Supporting Information

Copper(I)-Catalyzed Asymmetric Exo-selective [3+2] Cycloaddition of Azomethine Ylides with \(\beta\)-Tri fluoromethyl \(\beta\), \(\beta\)-Disubstituted Enones

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1. **General Information**

All reactions were carried out under an atmosphere of nitrogen in flame-dried glassware with magnetic stirring. $^1$H NMR spectra, $^{13}$C NMR spectra were recorded on a Bruker 300, and 400 MHz spectrometer in CDCl$_3$. All signals are reported in ppm with the internal TMS signal at 0 ppm as a standard. Data for $^1$H NMR spectra are reported as follows: chemical shift (ppm, referenced to TMS; s = singlet, d = doublet, t = triplet, dd = doublet of doublets, m = multiplet), coupling constant (Hz), and integration. Data for $^{13}$C NMR are reported in terms of chemical shift (ppm) relative to residual solvent peak (CDCl$_3$: 77.0 ppm). Reactions were monitored by thin layer chromatography (TLC) using silica gel plates. Flash column chromatography was performed over silica gel (300-400 mesh). Dichloromethane, dichloroethane, toluene were freshly distilled from CaH$_2$; THF and MTBE was freshly distilled from sodium metal prior to use. The substrate $^{1}$a-1l, $^{2}$a-2o, $^{3}$m were synthesized according to the procedure of references. In addition, the spectral data of the substrates were consisted with the literature.
2. Screening the Known Ligands

![Chemical structures and reactions](image)

3. Table S1. Optimization of Reaction Conditions

<table>
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<th>Entry</th>
<th>[M]</th>
<th>Solvent</th>
<th>T (°C)</th>
<th>Dr</th>
<th>Yield (Ee) [%]</th>
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<td>Cu(CH3CN)4BF4</td>
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<td>Acetone</td>
<td>-30</td>
<td>&gt;20:1</td>
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*All reactions were carried out with 0.1 mmol of 1a, 0.2 mmol of 2a, 5 mol% of catalyst ([Cu] to Ligand = 1:1.1) in 2.0 mL THF at -30 °C for 2-8 h. The yield of 3aa (exo-product). The yield of 3aa’ (endo-product). NMR yield with CH2Br2 as an internal standard. The diastereomeric ratios were determined by 1H, 13C NMR analysis of the crude products. The ee of 3aa (exo-product). Determined by chiral HPLC.
| 8 | Cu(CH$_3$CN)$_4$BF$_4$ | Toluene | -30 | >20:1 | 80(99) |
| 9 | Cu(CH$_3$CN)$_4$BF$_4$ | tPr$_2$O | -30 | >20:1 | 88(99) |
| 10 | Cu(CH$_3$CN)$_4$BF$_4$ | MTBE | -30 | >20:1 | 89(98) |
| 11 | Cu(CH$_3$CN)$_4$BF$_4$ | Et$_2$O | -30 | >20:1 | 87(98) |
| 12 | Cu(CH$_3$CN)$_4$BF$_4$ | THF | -20 | >20:1 | 93(98) |
| 13 | Cu(CH$_3$CN)$_4$BF$_4$ | THF | 0 | >20:1 | 92(97) |
| 14 | Cu(CH$_3$CN)$_4$BF$_4$ | THF | 20 | >20:1 | 80(94) |

[a] All reactions were carried out with 0.1 mmol of 1a, 0.2 mmol of 2a, 5 mol\% of catalyst ([Cu] to Ligand = 1:1.1) in 2.0 mL THF at -30 °C for 4-12 h. [b] The diastereomeric ratios were determined by $^1$H, $^{19}$F NMR analysis of the crude products. [c] NMR yield with CH$_2$Br$_2$ as an internal standard. [d] Determined by chiral HPLC.


**Typical procedure for asymmetric copper-catalyzed cycloaddition of enones with azomethine ylides.**

The solution of ligand (5.5 mol\%) and Cu(CH$_3$CN)$_4$BF$_4$ (5 mol\%) in THF (4 mL) was stirred at room temperature for 2 h. After the reaction temperature was dropped to -30 °C, azomethine ylides 2 (0.4 mmol), Cs$_2$CO$_3$ (0.1 mmol) and enones 1 (0.2 mmol) were added sequentially. The reaction was determined by TLC analysis. After the enones 1 were consumed completely, the solvent was removed under reduced pressure. The crude product was analyzed with $^1$H NMR and $^{19}$F NMR to determine the diastereomeric ratio. Then the crude product was then purified by flash column chromatography on silica gel to afford the desired product. The enantionmeric excesses of the products were determined by chiral stationary phase HPLC using a Chiralpak IC, IE, IF, OZ-3 and AD-H.

#### 4.1 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3aa).

![Structure of 3aa](image)

The reaction of enone 1a (50.0 mg, 0.2 mmol) and iminoester 2a (102.4 mg, 0.4 mmol),...
after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product **3aa** as a colorless ropy liquid (99.6 mg, 99% yield) with > 20:1 d.r. and 98% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.77-7.72 (m, 2 H), 7.43-7.37 (m, 4 H), 7.25-7.23 (m, 2 H), 4.76 (d, \(J = 8.9\) Hz, 1 H), 4.18 (d, \(J = 9.0\) Hz, 1 H), 3.82 (s, 1 H), 3.81 (s, 3 H), 2.68 (s, 1 H), 1.35 (s, 3 H). \(^{19}\)F NMR (282 MHz, CDCl\(_3\)) \(\delta\) -71.15. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 197.22, 169.87, 140.61, 138.21, 135.46, 132.02, 129.73, 129.19, 128.18, 126.35 (q, \(J_{C-F} = 282.1\) Hz), 122.09, 68.97, 65.33, 57.46 (q, \(J = 23.8\) Hz), 56.13, 52.57, 16.91 (d, \(J = 2.6\) Hz). MS (EI): m/z (%) = 503 (M\(^+\), 9.54), 139 (100); HRMS calculated for \([\text{C}_{21}\text{H}_{18}\text{NO}_3\text{F}_3\text{ClBr}]^+\): 503.0111 found: 503.0105. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer \(t_r = 19.9\) min, major enantiomer \(t_r = 17.2\) min. \([\alpha]_D^{20} = 13.0\) (c = 0.25, CHCl\(_3\)).

**4.2 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-5-(4-fluorophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ab).**

![Image of 3ab](image)

The reaction of enone **1a** (50.0 mg, 0.2 mmol) and azomethine ylide **2b** (78.0 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product **3ab** as a colorless ropy liquid (87.7 mg, 99% yield) with > 20:1 d.r. and 97% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.76-7.73 (m, 2 H), 7.40-7.33 (m, 4 H), 7.00-6.95 (m, 2 H), 4.77 (d, \(J = 9.0\) Hz, 1 H), 4.20 (d, \(J = 9.0\) Hz, 1 H), 3.83-3.81 (m, 4 H), 2.66 (s, 1 H), 1.36 (s, 3 H). \(^{19}\)F NMR (282 MHz, CDCl\(_3\)) \(\delta\) -71.16, -113.67. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 197.34, 169.94, 162.42 (d, \(J = 246.9\) Hz), 140.54, 135.55, 134.87 (d, \(J = 3.2\) Hz), 129.70, 129.15, 128.22 (d, \(J = 8.2\) Hz), 127.83 (q, \(J_{C-F} = 281.8\) Hz), 115.84 (d, \(J = 21.4\) Hz), 69.04, 65.45, 57.54 (q, \(J = 23.7\) Hz), 56.33, 52.56, 16.95 (d, \(J = 2.7\) Hz). MS (EI): m/z (%) = 443 (M\(^+\), 18.12), 139 (100); HRMS calculated for \([\text{C}_{21}\text{H}_{18}\text{NO}_3\text{F}_4\text{Cl}]^+\): 443.0911 found: 443.0907. Enantiomeric excess was determined by
HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 21.2 min, major enantiomer tr = 15.6 min. $[\alpha]_D^{20} = 5.7$ ($c = 0.50$, CHCl$_3$).

4.3 Synthesis of methyl (2$S$, 3$R$, 4$R$, 5$R$)-4-(4-chlorobenzoyl)-5-(4-chlorophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ac).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2c (84.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ac as a colorless ropy liquid (89.6 mg, 98% yield) with > 20:1 d.r. and 99% ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.78-7.74 (m, 2 H), 7.41-7.39 (m, 2 H), 7.33-7.26 (m, 4 H), 4.79 (d, $J = 8.7$ Hz, 1 H), 4.20 (d, $J = 8.9$ Hz, 1 H), 3.85-3.81 (m, 4 H), 2.71 (s, 1 H), 1.36 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) $\delta$ -71.15. $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 197.24, 169.89, 140.59, 137.65, 135.45, 133.94, 129.72, 129.17, 129.07, 127.85, 126.35 (q, $J_{C,F} = 281.8$ Hz), 68.96, 65.30, 57.46 (q, $J = 23.4$ Hz), 56.18, 52.57, 16.91. MS (EI): m/z (%) = 459 (M$^+$, 14.34), 139 (100); HRMS calculated for [C$_{21}$H$_{18}$NO$_3$F$_3$Cl$_2$]$^+$: 459.0616 found: 459.0613. Enantiomeric excess was determined by HPLC with a Chiralpak IE column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 25.0 min, major enantiomer tr = 34.6 min. $[\alpha]_D^{20} = 10.3$ ($c = 0.50$, CHCl$_3$).

4.4 Synthesis of methyl (2$S$, 3$R$, 4$R$, 5$R$)-4-(4-chlorobenzoyl)-5-(4-cyanophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ad).
The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2d (80.8 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ad as a colorless ropy liquid (87.0 mg, 97% yield) with > 20:1 d.r. and 98% ee. ¹H NMR (400 MHz, CDCl₃) δ 7.75-7.73 (m, 2 H), 7.57 (d, J = 8.2 Hz, 2 H), 7.50 (d, J = 8.1 Hz, 2 H), 7.40-7.37 (m, 2 H), 4.89 (d, J = 8.8 Hz, 1 H), 4.18 (d, J = 8.9 Hz, 1 H), 3.85 (s, 1 H), 3.80 (s, 3 H), 2.71 (s, 1 H), 1.35 (s, 3 H). ¹³C NMR (101 MHz, CDCl₃) δ 196.79, 169.96, 144.96, 140.82, 135.27, 132.64, 129.70, 129.24, 127.47 (q, J_C-F = 281.5 Hz), 127.28, 118.35, 112.00, 68.58, 64.90, 57.13 (q, J = 25.1, 24.6 Hz), 55.71, 52.57, 16.82 (d, J = 2.7 Hz). MS (EI): m/z (%) = 450 (M⁺, 18.42), 139 (100); HRMS calculated for [C₂₂H₁₈N₂O₃F₃Cl⁺]: 450.0958 found: 450.0955. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 90:10, 0.8 mL/min, 254 nm); minor enantiomer tr = 40.6 min, major enantiomer tr = 24.7 min. [α]D²⁰ = 1.8 (c = 0.25, CHCl₃).

4.5 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)-5-(4-(trifluoromethyl)phenyl)pyrroloidine-2-carboxylate (3ae).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2e (98.0 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ae as a colorless ropy liquid (93.5 mg, 95% yield) with > 20:1 d.r. and 99% ee. ¹H NMR (400 MHz, CDCl₃) δ 7.79-7.75 (m, 2 H), 7.55 (d, J = 8.2 Hz, 2 H), 7.49 (d, J = 8.2 Hz, 2 H), 7.42-7.38 (m, 2 H), 4.90 (d, J = 8.8 Hz, 1 H), 4.22 (d, J = 9.0 Hz, 1 H), 3.86 (s, 1 H), 3.82 (s, 3 H), 2.74 (s, 1 H), 1.36 (s, 3 H). ¹⁹F NMR (282 MHz, CDCl₃) δ -71.10. ¹³C NMR (101 MHz, CDCl₃) δ 197.44, 170.15, 143.69, 141.09, 135.71, 130.69 (q, J = 32.5 Hz), 130.10, 129.57, 128.05 (q, J_C-F = 281.8 Hz), 127.19, 126.20 (q, J = 3.8 Hz), 124.15 (q, J_C-F = 270.52 Hz), 69.25, 65.52, 57.74 (q, J = 23.9 Hz), 56.38, 52.92, 17.19 (d, J = 2.7 Hz). MS (EI): m/z (%) = 493 (M⁺, 16.25), 139 (100);
HRMS calculated for \([\text{C}_{22}\text{H}_{18}\text{NO}_{3}\text{F}_{6}\text{Cl}]^+\): 493.0879 found: 493.0876. Enantiomeric excess was determined by HPLC with a Chirapak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer \(t_r = 12.5\) min, major enantiomer \(t_r = 11.2\) min. \([\alpha]_D^{20} = 15.2\) (\(c = 0.25, \text{CHCl}_3\)).

4.6 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-5-(4-methoxyphenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3af).

![Chemical Structure](image)

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2f (83.0 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3af as a colorless ropy liquid (90.1 mg, 99% yield) with > 20:1 d.r. and 96% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.76-7.73 (m, 2 H), 7.38-7.35 (m, 2 H), 7.30-7.26 (m, 2 H), 6.83-6.79 (m, 2 H), 4.72 (d, \(J = 8.9\) Hz, 1 H), 4.22 (d, \(J = 9.0\) Hz, 1 H), 3.81-3.80 (m, 4 H), 3.73 (s, 3 H), 2.64 (s, 1 H), 1.35 (s, 3 H). \(^{19}\)F NMR (282 MHz, CDCl\(_3\)) \(\delta\) -71.16. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 197.60, 169.89, 159.34, 140.30, 135.68, 130.85, 129.69, 129.05, 127.95 (q, \(J_{C-F} = 281.8\) Hz), 127.65, 114.20, 69.22, 65.92, 57.71 (q, \(J = 23.5\) Hz), 56.43, 55.13, 52.48, 16.96 (d, \(J = 2.5\) Hz). MS (EI): m/z (%) = 455 (M\(^+\), 25.23), 139 (100); HRMS calculated for \([\text{C}_{22}\text{H}_{21}\text{NO}_{4}\text{F}_{3}\text{Cl}]^+\): 455.1111 found: 455.1107.

Enantiomeric excess was determined by HPLC with a Chirapak IE column (hexanes: 2-propanol = 90:10, 0.8 mL/min, 210 nm); minor enantiomer \(t_r = 22.5\) min, major enantiomer \(t_r = 35.1\) min. \([\alpha]_D^{20} = 8.5\) (\(c = 0.50, \text{CHCl}_3\)).

4.7 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-3-methyl -5-(p-tolyl)-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ag).
The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2g (76.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ag as a colorless ropy liquid (85.8 mg, 98% yield) with > 20:1 d.r. and 94% ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.77-7.74 (m, 2 H), 7.39-7.36 (m, 2 H), 7.23 (d, $J =$ 7.9 Hz, 2 H), 7.10 (d, $J =$ 7.7 Hz, 2 H), 4.75 (d, $J =$ 8.9 Hz, 1 H), 4.24 (d, $J =$ 8.9 Hz, 1 H), 3.82-3.81 (m, 4 H), 2.76 (s, 1 H), 2.28 (s, 3 H), 1.35 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) $\delta$ -71.15. $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 197.62, 169.79, 140.32, 137.93, 135.80, 135.65, 129.74, 129.56, 129.06, 127.98 (q, $J_{C-F}$ = 281.2 Hz), 126.28, 69.31, 66.13, 57.77 (q, $J =$ 21.5 Hz). MS (EI): m/z (%) = 439 (M$^+$, 23.93), 139 (100); HRMS calculated for [C$_{22}$H$_{21}$NO$_3$F$_3$Cl]$^+$: 439.1162 found: 439.1165.

Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 37.3 min, major enantiomer tr = 30.5 min. $[\alpha]_D^{20}$ = 12.4 ($c =$ 0.50, CHCl$_3$).

4.8 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(1,1'-biphenyl)-4-(4-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ah).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2h (101.2 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ah as a colorless ropy liquid (99.9 mg, > 99% yield) with > 20:1 d.r. and 97% ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.83-7.79 (m, 2 H), 7.55-7.53 (m, 4 H), 7.45-7.38 (m, 6 H), 7.35-7.31 (m, 1 H), 4.87 (d, $J =$ 8.9 Hz, 1 H), 4.31 (d, $J =$ 9.0 Hz, 1 H), 3.87 (s, 1
H), 3.83 (s, 3 H), 2.82 (s, 1 H), 1.39 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.08. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.54, 169.81, 141.01, 140.44, 140.28, 137.95, 135.61, 129.78, 129.12, 128.73, 127.95 (q, $J_{C-F} = 281.2$ Hz), 127.57, 127.39, 126.93, 126.85, 69.26, 65.90, 57.72 (q, $J = 23.5$ Hz), 56.34, 52.53, 16.94 (d, $J = 2.6$ Hz). MS (EI): m/z (%) = 501 (M$^+$, 30.27), 44 (100); HRMS calculated for [C$_{27}$H$_{23}$NO$_3$F$_3$Cl]$^+$: 501.1319 found: 501.1314. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 34.0 min, major enantiomer tr = 27.4 min. $[\alpha]_{D}^{20} = -3.5$ (c = 0.50, CHCl$_3$).

4.9 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-5-methyl-3-phenyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ai).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2i (70.8 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ai as a colorless ropy liquid (84.6 mg, > 99% yield) with > 20:1 d.r. and 92% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.78-7.74 (m, 2 H), 7.39-7.34 (m, 4 H), 7.32-7.24 (m, 3 H), 4.80 (d, $J = 8.9$ Hz, 1 H), 4.26 (d, $J = 9.0$ Hz, 1 H), 3.85-3.84 (m, 1 H), 3.81 (s, 3 H), 2.78 (s, 1 H), 1.37 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.16. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.55, 169.78, 140.37, 138.93, 135.65, 129.72, 129.08, 128.91, 128.20, 127.96 (q, $J_{C-F} = 281.8$ Hz), 126.40, 69.28, 66.26, 57.73 (q, $J = 23.6$ Hz), 56.44, 52.50, 16.94 (q, $J = 2.6$ Hz). MS (EI): m/z (%) = 425 (M$^+$, 20.47), 139 (100); HRMS calculated for [C$_{21}$H$_{19}$NO$_3$F$_3$Cl]$^+$: 425.1006 found: 425.1004. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 28.5 min, major enantiomer tr = 21.0 min. $[\alpha]_{D}^{20} = -13.9$ (c = 0.25, CHCl$_3$).

4.10 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-chlorobenzoyl)-5-(3-chlorophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3aj).
The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2j (84.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3aj as a colorless ropy liquid (90.8 mg, 99% yield) with > 20:1 d.r. and 92% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.79-7.75 (m, 2 H), 7.41-7.38 (m, 3 H), 7.24-7.20 (m, 3 H), 4.78 (d, $J = 8.9$ Hz, 1 H), 4.20 (d, $J = 8.9$ Hz, 1 H), 3.83-3.82 (m, 4 H), 2.70 (s, 1 H), 1.35 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.13. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.19, 169.78, 141.28, 140.62, 135.48, 134.80, 130.18, 129.78, 129.19, 128.43, 126.76, 126.37 (q, $J_{C-F} = 281.8$ Hz), 124.67, 68.99, 65.35, 57.43 (q, $J = 23.8$ Hz), 56.12, 52.59, 16.91-16.86 (m, 1 C). MS (EI): m/z (%) = 459 (M$^+$, 14.63), 139 (100); HRMS calculated for [C$_2$H$_{18}$NO$_3$F$_3$Cl$_2$]$^+$: 459.0616 found: 459.0608.

Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 18.3 min, major enantiomer tr = 16.8 min. $[\alpha]_D^{20} = 17.5$ (c = 0.25, CHCl$_3$).

4.11 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(3-bromophenyl)-4-(4-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ak).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2k (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ak as a colorless ropy liquid (99.3 mg, 98% yield) with > 20:1 d.r. and 92% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.78-7.75 (m, 2 H), 7.55 (t, $J = 1.8$ Hz, 1 H), 7.42-7.37 (m, 3 H), 7.26 (t, $J = 3.9$ Hz, 1 H), 7.15 (t, $J = 7.8$ Hz, 1 H), 4.78 (d, $J = 8.9$ Hz, 1
H), 4.19 (d, J = 8.9 Hz, 1 H), 3.84-3.82 (s, 4 H), 2.70 (s, 1 H), 1.34 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.12. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.17, 169.76, 141.51, 140.62, 135.44, 131.37, 130.45, 129.79, 129.66, 129.19, 126.34 (q, $J_{C-F}$ = 281.2 Hz), 125.11, 122.98, 68.94, 65.25, 57.39 (q, $J_{C}$ = 25.1 Hz), 56.07, 52.60, 16.89. MS (EI): m/z (%) = 503 (M$^+$, 9.08), 139 (100); HRMS calculated for [C$_{21}$H$_{18}$NO$_3$F$_3$ClBr]$^+$: 503.0111 found: 503.0094.

Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 19.1 min, major enantiomer tr = 16.6 min. [α]$_D^{20}$ = 2.1 (c = 0.50, CHCl$_3$).

4.12 Synthesis of methyl (2$S$, 3$R$, 4$R$, 5$R$)-4-(4-chlorobenzoyl)-3-methyl-5-(naphthalene-2-yl)-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3a).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2l (91.0 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3al as a colorless ropy liquid (94.6 mg, > 99% yield) with > 20:1 d.r. and 95% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.81-7.76 (m, 6 H), 7.51-7.43 (m, 3 H), 7.37-7.34 (m, 2 H), 4.99 (d, J = 8.9 Hz, 1 H), 4.36 (d, J = 8.9 Hz, 1 H), 3.91 (s, 1 H), 3.84 (s, 3 H), 2.91 (s, 1 H), 1.40 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.08. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.57, 169.86, 140.42, 136.29, 135.59, 133.17, 133.02, 129.74, 129.08, 128.93, 127.97 (q, $J_{C-F}$ = 281.9 Hz), 127.92, 127.58, 126.36, 126.19, 125.60, 123.94, 69.27, 66.30, 57.69 (q, J = 23.6 Hz), 56.40, 52.56, 16.99 (d, J = 2.7 Hz). MS (EI): m/z (%) = 475 (M$^+$, 31.26), 139 (100); HRMS calculated for [C$_{25}$H$_{21}$NO$_3$F$_3$Cl]$^+$: 475.1162 found: 475.1160. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 26.6 min, major enantiomer tr = 23.2 min. [α]$_D^{20}$ = 26.1 (c = 0.25, CHCl$_3$).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2m (81.2 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3am as a colorless ropy liquid (89.3 mg, 99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.91-7.87 (m, 2 H), 7.46-7.42 (m, 2 H), 7.31-7.20 (m, 5 H), 6.57-6.53 (m, 1 H), 6.25-6.19 (m, 1 H), 4.40 (t, $J = 7.9$ Hz, 1 H), 4.10 (d, $J = 8.3$ Hz, 1 H), 3.81 (s, 3 H), 3.79 (d, $J = 1.5$ Hz, 1 H), 2.47 (s, 1 H), 1.34 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.32. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 197.39, 169.94, 140.55, 135.86, 135.70, 133.13, 129.85, 129.20, 128.54, 128.05, 127.75 (q, $J_{C-F}$ = 281.8 Hz), 126.72, 126.50, 69.10, 64.86, 57.56 (q, $J = 23.4$ Hz), 54.89, 52.56, 16.81 (d, $J = 2.7$ Hz). MS (EI): m/z (%) = 451 (M$^+$, 27.48), 139 (100); HRMS calculated for [C$_{23}$H$_{21}$NO$_3$F$_3$Cl]$^+$: 451.1162 found: 451.1158. Enantiomeric excess was determined by HPLC with a Chiralpak AD-H column (hexanes: 2-propanol = 90:10, 0.5 mL/min, 254 nm); minor enantiomer tr = 23.3 min, major enantiomer tr = 32.9 min. $[\alpha]_D^{20} = 13.3 (c = 0.25, \text{CHCl}_3)$.

4.14 Synthesis of methyl (2S, 3R, 4R, 5S)-4-(4-chlorobenzoyl)-5-cyclohexyl-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3an).

The reaction of enone 1a (50.0 mg, 0.2 mmol) and azomethine ylide 2n (73.2 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3an as a colorless ropy liquid (79.3 mg, 92% yield) with > 20:1 d.r. and 90% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.95-7.91 (m, 2 H), 7.49-7.45 (m, 2 H), 3.89 (d, $J =$
7.9 Hz, 1 H), 3.76 (s, 3 H), 3.65 (d, \( J = 1.6 \) Hz, 1 H), 3.55 (t, \( J = 8.3 \) Hz, 1 H), 2.32 (s, 1 H), 1.98-1.94 (m, 1 H), 1.73-1.68 (m, 1 H), 1.61-1.55 (m, 2 H), 1.39-1.21 (m, 4 H), 1.18 (s, 3 H), 1.12-1.04 (m, 2 H), 0.90-0.84 (m, 1 H). \(^{19}\)F NMR (282 MHz, CDCl\(_3\)) \( \delta \) -71.19. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \( \delta \) 197.96, 169.41, 140.42, 135.26, 129.89, 129.28, 128.28 (q, \( J_{C-F} = 282.2 \) Hz), 69.20, 68.71, 57.32 (q, \( J = 22.6 \) Hz), 53.47, 52.40, 42.25, 30.83, 30.63, 26.11, 25.85, 25.64, 16.31 (d, \( J = 2.8 \) Hz). MS (EI): m/z (%) = 431 (M\(^+\), 13.60), 139 (100); HRMS calculated for \([C_{21}H_{25}NO_3F_3Cl]^+\): 431.1475 found: 431.1473.

Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 17.1 min, major enantiomer tr = 11.0 min. \([\alpha]_{D}^{20} = 35.1 \) (c = 0.25, CHCl\(_3\)).

4.15 Synthesis of methyl (2S, 3R, 4R, 5R)-4-benzoyl-5-(4-bromophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ba).

The reaction of enone 1b (42.8 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ba as a colorless ropy liquid (89.9 mg, 96% yield) with > 20:1 d.r. and 90% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \( \delta \) 7.84-7.82 (m, 2 H), 7.69-7.55 (m, 1 H), 7.45-7.41 (m, 4 H), 7.28-7.25 (m, 2 H), 4.81 (d, \( J = 8.8 \) Hz, 1 H), 4.27 (d, \( J = 8.9 \) Hz, 1 H), 3.84 (s, 1 H), 3.81 (s, 3 H), 2.71 (s, 1 H), 1.36 (s, 3 H). \(^{19}\)F NMR (282 MHz, CDCl\(_3\)) \( \delta \) -71.17. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \( \delta \) 198.48, 169.82, 138.34, 137.16, 133.90, 131.95, 128.81, 128.34, 128.22, 127.85 (q, \( J_{C-F} = 281.8 \) Hz), 121.95, 69.03, 65.27, 57.41 (q, \( J = 23.7 \) Hz), 56.08, 52.53, 16.84 (d, \( J = 2.6 \) Hz). MS (EI): m/z (%) = 469 (M\(^+\), 9.80), 105 (100); HRMS calculated for \([C_{21}H_{19}NO_3F_3Br]^+\): 469.0500 found: 469.0497. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 21.8 min, major enantiomer tr = 17.2 min. \([\alpha]_{D}^{20} = 0.7 \) (c = 0.25, CHCl\(_3\)).

4.16 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4-fluorobenzoyl)-3-
methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ca).

The reaction of enone 1c (46.1 mg, 0.20 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ca as a colorless ropy liquid (97.3 mg, > 99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (400 MHz, CDCl₃) δ 7.87-7.83 (m, 2 H), 7.41-7.38 (m, 2 H), 7.26-7.23 (m, 2 H), 7.11-7.06 (m, 2 H), 4.77 (d, J = 8.8 Hz, 1 H), 4.19 (d, J = 9.0 Hz, 1 H), 3.82 (s, 1 H), 3.80 (s, 3 H), 2.69 (s, 1 H), 1.34 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl₃) δ -71.15, -103.34. $^{13}$C NMR (101 MHz, CDCl₃) δ 196.72, 169.85, 166.15 (d, J = 256.9 Hz), 138.26, 133.59 (d, J = 2.9 Hz), 131.96, 131.11 (d, J = 9.6 Hz), 128.17, 127.78 (q, J_{CF} = 281.2 Hz), 122.00, 116.01 (d, J = 22.0 Hz), 68.94, 65.26, 57.36 (q, J = 23.8 Hz), 56.05, 52.53, 16.85-16.80 (m, 1 C). MS (EI): m/z (%) = 487 (M⁺, 8.66), 123 (100); HRMS calculated for [C₂₁H₁₈NO₃F₄Br]⁺: 487.0406 found: 487.0403. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 17.7 min, major enantiomer tr = 15.4 min. [α]D⁰ = 1.0 (c = 0.25, CHCl₃)

4.17 Synthesis of methyl (2S, 3R, 4R, 5R)-4-(4-bromobenzoyl)-5-(4-bromophenyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3da).

The reaction of enone 1d (58.4 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3da as a colorless ropy liquid (102.1 mg, 93% yield) with 12:1 d.r. and 98%
ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.67-7.65 (m, 2 H), 7.56-7.53 (m, 2 H), 7.41-7.38 (m, 2 H), 7.25-7.23 (m, 2 H), 4.76 (d, $J = 8.9$ Hz, 1 H), 4.17 (d, $J = 9.0$ Hz, 1 H), 3.82 (s, 1 H), 3.80 (s, 3 H), 2.69 (s, 1 H), 1.34 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) $\delta$ -71.12.

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 197.39, 169.83, 138.16, 135.78, 132.13, 131.97, 129.75, 129.42, 128.14, 127.70 ($q$, $J_{C-F} = 282.0$ Hz), 122.04, 68.89, 65.26, 57.38 ($q$, $J = 23.8$ Hz), 56.04, 52.54, 16.86 (d, $J = 9.2$ Hz). MS (EI): m/z (%) = 547 (M$^+$, 10.44), 183 (100); HRMS calculated for [C$_{21}$H$_{18}$NO$_3$F$_3$Br$_2$]$^+$: 546.9606 found: 546.9603. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 20.8 min, major enantiomer tr = 18.2 min. $[^\alpha]_D^{20} = 17.9$ (c = 0.25, CHCl$_3$).

4.18 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-3-methyl-3-(trifluoromethyl)-4-(4-(trifluoromethyl)benzoyl)pyrrolidine-2-carboxylate (3ea).

![3ea](image)

The reaction of enone 1e (56.4 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ea as a colorless ropy liquid (107.1 mg, >99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.91 (d, $J = 8.1$ Hz, 2 H), 7.69 (d, $J = 8.2$ Hz, 2 H), 7.45-7.42 (m, 2 H), 7.29-7.27 (m, 2 H), 4.79 (t, $J = 9.2$ Hz, 1 H), 4.25 (d, $J = 9.1$ Hz, 1 H), 3.87-3.83 (m, 4 H), 2.72 (t, $J = 9.7$ Hz, 1 H), 1.38 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) $\delta$ -63.29, -71.18. $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 197.74, 169.90, 139.72, 138.06, 134.97 ($q$, $J = 32.7$ Hz), 132.09, 128.61, 128.20, 127.66 ($q$, $J_{C-F} = 281.7$ Hz), 125.90 ($q$, $J = 3.7$ Hz), 123.29 ($q$, $J_{C-F} = 271.4$ Hz), 122.22, 68.92, 65.39, 57.53 ($q$, $J = 24.0$ Hz), 56.52, 52.61, 17.07-16.83 (m, 1 C). MS (EI): m/z (%) = 537 (M$^+$, 10.84), 173 (100); HRMS calculated for [C$_{22}$H$_{18}$NO$_3$F$_6$Br]$^+$: 537.0374 found: 537.0377. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 13.1 min, major enantiomer tr = 12.0
min. $[\alpha]_{D}^{20} = -9.0$ \(c = 0.50, \text{CHCl}_3\).

4.19 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-3-methyl-4-(4-nitrobenzoyl)-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3fa).

The reaction of enone 1f (52.0 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3fa as a colorless ropy liquid (102.5 mg, > 99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.26-8.23 (m, 2 H), 7.93-7.89 (m, 2 H), 7.44-7.41 (m, 2 H), 7.30-7.27 (m, 2 H), 4.76 (d, $J = 9.2$ Hz, 1 H), 4.23 (d, $J = 9.2$ Hz, 1 H), 3.85 (s, 1 H), 3.82 (s, 3 H), 2.69 (s, 1 H), 1.38 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) $\delta$ -71.14. $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 197.33, 170.00, 150.56, 141.49, 137.92, 132.17, 129.24, 128.21, 127.53 (q, $J_{C-F} = 281.5$ Hz), 124.02, 122.38, 68.85, 65.52, 57.62 (q, $J = 23.9$ Hz), 56.87, 52.66, 17.14 (d, $J = 2.4$ Hz). MS (EI): m/z (%) = 514 (M$^+$, 16.85), 150 (100); HRMS calculated for [C$_{21}$H$_{18}$N$_2$O$_5$F$_3$Br]$^+$: 514.0351 found: 514.0355. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 90:10, 0.5 mL/min, 254 nm); minor enantiomer $tr = 29.1$ min, major enantiomer $tr = 32.5$ min. $[\alpha]_{D}^{20} = 17.0$ \(c = 0.25, \text{CHCl}_3\).

4.20 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-3-methyl-4-(4-methylbenzoyl)-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ga).

The reaction of enone 1g (45.6 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the
product 3ga as a colorless ropy liquid (95.0 mg, 98% yield) with > 20:1 d.r. and 98% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.75-7.73 (m, 2 H), 7.42-7.38 (m, 2 H), 7.25-7.21 (m, 4 H), 4.79 (t, \(J = 8.4\) Hz, 1 H), 4.23 (d, \(J = 8.9\) Hz, 1 H), 3.84-3.80 (m, 4 H), 2.71-2.66 (m, 1 H), 2.37 (s, 3 H), 1.34 (s, 3 H). \(^19\)F NMR (282 MHz, CDCl\(_3\)) \(\delta\) -71.16. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 197.88, 169.84, 145.04, 134.71, 131.90, 129.53, 128.54, 128.20, 127.91 (q, \(J_{C-F} = 282.0\) Hz), 121.87, 69.04, 65.22, 57.38 (q, \(J = 23.7\) Hz), 55.91, 52.51, 21.62, 16.79 (d, \(J = 2.6\) Hz). MS (EI): m/z (%) = 483 (M\(^+\), 9.48), 119 (100); HRMS calculated for [C\(_{22}\)H\(_{21}\)NO\(_3\)F\(_3\)Br]: 483.0657 found: 483.0659. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 22.3 min, major enantiomer tr = 19.1 min. \([\alpha]_{D}^{20} = -0.2\) (c = 0.25, CHCl\(_3\)).

4.21 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4-methoxybenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ha).

The reaction of enone 1h (48.8 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ha as a colorless ropy liquid (92.5 mg, 93% yield) with > 20:1 d.r. and 98% ee. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.85-7.82 (m, 2 H), 7.41-7.39 (m, 2 H), 7.24-7.22 (m, 2 H), 6.91-6.87 (m, 2 H), 4.79 (d, \(J = 8.6\) Hz, 1 H), 4.19 (d, \(J = 8.8\) Hz, 1 H), 3.86-3.79 (m, 7 H), 2.68 (s, 1 H), 1.34 (s, 3 H). \(^19\)F NMR (282 MHz, CDCl\(_3\)) \(\delta\) -71.14. \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 196.54, 169.93, 164.24, 138.61, 131.96, 130.96, 130.29, 128.26, 128.05 (q, \(J_{C-F} = 281.6\) Hz), 121.90, 114.07, 69.12, 65.26, 57.40 (q, \(J = 23.4\) Hz), 55.79, 55.56, 52.58, 16.81. MS (EI): m/z (%) = 499 (M\(^+\), 8.96), 135 (100); HRMS calculated for [C\(_{22}\)H\(_{21}\)NO\(_4\)F\(_3\)Br]: 499.0604 found: 499.0610. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 35.2 min, major enantiomer tr = 26.5 min.
[α]_D^{20} = 22.2 (c = 0.25, CHCl₃).

4.22 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4,4-
dichlorobenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ia).

The reaction of enone 1i (56.4 mg, 0.2 mmol) and azomethine ylide 2a (102.6 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ia as a colorless ropy liquid (106.9 mg, > 99% yield) with > 20:1 d.r. and 98% ee. ^1H NMR (400 MHz, CDCl₃) δ 7.90 (d, J = 2.1 Hz, 1 H), 7.59-7.57 (m, 1 H), 7.48 (d, J = 8.4 Hz, 1 H), 7.43-7.40 (m, 2 H), 7.25-7.23 (m, 2 H), 4.74 (d, J = 9.0 Hz, 1 H), 4.12 (d, J = 9.1 Hz, 1 H), 3.81 (s, 4 H), 2.69 (s, 1 H), 1.35 (s, 3 H). ^19F NMR (282 MHz, CDCl₃) δ -71.10. ^13C NMR (101 MHz, CDCl₃) δ 196.25, 169.85, 138.74, 137.99, 136.51, 133.71, 132.08, 130.89, 130.19, 128.15, 127.65 (q, J_{C-F} = 281.8 Hz), 127.24, 122.21, 68.88, 65.37, 57.49 (q, J = 23.8 Hz), 56.27, 52.61, 16.96-16.91 (m, 1 C). MS (EI): m/z (%) = 537 (M⁺, 11.65), 173 (100); HRMS calculated for [C_{21}H_{17}NO_{3}Cl_{3}Br]⁺: 536.9721 found: 536.9718. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 15.3 min, major enantiomer tr = 13.4 min. [α]_D^{20} = -20.0 (c = 0.25, CHCl₃).

4.23 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-3-methyl-4-(3-nitrobenzoyl)-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ja).

The reaction of enone 1j (52.0 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4
mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ja as a colorless ropy liquid (102.1 mg, > 99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (400 MHz, CDCl$_3$) δ 8.64 (t, $J = 2.0$ Hz, 1 H), 8.41-8.39 (m, 2 H), 7.44-7.41 (m, 2 H), 7.30-7.26 (m, 2 H), 4.78 (t, $J = 9.2$ Hz, 1 H), 4.22 (d, $J = 9.2$ Hz, 1 H), 3.86-3.80 (m, 4 H), 2.72 (t, $J = 9.6$ Hz, 1 H), 1.38 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -71.09. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 196.48, 169.90, 148.53, 138.32, 137.86, 133.59, 132.17, 130.16, 128.24, 127.98, 127.59 (q, $J_{C,F} = 282.0$ Hz), 123.15, 122.36, 68.90, 65.50, 57.62 (q, $J = 24.0$ Hz), 56.65, 52.68, 17.11 (d, $J = 2.6$ Hz). MS (EI): m/z (%) = 514 (M$^+$, 1.07), 84 (100); HRMS calculated for [C$_{21}$H$_{18}$N$_2$O$_5$F$_3$Br]$^+$: 514.0351 found: 514.0356.

Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 210 nm); minor enantiomer tr = 43.0 min, major enantiomer tr = 38.9 min.

$[^{[α}]D]_{20} = -9.0$ (c = 0.25, CHCl$_3$).

**4.24 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(2-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ka).**

The reaction of enone 1k (50.0 mg, 0.2 mmol) and azomethine ylide 2a (73.2 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ka as a colorless ropy liquid (99.7 mg, 99% yield) with > 20:1 d.r. and 98% ee. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.48-7.46 (m, 2 H), 7.36-7.32 (m, 4 H), 7.24-7.19 (m, 1 H), 7.15-7.12 (m, 1 H), 4.75 (d, $J = 9.3$ Hz, 1 H), 4.19 (d, $J = 9.3$ Hz, 1 H), 3.79 (s, 4 H), 2.65 (s, 1 H), 1.45 (s, 3 H). $^{19}$F NMR (282 MHz, CDCl$_3$) δ -72.00. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 199.88, 169.70, 138.26, 138.05, 132.53, 131.98, 131.65, 131.12, 129.17, 128.68, 127.51 (q, $J_{C,F} = 282.0$ Hz), 126.81, 122.20, 68.93, 64.70, 60.42, 57.32 (q, $J = 24.0$ Hz), 52.53, 17.33. MS (EI): m/z (%) = 503 (M$^+$, 10.76), 139 (100); HRMS calculated for [C$_{21}$H$_{18}$NO$_3$F$_3$ClBr]$^+$: 503.0111 found: 503.0101. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5
mL/min, 210 nm); minor enantiomer tr = 21.5 min, major enantiomer tr = 18.4 min.
\([\alpha]_D^{20} = -109.0 \text{ (c = 0.50, CHCl}_3\).  

4.25 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4-chlorobenzoyl)-3-ethyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3la).

The reaction of enone 1l (52.4 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3la as a colorless ropy liquid (102.9 mg, >99% yield) with > 20:1 d.r. and 98% ee. 

\(^1\text{H NMR (400 MHz, CDCl}_3\) \(\delta 7.74-7.72 \text{ (m, 2 H), 7.41-7.35 \text{ (m, 4 H), 7.26-7.20 \text{ (m, 2 H), 4.62 \text{ (t, J = 8.2 Hz, 1 H), 4.18 \text{ (d, J = 9.4 Hz, 1 H), 3.90 \text{ (d, J = 6.4 Hz, 1 H), 3.81 \text{ (s, 3 H), 2.72 \text{ (s, 1 H), 2.14-2.04 \text{ (m, 1 H), 2.00-1.90 \text{ (m, 1 H), 0.85-0.80 \text{ (m, 3H). 19F NMR (282 MHz, CDCl}_3\) \(\delta -66.52. 13\text{C NMR (101 MHz, CDCl}_3\) \(\delta 197.42, 169.98, 140.49, 137.77, 135.74, 132.03, 129.51, 129.20, 128.21, 127.89 (q, J_{\text{C-F}} = 283.3 \text{ Hz), 122.19, 68.17, 66.61, 62.13 (q, J = 22.3 \text{ Hz), 56.26, 52.60, 24.66, 9.86 (d, J = 1.8 Hz). MS (EI): m/z (%) = 517 (M^+, 8.16), 139 (100); HRMS calculated for [C\textsubscript{22}H\textsubscript{20}NO\textsubscript{3}F\textsubscript{3}ClBr]^+: 517.0267 found: 517.0272. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 16.2 min, major enantiomer tr = 12.9 min. \([\alpha]_D^{20} = -30.9 \text{ (c = 0.25, CHCl}_3\).  

4.26 Synthesis of methyl (2S, 3S, 4R, 5S)-5-(4-bromophenyl)-4-nitro-3-phenyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (3ma).

The reaction of enone 1m (43.4 mg, 0.2 mmol) and azomethine ylide 2a (102.4 mg, 0.4 mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ma as a colorless ropy liquid (102.9 mg, >99% yield) with > 20:1 d.r. and 98% ee. 

\(^1\text{H NMR (400 MHz, CDCl}_3\) \(\delta 7.74-7.72 \text{ (m, 2 H), 7.41-7.35 \text{ (m, 4 H), 7.26-7.20 \text{ (m, 2 H), 4.62 \text{ (t, J = 8.2 Hz, 1 H), 4.18 \text{ (d, J = 9.4 Hz, 1 H), 3.90 \text{ (d, J = 6.4 Hz, 1 H), 3.81 \text{ (s, 3 H), 2.72 \text{ (s, 1 H), 2.14-2.04 \text{ (m, 1 H), 2.00-1.90 \text{ (m, 1 H), 0.85-0.80 \text{ (m, 3H). 19F NMR (282 MHz, CDCl}_3\) \(\delta -66.52. 13\text{C NMR (101 MHz, CDCl}_3\) \(\delta 197.42, 169.98, 140.49, 137.77, 135.74, 132.03, 129.51, 129.20, 128.21, 127.89 (q, J_{\text{C-F}} = 283.3 \text{ Hz), 122.19, 68.17, 66.61, 62.13 (q, J = 22.3 \text{ Hz), 56.26, 52.60, 24.66, 9.86 (d, J = 1.8 Hz). MS (EI): m/z (%) = 517 (M^+, 8.16), 139 (100); HRMS calculated for [C\textsubscript{22}H\textsubscript{20}NO\textsubscript{3}F\textsubscript{3}ClBr]^+: 517.0267 found: 517.0272. Enantiomeric excess was determined by HPLC with a Chiralpak IC column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor enantiomer tr = 16.2 min, major enantiomer tr = 12.9 min. \([\alpha]_D^{20} = -30.9 \text{ (c = 0.25, CHCl}_3\).
mmol), after a flash column chromatography (hexanes: AcOEt = 6:1) afforded the product 3ma as a colorless ropy liquid (71.7 mg, 76% yield) with > 20:1 d.r. and 98% ee. ^1H NMR (400 MHz, CDCl\textsubscript{3}) \(\delta\) 7.67-7.64 (m, 2 H), 7.58-7.55 (m, 2 H), 7.43-7.39 (m, 3 H), 7.29-7.26 (m, 2 H), 5.44 (d, \(J = 7.4\) Hz, 1 H), 4.94 (m, 2 H), 3.82 (s, 3 H), 3.09 (s, 1 H). ^19F NMR (282 MHz, CDCl\textsubscript{3}) \(\delta\) -66.19. ^13C NMR (101 MHz, CDCl\textsubscript{3}) \(\delta\) 168.11, 135.17, 132.52, 131.13, 129.43, 128.76, 128.11, 127.83 (q, \(J = 2.0\) Hz), 126.15 (q, \(J_{C\text{-}F} = 284.7\) Hz), 123.30, 96.54, 66.92, 66.62, 66.13 (d, \(J = 22.7\) Hz), 53.14. ESI-MS calculated for C\textsubscript{19}H\textsubscript{17}BrF\textsubscript{3}N\textsubscript{2}O\textsubscript{4}: m/z (%): 473.0318 (M+Na\textsuperscript{+}), found: 473.0315.

Enantiomeric excess was determined by HPLC with a Chiralpak AD-H column (hexanes: 2-propanol = 80:20, 0.8 mL/min, 210 nm); minor enantiomer \(t_r = 18.6\) min, major enantiomer \(t_r = 11.2\) min. \([\alpha]_D^{20} = 31.1\) (c = 0.25, CHCl\textsubscript{3}).

**4.27 Synthesis of methyl (R)-5-(4-bromophenyl)-4-(4-chlorobenzoyl)-3-methyl-3-(trifluoromethyl)-3H-pyrrole-2-carboxylate (4).**

![Chemical Structure](image)

The solution of compound 3aa (100.6 mg, 0.2 mmol) in Toluene (2 mL) was stirred at 70 °C in a sealed tube. Subsequently, DDQ (2.0 mmol) added to the above solution. Then the reaction was determined by TLC analysis. After the 3aa was consumed completely, the reaction mixture was quenched by the addition of NaHCO\textsubscript{3} aq. and diluted with EtOAc. The organic layer was separated, and the aqueous layer was extracted twice with EtOAc. The combined organic layers were dried over Na\textsubscript{2}SO\textsubscript{4}, filtered, concentrated. The crude product was analyzed with \(^1H\) NMR and \(^19F\) NMR to determine the diastereomeric ratio. Then the crude product was then purified by flash column chromatography on silica gel (hexanes: AcOEt = 20:1) to afford the desired product 4 as a brown liquid (90.0 mg, 90% yield) with > 20:1 d.r. and 98% ee. \(^1H\) NMR (400 MHz, CDCl\textsubscript{3}) \(\delta\) 7.69 (d, \(J = 8.4\) Hz, 2 H), 7.45-7.41 (m, 2 H), 7.38-7.36 (m, 2 H), 7.29 (d, \(J = 8.4\) Hz, 2 H), 4.01 (s, 3 H), 2.08 (s, 3 H). \(^19F\) NMR (376 MHz, CDCl\textsubscript{3}) \(\delta\) -
67.28. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 191.35, 169.50, 160.49, 154.57, 140.86, 133.75, 131.81, 131.34, 130.61, 129.82, 129.26, 126.64 (q, $J_{C-F} = 282.2$ Hz), 125.00, 70.65 (q, $J = 28.1$, 27.6 Hz), 53.30, 16.29. MS (EI): m/z (%) = 499 (M$^+$, 13.16), 139 (100); HRMS calculated for [C$_{21}$H$_{14}$NO$_3$F$_3$ClBr]$^+$: 498.9798 found: 498.9793.

Enantiomeric excess was determined by HPLC with a Chiralpak AD-H column (hexanes: 2-propanol = 97:3, 0.5 mL/min, 233 nm); minor enantiomer tr = 15.4 min, major enantiomer tr = 17.1 min. [α]$_{D}^{20}$ = 197.0 ($c = 0.50$, CHCl$_3$).

4.28 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-((S)-4-chlorophenyl)(hydroxy)methyl)-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (5).

The solution of compound 3aa (100.6 mg, 0.2 mmol) in $^1$PrOH (2 mL) was stirred at 0 °C in a sealed tube. Subsequently, LiBH$_4$ (4.8 mg, 0.22 mmol) added to the above solution. The reaction was determined by TLC analysis. After the 3aa was consumed completely, remove the solvent under reduced pressure. The crude product was analyzed with $^1$H NMR and $^{19}$F NMR to determine the diastereomeric ratio. Then the crude product was then purified by flash column chromatography on silica gel (hexanes: AcOEt = 2:1) to afford the desired product 5 as a white solid (72.7 mg, 72% yield) with 7:1 d.r. and >99% ee. Mp: 74-75 °C. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.20-7.18 (m, 2 H), 7.00-6.97 (m, 2 H), 6.92-6.89 (m, 2 H), 6.63-6.59 (m, 2 H), 4.54 (d, $J = 9.0$ Hz, 1 H), 3.75 (s, 3 H), 3.50 (s, 1 H), 3.37 (d, $J = 9.1$ Hz, 1 H), 2.76 (t, $J = 9.1$ Hz, 1 H), 2.65 (s, 1 H), 2.37 (s, 1 H), 1.64 (s, 3 H). $^{19}$F NMR (376 MHz, CDCl$_3$) δ -71.87. $^{13}$C NMR (101 MHz, CDCl$_3$) δ 169.31, 139.34, 138.63, 134.22, 131.38, 128.84, 128.43, 128.33 (q, $J_{C-F} = 281.5$ Hz), 128.19, 121.26, 72.92, 69.14, 64.76, 56.96, 56.07 (q, $J = 23.1$ Hz), 52.44 (d, $J = 2.2$ Hz), 15.28. MS (EI): m/z (%) = 505 (M$^+$, 6.10), 255 (100); HRMS calculated for [C$_{21}$H$_{20}$NO$_3$F$_3$ClBr]$^+$: 505.0267 found: 505.0256. Enantiomeric excess was determined by HPLC with a Chiralpak OZ-3 column (hexanes: 2-propanol = 95:5, 0.5
mL/min, 210 nm); minor enantiomer tr = 54.9 min, major enantiomer tr = 25.2 min. 
\([\alpha]_D^{20} = -66.9 \ (c = 0.25, \text{CHCl}_3)\).

4.29 Synthesis of methyl (2S, 3R, 4R, 5R)-5-(4-bromophenyl)-4-(4-chlorobenzoyl)-1-
hydroxy-3-methyl-3-(trifluoromethyl)pyrrolidine-2-carboxylate (6).

The solution of compound 3aa (100.6 mg, 0.2 mmol) in DCM (2 mL) was stirred at 25
°C in a sealed tube. Subsequently, MCPBA (0.22 mmol) added to the above solution.
Then the reaction was determined by TLC analysis. After the 3aa was consumed
completely, the reaction mixture was quenched by the addition of NaHCO$_3$ aq. and
diluted with EtOAc. The organic layer was separated, and the aqueous layer was
extracted twice with EtOAc. The combined organic layers were dried over Na$_2$SO$_4$,
filtered, concentrated. The crude product was analyzed with $^1$H NMR and $^{19}$F NMR to
determine the diastereomeric ratio. Then the crude product was then purified by flash
column chromatography on silica gel (hexanes: AcOEt = 6:1) to afford the desired
product 6 as a white solid (62.3 mg, 60% yield) with > 20:1 d.r. and 99% ee. Mp: 119-
120 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.71–7.68 (m, 2 H), 7.45–7.37 (m, 4 H), 7.33-
7.30 (m, 2 H), 5.37 (s, 1 H), 4.51 (d, $J = 9.5$ Hz, 1 H), 4.05 (d, $J = 9.5$ Hz, 1 H), 3.82 (s,
3 H), 3.72 (s, 1 H), 1.31 (s, 3 H). $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -72.29. $^{13}$C NMR (126
MHz, CDCl$_3$) $\delta$ 195.81, 168.14, 140.87, 137.33, 135.38, 132.00, 129.84, 129.23, 128.94,
127.23 (q, $J_{C-F} = 281.9$ Hz), 122.28, 75.89, 71.01, 52.46, 52.01, 49.83 (q, $J = 26.2$ Hz),
17.30–17.25 (m, 1 C). ESI-MS calculated for C$_{21}$H$_{18}$BrClF$_3$NO$_4$Na: m/z: 541.99S8
(M+Na$^+$), found: 541.9852. Enantiomeric excess was determined by HPLC with a
Chiralpak IF column (hexanes: 2-propanol = 95:5, 0.5 mL/min, 254 nm); minor
enantiomer tr = 40.5 min, major enantiomer tr = 31.5 min. $[\alpha]_D^{20} = 21.6 \ (c = 0.25,
\text{CHCl}_3)$.

4.30 Synthesis of (2R,3R,4R)-2-(4-bromophenyl)-3-(4-chlorobenzoyl)-5-(methoxy-
carbonyl)-4-methyl-4-(trifluoromethyl)-3,4-dihydro-2H-pyrrole 1-oxide (7).

The solution of compound 3aa (100.6 mg, 0.2 mmol) in DCM (2 mL) was stirred at 25 °C in a sealed tube. Subsequently, MCPBA (0.42 mmol) added to the above solution. Then the reaction was determined by TLC analysis. After the 3aa was consumed completely, the reaction mixture was quenched by the addition of NaHCO₃ aq. and diluted with EtOAc. The organic layer was separated, and the aqueous layer was extracted twice with EtOAc. The combined organic layers were dried over Na₂SO₄, filtered, concentrated. The crude product was analyzed with ¹H NMR and ¹⁹F NMR to determine the diastereomeric ratio. Then the crude product was then purified by flash column chromatography on silica gel (hexanes: AcOEt = 6:1) to afford the desired product 7 as a white solid (51.7 mg, 50% yield) with >20:1 d.r. and >99% ee. Mp: 70-71 °C. ¹H NMR (400 MHz, CDCl₃) δ 7.76-7.73 (m, 2 H), 7.54-7.51 (m, 2 H), 7.46-7.42 (m, 2 H), 7.16-7.12 (m, 2 H), 5.76 (d, J = 8.6 Hz, 1 H), 4.54 (d, J = 8.6 Hz, 1 H), 3.93 (s, 3 H), 1.57 (s, 3 H). ¹⁹F NMR (376 MHz, CDCl₃) δ -72.61. ¹³C NMR (126 MHz, CDCl₃) δ 193.86, 159.40, 141.55, 134.51, 133.14, 132.56, 129.92, 129.64 (q, J_C-F = 281.8 Hz), 129.45, 129.24, 123.94, 79.03, 54.54 (q, J = 28.6 Hz), 52.97, 49.94, 29.68, 15.86. MS (EI): m/z (%) = 517 (M⁺, 1.23), 139 (100); HRMS calculated for [C₂₁H₁₆NO₄F₃ClBr]⁺: 516.9903 found: 516.9897. Enantiomeric excess was determined by HPLC with a Chiralpak AD-H column (hexanes: 2-propanol = 90:10, 0.8 mL/min, 254 nm); minor enantiomer tr = 37.3 min, major enantiomer tr = 25.1 min. [α]D²⁰ = -39.0 (c = 0.25, CHCl₃).
5. X-ray structures of 5 and 7.
6. $^{1}H$, $^{19}F$, $^{31}P$, $^{13}C$ NMR and HPLC Spectra
### Integration Results

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**Chromatogram**

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  - Peak 2: Retention Time = 12.883 min, Area = 9.445 mAU/min, Peak Height = 5.752 mAU, Relative Area = 0.83%, Relative Height = 1.07%

**NMR Spectrum**

- Details of the NMR spectrum at different chemical shifts.
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**Integration Results**
Chromatogram

Integration Results

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![Chromatogram Image]

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![Integration Results Table]

### Additional Structures

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**Note:** The peaks are labeled as 3ja and 3ka.
### Chromatogram

**Top Chromatogram**

![Chromatogram Image](image1)

#### Integration Results

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<td>100.00</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

**Bottom Chromatogram**

![Chromatogram Image](image2)

#### Integration Results

<table>
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<tr>
<th>No.</th>
<th>Peak Name</th>
<th>Retention Time (min)</th>
<th>Area (mAU*min)</th>
<th>Height (mAU)</th>
<th>Relative Area (%)</th>
<th>Relative Height (%)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>18.367</td>
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<td>231.542</td>
<td>98.90</td>
<td>98.81</td>
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<tr>
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<td>14.73</td>
<td>2.737</td>
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<td>1.12</td>
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</tr>
<tr>
<td>Total</td>
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<td>254.329</td>
<td>100.00</td>
<td>100.00</td>
<td>n.a.</td>
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</tbody>
</table>
### Chromatogram

![Chromatogram Image]

#### Integration Results

<table>
<thead>
<tr>
<th>No.</th>
<th>Peak Name</th>
<th>Retention Time</th>
<th>Area (mAU)</th>
<th>Height (mAU)</th>
<th>Relative Area (%)</th>
<th>Relative Height (%)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
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<td>100.00</td>
</tr>
</tbody>
</table>

![NMR Spectrum Image]
### Integration Results

<table>
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<tr>
<th>No.</th>
<th>Peak Name</th>
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<th>Area</th>
<th>Height</th>
<th>Relative Area</th>
<th>Relative Height</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
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<td>23.561</td>
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<tr>
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<td>60.989</td>
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<td>100.00</td>
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</tbody>
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7. References

