3 [*C*H(CH$_3$)$_2$], 61.3 (*C*HN), 75.3 (q, $^2J_{C,F}$ = 32.4 Hz, *C*HO), 158.3 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −73.81 (d, 3 F, $^3J_{F,H}$ = 6.5 Hz, C*F*$_3$) ppm. $C_7H_{10}F_3NO_2$ (197.2): calcd. C 42.64, H 5.11, N 7.10; found C 42.14, H 8.98, N 6.96.

(4*S*,5*R*)-4-Isobutyl-5-(trifluoromethyl)oxazolidin-2-one (*trans*-6c): 64% yield. Colorless oil. $[\alpha]_D^{20}$ = −40.2 (c = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 3280, 1770, 1150 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.95 (d, J = 6.5 Hz, 3 H, C*H*$_3$), 0.96 (d, J = 6.3 Hz, 3 H, C*H*$_3$), 1.45 (m, 1 H, C*H*HCHN), 1.66 (m, 2 H, CH*H*CHN and C*H*(CH$_3$)$_2$], 3.95 (m, 1 H, C*H*N), 4.41 (dq, J = 6.0, J = 4.5 Hz, 1 H, C*H*O), 7.27 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 21.6 (*C*H$_3$), 22.6 (*C*H$_3$), 24.3 [*C*H(CH$_3$)$_2$], 44.9 (*C*H$_2$), 51.0 (*C*HN), 77.7 (q, $^2J_{C,F}$ = 34.1 Hz, *C*HO), 157.8 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −80.44 (d, 3 F, $^3J_{F,H}$ = 5.3 Hz, C*F*$_3$) ppm. $C_8H_{12}F_3NO_2$ (211.2): calcd. C 45.50, H 5.73, N 6.63; found C 45.28, H 5.40, N 6.39.

(4*S*,5*S*)-4-Isobutyl-5-(trifluoromethyl)oxazolidin-2-one (*cis*-6c): 75% yield. Colorless solid, m.p. 83−84 °C (from hexane). $[\alpha]_D^{20}$ = −6.0 (c = 1.0, MeOH). IR (KBr): $\tilde{\nu}$ = 3305, 1795, 1740, 1155 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.91 (d, J = 6.5 Hz, 3 H, C*H*$_3$), 0.98 (d, J = 6.4 Hz, 3 H, C*H*$_3$), 1.43 (m, 1 H, C*H*HCHN), 1.67 (m, 2 H, CH*H*CHN and C*H*(CH$_3$)$_2$], 4.23 (m, 1 H, C*H*N), 4.80 (dq, J = 8.5, J = 7.1 Hz, 1 H, C*H*O), 7.27 (br. s, 1 H, N*H*) ppm. ^{13}C NMR ($CDCl_3$): δ = 20.5 (*C*H$_3$), 23.7 [*C*H(CH$_3$)$_2$], 25.2 (*C*H$_3$), 37.5 (*C*H$_2$), 51.9 (*C*HN), 75.0 (q, $^2J_{C,F}$ = 32.9 Hz, *C*HO), 158.0 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −73.46 (d, 3 F, $^3J_{F,H}$ = 6.4 Hz, C*F*$_3$) ppm. $C_8H_{12}F_3NO_2$ (211.2): calcd. C 45.50, H 5.73, N 6.63; found C 45.34, H 5.52, N 6.48.

(4*S*,5*R*)-4-Benzyl-5-(trifluoromethyl)oxazolidin-2-one (*trans*-6d): 54% yield. Colorless solid, m.p. 109−110 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = −65.3 (c = 0.6, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3285, 1765, 1740, 1165, 755, 705 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 2.92 (dd, J = 13.7, J = 7.4 Hz, 1 H, C*H*HPh), 2.98 (dd, J = 13.7, J = 6.0 Hz, 1 H, CH*H*Ph), 4.13 (m, 1 H, C*H*N), 4.54 (dq, J = 6.2, J = 4.3 Hz, 1 H, C*H*O), 6.19 (br. s, 1 H, N*H*), 7.15−7.45 (m, 5 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 41.3 (*C*H$_2$), 53.6 (*C*HN), 76.1 (q, $^2J_{C,F}$ = 34.6 Hz, *C*HO), 127.7, 129.1, 129.2 (*C*H$_{arom}$), 134.2 (C_{arom}), 156.7 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −80.4 (d, 3 F, $^3J_{F,H}$ = 6.4 Hz, C*F*$_3$) ppm. $C_{11}H_{10}F_3NO_2$ (245.2): calcd. C 53.88, H 4.11, N 5.71; found C 53.33, H 3.70, N 5.49.

(4*S*,5*S*)-4-Benzyl-5-(trifluoromethyl)oxazolidin-2-one (*cis*-6d): 54% yield. Colorless solid, m.p. 85−86 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = −82.8 (c = 0.8, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3325, 1775, 1180, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 2.85 (dd, J = 13.3, J = 10.5 Hz, 1 H, C*H*HPh), 3.11 (d, J = 13.3 Hz, 1 H, CH*H*Ph), 4.32 (m, 1 H, C*H*N), 4.91 (dq, J = 8.4, J = 7.1 Hz, 1 H, C*H*O), 5.40 (br. s, 1 H, N*H*), 7.15−7.40 (m, 5 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 35.7 (*C*H$_2$), 54.8 (*C*HN), 74.4 (q, $^2J_{C,F}$ = 33.7 Hz, *C*HO), 127.6, 128.8, 129.2 (*C*H$_{arom}$), 135.9 (C_{arom}), 155.9 (*C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −73.36 (d, 3 F, $^3J_{F,H}$ = 7.1 Hz, C*F*$_3$) ppm. $C_{11}H_{10}F_3NO_2$ (245.2): calcd. C 53.88, H 4.11, N 5.71; found C 53.14, H 3.69, N 5.42.

General Procedure for the Oxidation of Dibenzylamino Alcohols 2 to Amino Ketones 7: DMSO (220 μL, 3.1 mmol) was added dropwise to a stirred solution of oxalyl chloride (130 μL, 1.49 mmol) in dichloromethane (3 mL) cooled to −78 °C under argon. After 15 min, a solution of amino alcohol **2** (1.1 mmol) in dichloromethane (3 mL) was added, the mixture was stirred at −78 °C for 30 min and triethylamine (0.44 mL, 3.15 mmol) was added. Then, the mixture was allowed to reach room temperature whilst being stirred for 45 min and quenched with water (5 mL). The aqueous phase was extracted with CH_2Cl_2 (5 mL), and the combined organic layers were washed with saturated aqueous $NaHCO_3$ and brine. The organic phase was dried ($MgSO_4$) and concentrated to yield an oil that was purified by flash chromatography (silica gel; hexane/EtOAc, 15:1−30:1).

(3*S*)-3-(Dibenzylamino)-1,1,1-trifluorobutan-2-one (7a): Colorless oil. $[\alpha]_D^{20}$ = −71.5 (c = 1.1, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1755, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 1.31 (d, J = 6.8 Hz, 3 H, C*H*$_3$), 3.56 (d, J = 13.6 Hz, 2 H, C*H*HPh), 3.76 (d, J = 13.6 Hz, 2 H, CH*H*Ph), 3.99 (q, J = 6.8 Hz, 1 H, C*H*N), 7.20−7.50 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 8.1 (*C*H$_3$), 54.2 (*C*H$_2$Ph), 57.5 (*C*HN), 127.4, 128.4, 128.9 (*C*H$_{arom}$), 138.2 (C_{arom}), 192.5 (q, $^2J_{C,F}$ = 32.6 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.04 (s, 3 F, C*F*$_3$) ppm. $C_{18}H_{18}F_3NO$ (321.3): calcd. C 67.28, H 5.65, N 4.36; found C 67.50, H 5.82, N 4.14.

(3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-methylpentan-2-one (7b): Colorless oil. $[\alpha]_D^{20}$ = −240.9 (c = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1746, 1205, 1153, 745, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.84 (d, J = 6.6 Hz, 3 H, C*H*$_3$), 1.18 (d, J = 6.6 Hz, 3 H, C*H*$_3$), 2.34 [m, 1 H, C*H*(CH$_3$)$_2$], 3.52 (d, J = 14.1 Hz, 2 H, C*H*HPh), 3.63 (d, J = 10.6 Hz, 1 H, C*H*N), 4.08 (d, J = 14.1 Hz, 2 H, CH*H*Ph), 4.05 (m, 1 H, C*H*OH), 7.25−7.45 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 19.4 (*C*H$_3$), 20.2 (*C*H$_3$), 28.2 [*C*H(CH$_3$)$_2$], 54.3 (*C*H$_2$Ph), 66.0 (*C*HN), 127.3, 128.3, 128.8 (*C*H$_{arom}$), 138.6 (C_{arom}), 195.0 (q, $^2J_{C,F}$ = 32.8 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −79.91 (s, 3 F, C*F*$_3$) ppm. $C_{20}H_{22}F_3NO$ (349.4): calcd. C 68.75, H 6.35, N 4.01; found C 68.65, H 6.40, N 3.90.

(3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-5-methylhexan-2-one (7c): Colorless oil. $[\alpha]_D^{20}$ = −96.9 (c = 1.0, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1755, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 0.77 (d, J = 6.2 Hz, 3 H, C*H*$_3$), 0.83 (d, J = 6.2 Hz, 3 H, C*H*$_3$), 1.60 (m, 3 H, C*H*$_2$CH and C*H*(CH$_3$)$_2$], 3.69 (m, 2 H, C*H*$_2$Ph), 3.88 (m, 1 H, C*H*N), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 22.2 (*C*H$_3$), 22.5 (*C*H$_3$), 25.0 [*C*H(CH$_3$)$_2$], 32.8 (*C*H$_2$CHN), 54.1 (*C*H$_2$Ph), 59.4 (*C*HN), 127.4, 128.3, 129.0 (*C*H$_{arom}$), 138.4 (C_{arom}), 192.3 (q, $^2J_{C,F}$ = 32.5 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.86 (s, 3 F, C*F*$_3$) ppm. $C_{21}H_{24}F_3NO$ (363.4): calcd. C 69.40, H 6.66, N 3.85; found C 69.54, H 6.83, N 3.70.

(3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-4-phenylbutan-2-one (7d): Colorless oil. $[\alpha]_D^{20}$ = −123.6 (c = 1.1, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1755, 1160, 750, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ = 2.97 (dd, J = 13.6, J = 4.7 Hz, 1 H, C*H*HCHN), 3.16 (dd, J = 13.6, J = 9.4 Hz, 1 H, CH*H*CHN), 3.66 (d, J = 13.6 Hz, 2 H, C*H*HN), 3.81 (d, J = 13.6 Hz, 2 H, CH*H*N), 4.13 (dd, J = 9.4, J = 4.7 Hz, 1 H, C*H*N), 7.00−7.50 (m, 15H. H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 29.4 (*C*H$_2$CH), 54.1 (*C*H$_2$N), 63.3 (*C*HN), 126.6, 127.5, 128.4, 128.6, 129.0, 129.3 (*C*H$_{arom}$), 137.1, 137.8 (C_{arom}), 190.4 (q, $^2J_{C,F}$ = 33.8 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −76.7 (s, 3 F, C*F*$_3$)

ppm. $C_{24}H_{22}F_3NO$ (399.4): calcd. C 72.53, H 5.58, N 3.52; found C 72.38, H 5.69, N 3.57.

3-(Dibenzylamino)-1,1,1-trifluoro-3-phenylpropan-2-one (7e): Colorless oil. IR (film): $\tilde{\nu}$ = 1760, 1205, 1150, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 3.72 (d, *J* = 13.8 Hz, 2 H, C*H*HPh), 3.91 (d, *J* = 13.8 Hz, 2 H, CH*H*Ph), 5.10 (s, 1 H, C*H*N), 7.25−7.50 (m, 15H. H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 54.2 (CH_2Ph), 63.8 (*C*HN), 127.3, 128.4, 128.7, 128.8, 129.0, 129.8 (CH_{arom}), 132.0, 138.7 (C_{arom}), 192.7 (q, $^2J_{C,F}$ = 33.0 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.1 (s, 3 F, CF_3) ppm. $C_{23}H_{20}F_3NO$ (383.4): calcd. C 72.05, H 5.26, N 3.65; found C 71.84, H 5.36, N 3.73.

(3*S*)-4-(*tert*-Butyldimethylsilyloxy)-3-(dibenzylamino)-1,1,1-trifluorobutan-2-one (7f): Colorless oil. $[\alpha]_D^{20}$ = −34.0 (*c* = 0.7, $CHCl_3$). IR (film): $\tilde{\nu}$ = 1757, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 0.03 (s, 3 H, CH_3Si), 0.04 (s, 3 H, CH_3Si), 0.86 [s, 9 H, $(CH_3)_3C$], 3.80 (d, *J* = 13.8 Hz, 2 H, C*H*HPh), 3.86 (d, *J* = 13.8 Hz, 2 H, C*H*HPh), 4.05 (m, 3 H, C*H*N and CH_2OTBDMS), 7.20−7.40 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = −5.8 (CH_3Si), 18.0 [$C(CH_3)_3$], 25.6 [$(CH_3)_3C$], 54.9 (CH_2Ph), 59.9 (CH_2OTBDMS), 62.9 (*C*HN), 127.3, 128.4, 128.8 (CH_{arom}), 138.6 (C_{arom}), 191.3 (q, $^2J_{C,F}$ = 33.8 Hz, *C*O) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.97 (s, 3 F, CF_3) ppm. $C_{24}H_{32}F_3NO_2Si$ (451.6): calcd. C 63.83, H 7.14, N 3.10; found C 64.01, H 7.18, N 3.19.

General Procedure for the Stereoselective Reduction of Amino Ketones 7 with Sodium Borohydride: Sodium borohydride (136 mg, 3.6 mmol, 4.5 equiv.) was added to a stirred solution of ketone **7** (0.8 mmol) in 5 mL of MeOH/THF (9:2), cooled to −20 °C. After stirring for 0.5−1 h, the mixture was quenched with H_2O and extracted with diethyl ether. The ethereal layer was washed with NaCl solution and dried with $MgSO_4$, the solvents were removed and the residue was purified by flash chromatography (silica gel; hexane/EtOAc, 30:1).

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-methyl-2-butanol (8a): A 3 M solution of MeMgBr in diethyl ether (0.5 mL, 1.5 mmol, 2 equiv.) was added to a solution of amino ketone **7a** (241 mg, 0.75 mmol) in diethyl ether (8 mL) at 0 °C. After stirring at this temperature until the reaction was finished (TLC), saturated NH_4Cl solution (10 mL) was added and the mixture was extracted with diethyl ether (3 × 10 mL). The combined organic layers were washed with brine, dried with $MgSO_4$ and the solvent was evaporated under vacuum. The residue was purified by flash chromatography (silica gel; hexane/EtOAc, 30:1) to yield 152 mg of **8a** (0.45 mmol, 60%). Colorless solid, m.p. 48−49 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = +72.4 (*c* = 1.0, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3435, 1140, 745, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.26 (d, *J* = 7.1 Hz, 3 H, CH_3CH), 1.42 (s, 3 H, CH_3), 3.30 (q, *J* = 7.1 Hz, 1 H, C*H*CH_3), 3.44 (d, *J* = 13.2 Hz, 2 H, C*H*HPh), 3.89 (d, *J* = 13.2 Hz, 2 H, CH*H*Ph), 5.90 (s, 1 H, O*H*), 7.25−7.45 (m, 10 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 8.6 (CH_3), 18.4 (CH_3), 53.8 (*C*HN), 55.0 (CH_2Ph), 72.4 (q, $^2J_{C,F}$ = 27.2 Hz, *C*OH), 127.7, 128.6, 129.0 (CH_{arom}), 137.7 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −82.49 (s, 3 F, CF_3) ppm. $C_{19}H_{22}F_3NO$ (337.38): calcd. C 67.64, H 6.57, N 4.15; found C 67.52, H 6.48, N 4.20.

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-methyl-4-phenyl-2-butanol (8d): Compound **8d** was obtained from amino ketone **7d** (298 mg, 0.75 mmol) by treatment with MeMgBr as described for compound **8a**. The product was purified by flash chromatography (silica gel; hexane/EtOAc, 30:1) to yield 217 mg of **8d** (0.525 mmol, 70%). Colorless solid, m.p. 129−130 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = +45.9 (*c* = 1.0, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3435, 1495, 1455, 1135, 745, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.51 (s, 3 H, CH_3), 2.76 (br., 1 H, C*H*HN), 3.02 (dd, *J* = 14.5, *J* = 2.8 Hz, 1 H, C*H*HPh), 3.23 (dd, *J* = 14.5, *J* = 11.2 Hz, 1 H, CH*H*Ph), 3.53 (br., 1 H, C*H*HN), 3.60 (dd, *J* = 11.2, *J* = 2.8 Hz, 1 H, C*H*N), 3.87 (br., 1 H, CH*H*N), 4.19 (br., 1 H, CH*H*N), 6.09 (s, 1 H, O*H*), 6.75 (br. s, 2 H, H_{arom}), 7.20−7.50 (m, 13 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 19.2 (CH_3), 33.6 (CH_2Ph), 55.7 (CH_2N), 59.3 (*C*HN), 72.3 (q, $^2J_{C,F}$ = 27.0 Hz, *C*OH), 126.9, 127.7, 128.8, 129.2, 129.4 (CH_{arom}), 137.1, 137.8, 139.3 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −81.92 (s, 3 F, CF_3) ppm. $C_{25}H_{26}F_3NO$ (413.5): calcd. C 72.62, H 6.34, N 3.39; found C 72.03, H 5.90, N 3.52.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-2-methyl-2-butanol (9a): Colorless solid, m.p. 73−74 °C (sublimes). $[\alpha]_D^{20}$ = +2.4 (*c* = 0.6, MeOH). ^1H NMR (CD_3OD): δ = 1.10 (d, *J* = 6.8 Hz, 3 H, CH_3CH), 1.24 (s, 3 H, CH_3), 3.11 (q, *J* = 6.8 Hz, 1 H, C*H*CH_3), 4.87 (br. s, 3 H, O*H* and NH_2) ppm. ^{13}C NMR (CD_3OD): δ = 15.5 (CH_3), 17.2 (CH_3), 50.7 (*C*HN), 76.2 (q, $^2J_{C,F}$ = 26.0 Hz, *C*OH) ppm. ^{19}F NMR (CD_3OD): δ = −78.49 (s, 3 F, CF_3) ppm. $C_5H_{10}F_3NO$ (157.1): calcd. C 38.22, H 6.41, N 8.91; found C 38.08, H 6.11, N 8.61.

(2*R*,3*S*)-3-Amino-1,1,1-trifluoro-2-methyl-4-phenyl-2-butanol (9d): Colorless solid, m.p. 87−88 °C (from hexane/EtOAc). $[\alpha]_D^{20}$ = −47.3 (*c* = 0.5, MeOH). IR (KBr): $\tilde{\nu}$ = 3360, 1135, 745, 700 cm^{-1}. ^1H NMR (CD_3OD): δ = 1.39 (s, 3 H, CH_3), 2.39 (dd, *J* = 13.6, *J* = 11.3 Hz, 1 H, C*H*HPh), 3.06 (dd, *J* = 13.6, *J* = 2.6 Hz, 1 H, CH*H*Ph), 3.28 (dd, *J* = 11.3, *J* = 2.6 Hz, 1 H, C*H*N), 7.20−7.40 (m, 5 H, H_{arom}) ppm. ^{13}C NMR (CD_3OD): δ = 16.6 (CH_3), 38.6 (CH_2), 56.9 (*C*HN), 76.0 (q, $^2J_{C,F}$ = 26.3 Hz, *C*OH), 127.8, 129.9, 130.4 (CH_{arom}), 140.1 (C_{arom}) ppm. ^{19}F NMR (CD_3OD): δ = −77.74 (s, 3 F, CF_3) ppm. $C_{11}H_{14}F_3NO$ (233.2): calcd. C 56.65, H 6.05, N 6.01; found C 57.05, H 5.80, N 5.72.

(2*R*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-phenyl-2-butanol (10a): This compound was obtained as the major diastereomer in the reaction of **7a** (257 mg, 0.8 mmol) with PhMgBr as described for compound **8a**. The product was purified by flash chromatography (silica gel; hexane/EtOAc, 50:1) to yield 149 mg of **10a** (0.37 mmol, 47%). Colorless oil. $[\alpha]_D^{20}$ = −105.0 (*c* = 1, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3400, 1265, 1155, 750, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.25 (d, *J* = 7.1 Hz, 3 H, CH_3), 3.18 (br., 2 H, C*H*HPh), 3.41 (br., 2 H, CH*H*Ph), 3.47 (q, *J* = 7.1 Hz, 1 H, C*H*N), 6.67 (br. s, 1 H, O*H*), 7.20−7.40 (m, 13 H, H_{arom}), 7.73 (m, 2 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 9.6 (CH_3), 54.4 (CH_2), 55.5 (*C*HN), 75.7 (q, $^2J_{C,F}$ = 27.2 Hz, *C*OH), 127.2, 127.7, 128.0, 128.2, 128.7, 129.0 (CH_{arom}), 136.6, 137.6 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −77.06 (s, 3 F, CF_3) ppm. $C_{24}H_{24}F_3NO$ (399.4): calcd. C 72.16, H 6.06, N 3.51; found C 71.74, H 5.76, N 3.68.

(2*S*,3*S*)-3-(Dibenzylamino)-1,1,1-trifluoro-2-phenyl-2-butanol (*epi*-10a): This compound was obtained as the minor diastereomer in the reaction of **7a** (257 mg, 0.8 mmol) with PhMgBr and purified by flash chromatography (silica gel; hexane/EtOAc, 50:1) to yield 58 mg of *epi*-**10a** (0.15 mmol, 18%). Colorless oil. $[\alpha]_D^{20}$ = +99.0 (*c* = 0.75, $CHCl_3$). IR (KBr): $\tilde{\nu}$ = 3420, 1260, 1155, 745, 700 cm^{-1}. ^1H NMR ($CDCl_3$): δ = 1.32 (d, *J* = 7.4 Hz, 3 H, CH_3), 3.08 (q, *J* = 7.4 Hz, 1 H, C*H*N), 3.29 (d, *J* = 13.1 Hz, 2 H, C*H*HPh), 3.98 (d, *J* = 13.1 Hz, 2 H, CH*H*Ph), 5.97 (br. s, 1 H, O*H*), 7.10−7.40 (m, 15 H, H_{arom}) ppm. ^{13}C NMR ($CDCl_3$): δ = 7.8 (CH_3), 55.3 (CH_2), 62.5 (*C*HN), 77.0 (q, $^2J_{C,F}$ = 28.0 Hz, *C*OH), 125.7, 127.6, 127.7, 127.9, 128.6, 129.4 (CH_{arom}), 138.3, 139.5 (C_{arom}) ppm. ^{19}F NMR ($CDCl_3$): δ = −69.79 (s, 3 F, CF_3) ppm. $C_{24}H_{24}F_3NO$ (399.4): calcd. C 72.16, H 6.06, N 3.51; found C 71.89, H 5.83, N 3.62.

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[21] CCDC-230609 contains the supplementary crystallographic data for this paper. These data can be obtained free of charge at www.ccdc.cam.ac.uk/conts/retrieving.html [or from the Cambridge Crystallographic Data Centre, 12 Union Road, Cambridge CB2 1EZ, UK; Fax: (internat.) + 44-1223-336-033; E-mail: deposit@ccdc.cam.ac.uk].

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