Supporting Information

Enantioselective bromination/semipinacol rearrangement for the synthesis of β-bromoketones containing an all-α-carbon quaternary center

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Context

Experimental details for new compounds--------------------------S2-S14

More information about substrate scope--------------------------S14-S19

X-Ray Ellipsoid Plots of 2a ---------------------------------------S19-S19

Copies of 1H and 13C spectra of new compounds-------------------S20-S67

Copies of HPLC Spectra for Products-----------------------------S68-S79
Experimental Details

General Information:

All reactions under standard conditions were monitored by thin-layer chromatography (TLC) on gel F254 plates. The silica gel (200-300 meshes) was used for column chromatography, and the distillation range of petroleum was 60-90 °C. CH₃OH and CCl₄ were purified under standard method. NBS was recrystallized with H₂O (23 mL H₂O per 1 g NBS). ¹HNMR and ¹³C NMR spectra were recorded in CDCl₃ solution on Bruker AX-400 MHz instruments and spectral data were reported in ppm relative to tetramethylsilane (TMS) as internal standard. IR spectra were recorded on a Nicolet FT-170SX spectrometer. Mass spectra (MS) were measured on spectrometer by direct inlet at 70 eV and signals were given in m/z with relative intensity (%) in brackets. High-resolution mass spectral analysis (HRMS) data were measured on the Bruker ApexII by means of the ESI technique. Enantioselectivities were determined by High performance liquid chromatography (HPLC) analysis employing a Daicel Chiralcel OZ-H, OJ or Chiralpak AD column.

General procedure for the synthesis of allylic alcohols 1:

Compound 1a was prepared as follows:

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t-BuLi (1.6 M in pentane, 4.3 mL, 6.9 mmol, 2 equiv) was added slowly to the solution of 2-bromopropene in dry THF (8 mL) under argon at -78 °C during 10 min. The resulting solution was stirred at -78 °C for 0.5 h. The benzophenone (0.629 g, 3.45 mmol, 1 equiv) was added, and the reaction mixture was stirred at -78 °C for 0.5 h then allowed warm to room temperature. When benzophenone was disappeared completely (TLC), water (3 mL) was added. The organic layer was separated and aqueous layer was extracted with Et₂O (2 × 50 mL). The combined organic layer was washed with brine (30 mL), dried over Na₂SO₄ and concentrated under vacuum. Purification of the residue by column chromatography on silica gel (ethyl acetate: petroleum ether = 1:50) to give product compound 1a as a colorless oil (0.6 g, 78% yield). Compounds 1b-1l
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were prepared in the similar methods.

\begin{center}
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**1a**

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.36-7.21 (m, 10 H), 5.12 (t, $J$ = 1.2 Hz, 1 H), 4.72 (s, 1 H), 2.50 (s, 1 H), 1.79 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 149.0, 144.8, 127.9, 127.6, 127.2, 115.5, 82.9, 20.0; MS (EI) m/z (%): 224 (M$^+$, 8), 209 (36), 183 (66), 120 (27), 105 (100), 77 (32), 40 (77); IR (cm$^{-1}$): 3474, 3059, 1642, 1447, 1026, 760, 701; HRMS (ESI) calcd for C$_{16}$H$_{16}$ONa [M+Na]$^+$: 247.1093, found 247.1095.

\begin{center}
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\end{center}

Prepared according to general procedure with petroleum ether /EtOAc = 50:1 as eluent to afford **1b** as a white amorphous solid (66% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.34-7.21 (m, 10 H), 5.16 (d, $J$ = 0.8 Hz, 1 H), 4.82 (d, $J$ = 0.8 Hz, 1 H), 2.50 (s, 1 H), 2.07 (q, $J$ = 7.4 Hz, 2 H), 1.03 (t, $J$ = 7.4 Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 154.9, 145.2, 127.8, 127.7, 127.2, 112.8, 83.5, 24.8, 12.6; MS (EI) m/z (%): 238 (M$^+$, 2), 209 (32), 183 (86), 118 (55), 105 (100), 77 (38); IR (cm$^{-1}$): 3482, 2963, 1639, 1445, 1020, 908, 758, 701; HRMS (ESI) calcd for C$_{17}$H$_{18}$ONa [M+Na]$^+$: 261.1250, found 261.1252.

\begin{center}
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Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford **1c** as a colorless oil (70% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.34-7.19 (m, 10 H), 5.15 (d, $J$ = 0.8 Hz, 1 H), 4.79 (s, 1 H), 2.52 (s, 1 H), 2.03 (t, $J$ = 8 Hz, 2 H), 1.51-1.41 (m, 2 H), 0.86 (t, $J$ = 7.2 Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 153.4, 145.2, 127.8, 127.7, 127.1, 113.5, 83.5, 34.1, 21.7, 14.1; MS (EI) m/z (%): 252 (M$^+$, 2), 209 (23), 183 (100), 132 (40), 105 (83), 77 (30); IR (cm$^{-1}$): 3475, 2959, 1639, 1447, 1019, 761, 701; HRMS (ESI) calcd for C$_{18}$H$_{19}$ [M-H$_2$O+H]$^+$: 235.1481, found 235.1486.
Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford **1d** as a colorless oil (54% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.34-7.25 (m, 10 H), 5.16 (s, 1 H), 4.79 (s, 1 H), 2.46 (s, 1 H), 2.06 (t, $J = 8.0$ Hz, 2 H), 1.46-1.39 (m, 2 H), 1.31-1.22 (m, 2 H), 0.84 (t, $J = 7.2$ Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 153.7, 145.3, 127.8, 127.7, 127.2, 113.6, 83.6, 31.8, 30.9, 22.7, 14.0; MS (EI) $m/z$ (%): 266 (M$^+$, 2), 209 (29), 183 (100), 146 (49), 105 (91), 77 (33); IR (cm$^{-1}$): 3475, 2956, 1639, 1447, 1021, 906, 762, 701; HRMS (ESI) calcd for C$_{19}$H$_{22}$O$_2$Na $[M+Na]^+$: 289.1563 found 289.1567.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford **1e** as a colorless oil (61% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.35-7.25 (m, 10 H), 5.16 (s, 1 H), 4.79 (s, 1 H), 2.46 (s, 1 H), 2.05 (t, $J = 8$ Hz, 2 H), 1.48-1.40 (m, 2 H), 1.28-1.21 (m, 4 H), 0.84 (t, $J = 6.8$ Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 153.7, 145.2, 127.8, 127.7, 127.2, 113.6, 83.6, 32.0, 31.8, 28.3, 22.5, 14.0; MS (EI) $m/z$ (%): 280 (M$^+$, 2), 209 (22), 183 (100), 160 (34), 105 (63), 77 (19), 40 (48); IR (cm$^{-1}$): 3459, 2926, 1640, 1447, 1021, 700; HRMS (ESI) calcd for C$_{20}$H$_{23}$ [M-H$_2$O+H]$^+$: 263.1794 found 263.1800.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford **1f** as a colorless oil (95% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.23 (d, $J = 8.0$ Hz, 4 H), 7.12 (d, $J = 8.0$ Hz, 4 H), 5.10 (s, 1 H), 4.74 (s, 1 H), 2.38 (s, 1 H), 2.33 (s, 6 H), 1.78 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 149.3, 142.1, 136.7, 128.5, 127.5, 115.0, 82.7, 21.0, 20.1; MS
(EI) m/z (%): 252 (M+, 11), 237 (29), 119 (100), 91 (28); IR (cm⁻¹): 3474, 2922, 1644, 1510, 1452, 815; HRMS (ESI) calcd for C₁₈H₂₀ONa [M+Na]⁺: 275.1406 found 275.1404.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 1g as a colorless oil (93% yield). ¹HNMR (400 MHz, CDCl₃, ppm): δ 7.21-7.17 (m, 4 H), 7.11-7.06 (m, 4 H), 5.11 (s, 1 H), 4.73 (s, 1 H), 2.44 (S, 1 H), 2.32 (s, 6 H), 1.79 (s, 3 H); ¹³C NMR (100 MHz, CDCl₃, ppm): δ 149.1, 144.8, 137.4, 128.1, 127.9, 127.6, 124.8, 115.3, 82.9, 21.6, 20.1; MS (EI) m/z (%): 252 (M⁺, 5), 237 (27), 211 (46), 119 (100), 105 (24), 91 (34), 40 (35); IR (cm⁻¹): 3468, 2921, 1643, 1485, 1039, 908, 780, 706; HRMS (ESI) calcd for C₁₈H₂₀ONa [M +Na]⁺: 275.1408 found 275.1406.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 1h as a colorless oil (99% yield). ¹HNMR (400 MHz, CDCl₃, ppm): δ 7.29-7.24 (m, 8 H), 5.14 (d, J = 1.2 Hz, 1 H), 4.69 (s, 1 H), 2.49 (s, 1 H), 1.76 (s, 3 H); ¹³C NMR (100 MHz, CDCl₃, ppm): δ 148.2, 142.9, 133.3, 128.9, 128.1, 116.2, 82.2, 19.8; MS (EI) m/z (%): 292 (M⁺, 2), 277 (19), 251 (60), 139 (100), 111 (26); IR (cm⁻¹): 3470, 2974, 1644, 1488, 1094, 1012, 822.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 1i
as a white amorphous solid (91% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.90-7.49 (m, 14 H), 5.29 (s, 1 H), 4.90 (s, 1 H), 2.76 (s, 1 H), 1.95 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 148.8, 142.1, 132.8, 132.6, 128.3, 127.6, 127.5, 126.4, 126.13, 126.11, 126.0, 116.0, 83.3, 20.1; MS (EI) $m/z$ (%): 324 (M$^+$, 10), 283 (20), 155 (47), 149 (100), 127 (23), 40 (83); IR (cm$^{-1}$): 3468, 3056, 1637, 1505, 817, 746; HRMS (ESI) calcd for C$_{24}$H$_{20}$ONa [M+Na]$^+$: 347.1406, found 347.1399.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 1j (80% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.32-7.27 (m, 4 H), 7.02-6.96 (m, 4 H), 5.13 (t, $J$ = 1.2 Hz, 1 H), 4.69 (s, 1 H), 2.52 (s, 1 H), 1.77 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 162.0 (d, $J$ = 245 Hz), 148.8, 140.5 (d, $J$ = 4 Hz), 129.3 (d, $J$ = 8 Hz), 115.8, 144.7 (d, $J$ = 22 Hz), 82.2, 19.4; MS (EI) $m/z$ (%): 260 (M$^+$, 3) 245 (23), 219 (58), 123 (100); IR (cm$^{-1}$): 3470, 2925, 1602, 1506, 1228, 1160, 834; HRMS (ESI) calcd for C$_{16}$H$_{13}$F$_2$ [M-H$_2$O+H]$^+$: 243.0980 found 243.0986.

Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 1k as a colorless oil (99% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 6.96 (s, 4 H), 6.89 (s, 2 H), 5.09 (t, $J$ = 1.2 Hz, 1 H), 4.74 (s, 1 H), 2.04 (s, 1 H), 2.27 (s, 12 H), 1.78 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 149.3, 145.0, 137.1, 128.8, 125.4, 115.1, 82.8, 21.4, 20.2; MS (EI) $m/z$ (%): 280 (M$^+$, 21), 239 (47), 133 (100), 105 (34); IR (cm$^{-1}$): 3466, 2918, 1643, 1602, 1450, 854; HRMS (ESI) calcd for C$_{20}$H$_{24}$ONa [M+Na]$^+$: 303.1719 found 303.1715.
Prepared according to general procedure with petroleum ether/EtOAc = 50:1 as eluent to afford 11 as a white amorphous solid (80% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): 7.32-7.21 (m, 10 H), 5.22-5.17 (m, 1 H), 2.48 (s, 1 H), 1.66 (s, 3 H), 1.64 (d, $J = 6.8$ Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 145.4, 140.1, 127.8, 127.7, 127.0, 124.2, 83.8, 14.0, 13.6; MS (EI) m/z (%): 238 (M$,^+$, 7), 183 (34), 134 (50), 105 (100), 77 (28); IR (cm$^{-1}$): 3483, 3060, 1598, 1445, 1162, 1003, 758, 701; HRMS (ESI) calcd for C$_{17}$H$_{17}$ [M–H$_2$O+H]$^+$: 221.1325 found 221.1331.

General Procedure for synthesis of the racemates of $\beta$-haloketone products:
The racemate products 2a-l were prepared using NBS in acetonitrile at room temperature.

General Procedure for the asymmetric Synthesis of $\alpha$-All-Carbon Quaternary $\beta$-Bromoketo Compounds:

To a flame-dried round-bottom flask were added CCl$_4$ (1 mL), NBS (3.6 mg, 0.02 mmol, 0.2 equiv), catalyst 3b (3.6 mg, 0.005 mmol, 5 mol%), 3, 4-dimethoxybenzoic acid 4b (0.9 mg, 0.005 mmol, 5 mol%) and CH$_3$OH (6.5 $\mu$L, 0.15 mmol, 1.5 equiv). The mixture was stirred for 10 minutes at room temperature and then a solution of substrate (0.1 mmol) and CH$_3$OH (6.5 $\mu$L, 0.15 mmol, 1.5 equiv) in CCl$_4$ (1 mL) was added. The flask was heated to 50 °C and the additional NBS (18 mg, 0.1 mmol, 1 equiv) was added in five portions (0.02 mmol every 12 hours). After 72 hours, the reaction mixture was directly subjected to column chromatography on silica gel. The products
were eluted by petroleum ether/ethyl acetate (100:1).

(S)-3-bromo-2-methyl-1,2-diphenylpropan-1-one (2a):
Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2a as crystal solid (23.0 mg, 76% yield). Mp: 76-79 °C; $^1$H NMR (400 MHz, CDCl$_3$, ppm): δ 7.44-7.32 (m, 8 H), 7.25-7.21 (m, 2 H), 4.07 (d, $J = 10.4$ Hz, 1 H), 3.78 (d, $J = 10.4$, 1 H), 1.81 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 201.2, 140.4, 136.1, 132.0, 129.3, 129.2, 128.1, 127.9, 126.4, 54.9, 43.1, 22.8; MS (EI) m/z (%) 118 (100), 105 (63), 77 (29); IR (cm$^{-1}$): 2927, 1674, 1248, 969, 700; HRMS (ESI) calcd for C$_{16}$H$_{15}$BrONa [M+Na$^+$]: 325.0198, found 325.0189, $\alpha$$_{16}^D$ = $+118^\circ$ (c = 1.0, CHCl$_3$); Enantiomeric excess is 93% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R$ = 9.34 min; major isomer: $t_R$ = 11.22 min.

(S)-2-(bromomethyl)-1,2-diphenylbutan-1-one (2b):
Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2b as a colorless oil (25.6 mg, 81% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): δ 7.40-7.30 (m, 8 H), 7.24-7.18 (m, 2 H), 4.12 (d, $J = 10.8$ Hz, 1 H), 3.93 (dd, $J = 10.8$ Hz, 0.6 Hz, 1 H), 2.57-2.48 (m, 1 H), 2.32-2.24 (m, 1 H), 0.74 (t, $J = 7.4$ Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 201.7, 140.3, 136.4, 132.0, 129.2, 129.0, 128.0, 127.7, 126.8, 58.6, 40.4, 26.0, 7.8; MS (EI) m/z (%): 132 (100), 117 (40), 105 (72), 77 (35); IR (cm$^{-1}$): 2971, 1671, 1447, 1231, 1001, 762, 705, 606; HRMS (ESI) calcd for C$_{17}$H$_{17}$BrONa [M+Na$^+$]: 339.0355, found 339.0353; $\alpha$$_{24}^D$ = +90$^\circ$ (c = 1.0, CHCl$_3$); Enantiomeric excess is 91% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R$ = 7.31 min; major isomer: $t_R$ = 9.15 min.
(S)-2-(bromomethyl)-1,2-diphenylpentan-1-one (2c):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2c as a colorless oil (28.4 mg, 86% yield). ^1^HNMR (400 MHz, CDCl3, ppm): δ 7.40-7.31 (m, 8 H), 7.24-7.19 (m, 2 H), 4.12 (d, J = 10.8 Hz, 1 H) 3.94 (d, J = 10.4 Hz, 1 H), 2.45 (td, J = 12.8 Hz, 4.4 Hz, 1 H), 2.17 (td, J = 12.8 Hz, 4.4 Hz, 1H), 1.30-1.18 (m, 1 H), 1.03-0.89 (m, 1 H), 0.84 (t, J = 7.2 Hz, 3 H); ^1^C NMR (100 MHz, CDCl3, ppm): δ 201.7, 140.4, 136.4, 132.0, 129.2, 129.0, 128.0, 127.7, 126.8, 58.3, 41.2, 35.4, 16.8, 14.5; MS (EI) m/z (%): 146 (54), 131 (34), 118 (81), 105 (100), 77 (34); IR (cm⁻¹): 2960, 1670, 1446, 1224, 1009, 698; HRMS (ESI) calcd for C18H19BrONa [M+Na]+: 353.0511 found 353.0506; [α]_D^16 = +92° (c = 1.0, CHCl3). Enantiomeric excess is 90% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 90/10, flow rate = 1.0 mL/min, 254 nm): minor isomer: t_R = 4.68 min; major isomer: t_R = 6.02 min.

(2d)

(S)-2-(bromomethyl)-1,2-diphenylhexan-1-one (2d):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2d as a colorless oil (26.9 mg, 78% yield). ^1^HNMR (400 MHz, CDCl3, ppm): δ 7.42-7.31 (m, 8 H), 7.23-7.19 (m, 2 H), 4.11 (d, J = 10.8 Hz, 1 H) 3.94 (dd, J = 10.8 Hz, 1 Hz, 1 H), 2.47 (td, J = 13.2 Hz, 4 Hz, 1 H), 2.23-2.19 (m, 1 H), 1.29-1.16 (m, 3 H), 0.92-0.86 (m, 1 H), 0.76 (t, J = 7.0 Hz, 3 H); ^1^C NMR (100 MHz, CDCl3, ppm): δ 201.9, 140.5, 136.5, 132.0, 129.2, 129.0, 128.1, 127.8, 126.9, 58.3, 41.3, 32.8, 25.5, 22.9, 13.7; MS (EI) m/z (%): 160 (22), 118 (100), 105 (76), 77(28); IR (cm⁻¹): 2958, 1671, 1446, 1255, 1021, 697; HRMS (ESI) calcd for C19H21BrONa [M+Na]+: 367.0668 found 367.0506; [α]_D^16 = +77° (c = 1.0, CHCl3). Enantiomeric excess is 91% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 80/20, flow rate = 1.0 mL/min, 254 nm): minor isomer: t_R = 4.27 min; major isomer: t_R = 6.16 min.
(S)-2-(bromomethyl)-1,2-diphenylheptan-1-one (2e):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2e as a colorless oil (29.7 mg, 83% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.42-7.31 (m, 8 H), 7.24-7.20 (m, 2 H), 4.11 (d, $J = 10.8$, 1 H), 3.94 (dd, $J = 10.8$ Hz, 0.8 Hz, 1 H), 2.46 (td, $J = 13.2$ Hz, 4 Hz, 1 H), 2.22-2.14 (m, 1 H), 1.25-1.13 (m, 5 H), 0.96-0.88 (m, 1 H), 0.76 (t, $J = 6.8$ Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.9, 140.5, 136.5, 132.0, 129.2, 129.0, 128.1, 127.8, 126.9, 58.3, 41.3, 33.0, 31.9, 22.9, 22.1, 13.8; MS (EI) $m/z$ (%): 174 (19), 118 (90), 105 (62), 40 (100); IR (cm$^{-1}$): 2925, 1670, 698; HRMS (ESI) calcd for C$_{20}$H$_{24}$BrO $[M+H]^+$: 359.1005 found 359.1011; $[\alpha]_{D}^{16} = +58^\circ$ (c = 1.0, CHCl$_3$); Enantiomeric excess is 87% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99.5/0.5, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 9.99$ min; major isomer: $t_R = 11.65$ min.

(S)-3-bromo-2-methyl-1,2-ditolylpropan-1-one (2f):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2f as a colorless oil (31.1 mg, 94% yield). $^1$H NMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.38 (d, $J = 8.4$ Hz, 2 H), 7.22-7.17 (m, 4 H), 7.04 (d, $J = 8$ Hz, 2 H), 4.04 (d, $J = 10$ Hz, 1 H), 3.75 (d, $J = 10$ Hz, 1 H), 2.35 (s, 3 H), 2.30 (s, 3 H), 1.79 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 200.9, 142.7, 137.7, 137.5, 133.3, 129.8, 129.7, 128.7, 126.2, 54.5, 43.6, 22.9, 21.5, 21.1; MS (EI) $m/z$ (%): 132 (100), 119 (53), 117 (15), 91 (24); IR (cm$^{-1}$): 2924, 1677, 1251, 1021, 972, 823; HRMS (ESI) calcd for C$_{18}$H$_{19}$BrONa $[M+Na]^+$:353.0511 found 353.0502; $[\alpha]_{D}^{16} = +125^\circ$ (c = 1.0, CHCl$_3$);
Enantiomeric excess is 88% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 7.95$ min; major isomer: $t_R = 9.46$ min.

$\text{(S)-3-bromo-2-methyl-1,2-dim-tolylpropan-1-one (2g):}$

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2g as a colorless oil (31.1 mg, 94% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.37-7.05 (m, 8 H), 4.07 (d, $J = 10$ Hz, 1 H), 3.74 (d, $J = 10.4$ Hz, 1 H), 2.34 (s, 3 H), 2.27 (s, 3 H), 1.78 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.6, 140.3, 138.8, 138.0, 136.3, 132.7, 129.9, 129.0, 128.7, 127.7, 127.0, 126.4, 123.3, 54.8, 43.1, 22.9, 21.6, 21.3; MS (EI) $m/z$ (%) 132 (100), 119 (54), 91 (28); IR (cm$^{-1}$): 2924, 1679, 1264, 1020, 801; HRMS (ESI) calcd for C$_{18}$H$_{20}$BrO [M+H]$^+$: 331.0692 found 331.0700; $[\alpha]_{16}^D = +113^\circ$ (c = 1.0, CHCl$_3$); Enantiomeric excess is 90% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 6.62$ min; major isomer: $t_R = 7.25$ min.

$\text{(S)-3-bromo-1,2-bis(4-chlorophenyl)-2-methylpropan-1-one (2h):}$

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2h as a colorless oil (23 mg, 62% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.40-7.37 (m, 4 H), 7.26-7.23 (m, 4 H), 3.98 (d, $J = 10.4$ Hz, 1 H), 3.75 (d, $J = 10.4$, 1 H), 1.79 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 199.6, 138.81, 138.78, 134.1, 133.8, 130.9, 129.5, 128.6, 127.8, 54.5, 42.8, 22.7; MS (EI) $m/z$ (%): 154 (32) 152 (100), 139 (86), 117 (20), 111 (25), 40 (31); IR (cm$^{-1}$): 3392, 2923, 1676, 1249, 1094, 1015, 664; $[\alpha]_{16}^D = +39^\circ$ (c = 1.0, CHCl$_3$); Enantiomeric excess is 83% determined by HPLC (Chiralpak AD, Hexane/Isopropanol 90/10, flow rate = 1.0 mL/min,
(S)-3-bromo-2-methyl-1,2-di(naphthalen-2-yl)propan-1-one (2i):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2i as a white amorphous solid (35.4 mg, 88% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 8.06 -7.40 (m, 14 H), 4.25 (d, $J = 10.4$ Hz, 1 H), 3.96 (d, $J = 10$ Hz, 1 H), 2.02 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.1, 138.1, 134.7, 133.42, 133.36, 132.7, 132.1, 131.0, 129.5, 129.1, 128.23, 128.15, 127.8, 127.7, 127.5, 126.6, 126.49, 126.48, 125.5, 125.3, 124.2, 55.2, 43.2, 23.1; MS (EI) m/z (%): 168 (64), 155 (55), 149 (80), 127 (46), 85 (65), 71 (70), 57 (90), 43 (100); IR (cm$^{-1}$): 3057, 1674, 1274, 1019, 820, 747; HRMS (ESI) calcd for C$_{24}$H$_{19}$BrONa [M+Na]$^+$: 425.0511 found 425.0501; $[\alpha]_{D}^{16} = +65^\circ$ (c = 1.0, CHCl$_3$). Enantiomeric excess is 84% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): major isomer: $t_R = 15.82$ min; minor isomer: $t_R = 22.37$ min.

(S)-3-bromo-1,2-bis(4-fluorophenyl)-2-methylpropan-1-one (2j):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2j as a colorless oil (32.8 mg, 97% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.51-7.47 (m, 2 H), 7.31-7.27 (m, 2 H), 7.10 (t, $J = 8.4$ Hz, 2 H), 6.94 (t, $J = 8.4$ Hz, 2 H), 4.00 (d, $J = 10.4$ Hz, 1 H), 3.75 (d, $J = 10.4$ Hz, 1 H), 1.81 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 199.4, 164.8 (d, $J = 253$ Hz), 162.2 (d, $J = 247$ Hz), 136.0 (d, $J = 3$ Hz), 132.1 (d, $J = 9$ Hz), 131.8 (d, $J = 3$ Hz), 128.1 (d, $J = 8$Hz), 116.2 (d, $J = 22$ Hz), 153.3 (d, $J = 22$ Hz), 54.3, 43.2, 22.8; MS (EI) m/z (%): 136 (100), 123 (78), 95 (23); IR (cm$^{-1}$): 2962, 1674, 1598, 1508, 1237, 1017, 838; HRMS (ESI)
(S)-3-bromo-1,2-bis(3,5-dimethylphenyl)-2-methylpropan-1-one (2k):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2k as a colorless oil (31.9 mg, 89% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.03 (s, 3 H), 6.97 (s, 1 H), 6.94 (s, 2 H), 4.07 (d, $J$ = 10 Hz, 1 H), 3.71 (d, $J$ = 10 Hz, 1 H), 2.31 (s, 6 H), 2.20 (s, 6 H), 1.76 (s, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.9, 140.3, 138.6, 137.5, 136.7, 133.5, 129.5, 127.0, 124.0, 54.7, 43.1, 23.0, 21.5, 21.2; MS (EI) $m/z$ (%): 146 (100), 133 (56), 105 (28); IR (cm$^{-1}$): 2923, 2854, 1678, 1458, 1036, 804; HRMS (ESI) calcd for C$_{20}$H$_{23}$BrONa [M+Na]$^+$: 381.0824 found 381.0834; $\left[\alpha\right]_{D}^{16}$ = +79$^\circ$ (c = 1.0, CHCl$_3$). Enantiomeric excess is 72% determined by HPLC (Chiralcel OZ-H, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): major isomer: $t_R = 4.88$ min; minor isomer: $t_R = 5.76$ min.

(2S)-3-bromo-2-methyl-1,2-diphenylbutan-1-one (2l):

Prepared according to general procedure with petroleum ether/EtOAc = 100:1 as eluent to afford 2l as a colorless oil (20 mg, 63% yield). $^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.41-7.21 (m, 10 H), 5.14 (q, $J$ = 7.2 Hz, 1 H), 1.84 (s, 3 H), 1.36 (d, $J$ = 7.2 Hz, 3 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.9, 138.3, 137.8, 131.3, 129.2, 128.5, 128.1, 127.9, 127.1, 58.8, 55.1, 21.0, 18.8; MS (EI) $m/z$ (%): 132 (100), 117 (69), 105 (44), 77 (22); IR (cm$^{-1}$): 2927, 1682, 1447, 1247, 964, 702; HRMS (ESI) calcd for C$_{17}$H$_{17}$BrONa [M+Na]$^+$: 339.0355 found 339.0350; $\left[\alpha\right]_{D}^{23}$ = +101$^\circ$ (c =
1.0, CHCl$_3$); Enantiomeric excess is 58% determined by HPLC (Chiralpak AD, Hexane/Isopropanol 90/10, flow rate = 1.0 mL/min, 254 nm): major isomer: $t_R = 5.41$ min; minor isomer: $t_R = 6.99$ min

**More information about substrate scope:**

we have also investigated some substrates bearing a functionalized group or beta-branched alkyl groups. The results are as follows:

![Chemical structures and reaction scheme]

- **2m** 20% yield, 37% ee
- **2n** 30% yield, 4% ee
- **2o** 24% yield, 44% ee
- **2p** 60% yield, 45% ee
- **2q** 60% yield, 55% ee
- **2r** 60% yield, 57% ee

**1m**

5-(methoxymethoxy)-2-methylene-1,1-diphenylpentan-1-ol:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): δ 7.35-7.24 (m, 10 H), 5.18 (s, 1 H), 4.78 (s, 2 H), 4.56 (s, 2 H), 3.50 (t, J = 6 Hz, 2 H), 3.30 (s, 3 H), 2.98 (s, 1 H), 2.17 (t, J = 7.6 Hz, 2 H), 1.80-1.73 (m, 2 H);

$^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 153.0, 145.2, 127.8, 127.7, 127.2, 114.4, 96.3, 83.5, 67.4, 55.2, 28.9, 28.8; MS (El) m/z (%): 183 (96), 160 (31), 105 (100), 77 (24).
(S)-2-(bromomethyl)-5-(methoxymethoxy)-1,2-diphenylpentan-1-one:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.42-7.31 (m, 8 H), 7.24-7.20 (m, 2 H), 4.47 (s, 2 H), 4.11 (d, $J = 10.8$ Hz, 1 H), 7.93 (d, $J = 10.8$ Hz, 1 H), 3.43 (t, $J = 6.4$ Hz, 2 H), 3.27 (s, 3 H), 2.54 (td, $J = 12.8$ Hz, 4.4 Hz, 1 H), 2.30 (td, $J = 13.2$ Hz, 3.6 Hz, 1 H), 1.53-1.40 (m, 2 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.5, 140.1, 136.4, 132.1, 129.2, 129.1, 128.1, 127.8, 126.8, 96.1, 67.3, 58.1, 55.1, 40.5, 30.2, 23.8; MS (EI) $m/z$ (%): 255 (10), 161 (26), 144 (45), 129 (42), 118 (72), 105 (100), 71 (67), 57 (79); Enantiomeric excess is 37% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 70/30, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 5.69$ min; major isomer: $t_R = 12.65$ min.

5-methoxy-2-methylene-1,1-diphenylpentan-1-ol:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.35-7.24 (m, 10 H), 5.16 (s, 1 H), 4.74 (s, 1 H), 3.48 (s, 1 H), 3.38 (t, $J = 6.4$ Hz, 2 H), 3.29 (s, 3 H), 2.16 (t, $J = 7.6$ Hz, 2 H), 1.80-1.73 (m, 2 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 153.1, 145.3, 127.8, 127.7, 127.0, 114.7, 83.4, 72.1, 58.4, 28.9, 28.6; MS (EI) $m/z$ (%): 282 (M$^+$, 4), 209 (30), 183 (100), 105 (91), 77 (27).

(S)-2-(bromomethyl)-5-methoxy-1,2-diphenylpentan-1-one:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.42-7.31 (m, 8 H), 7.23-7.20 (m, 2 H), 4.11 (d, $J = 10.8$, 1 H), 3.96 (d, $J = 10.8$ Hz, 1 H), 3.31-3.26 (m, 2 H), 3.17 (s, 3 H), 2.51 (td, $J = 13.6$ Hz, 4.4 Hz, 1 H),
2.29 (td, J = 13.2 Hz, 4.4 Hz, 1 H), 1.51-1.36 (m, 2 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 201.5, 140.2, 136.4, 132.1, 129.2, 129.1, 128.1, 127.8, 72.3, 58.2, 58.1, 40.6, 30.0, 23.4; MS (EI) m/z (%): 149 (19), 144 (31), 118 (100), 105 (73), 77 (260); Enantiomeric excess is 4% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 70/30, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 5.00$ min; major isomer: $t_R = 7.56$ min.

2-benzyl-1,1-diphenylprop-2-en-1-ol:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): δ 7.63-7.11 (m, 15 H), 4.85 (d, J = 0.8 Hz, 1 H), 4.79 (s, 1 H), 3.40 (s, 2H), 2.51 (s, 1H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 153.4, 144.9, 139.8, 129.5, 128.3, 127.9, 127.7, 127.3, 126.0, 117.0, 83.6, 38.7; MS (EI) m/z (%): 300 (M$^+$, 1), 282 (20), 209 (9), 191 (29), 183 (100), 105 (92), 77 (29).

(S)-2-benzyl-3-bromo-1,2-diphenylpropan-1-one:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): δ 7.46-6.72 (m, 15 H), 3.98 (d, J = 10.4 Hz, 1 H), 3.87 (d, J = 10.4 Hz, 1 H), 3.64 (d, J = 13.6 Hz, 1 H), 3.56 (d, J = 13.6 Hz, 1 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): δ 200.1, 140.0, 136.7, 135.9, 132.1, 130.3, 129.6, 129.1, 128.2, 127.91, 127.87, 126.9, 126.8, 59.4, 40.3, 38.8; MS (EI) m/z (%): 299 (4), 194 (100), 179 (37), 149 (27), 116 (40), 105 (88), 77 (37); Enantiomeric excess is 44% determined by HPLC (Chiralcel IC, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): major isomer: $t_R = 7.68$ min; minor isomer: $t_R = 8.25$ min.

5-methyl-2-methylene-1,1-diphenylhexan-1-ol:
1HNMR (400 MHz, CDCl₃, ppm): δ 7.34-7.25 (m, 10 H), 5.15 (d, J = 0.8 Hz, 1 H), 4.79 (s, 1 H), 2.47 (s, 1 H), 2.05 (t, J = 8.2 Hz, 2 H), 1.52-1.42 (m, 1 H), 1.35-1.29 (m, 2 H), 0.81 (d, J = 6.4 Hz, 6 H); ¹³C NMR (100 MHz, CDCl₃, ppm): δ 153.9, 145.2, 127.8, 127.7, 127.2, 113.5, 83.6, 38.0, 29.9, 28.0, 22.6; MS (EI) m/z (%): 280 (M⁺, 1), 209 (21), 183 (100), 160 (28), 105 (80), 77 (22).

2p

(S)-2-(bromomethyl)-5-methyl-1,2-diphenylhexan-1-one:

¹HNMR (400 MHz, CDCl₃, ppm): δ 7.39-7.31 (m, 8 H), 7.24-7.18 (m, 2 H), 4.09 (d, J = 10.8 Hz, 1 H), 3.94 (dd, J = 10.8 Hz, 1.2 Hz, 1 H), 2.48 (td, J = 13.2 Hz, 4.8 Hz, 1 H), 2.19 (td, J = 13.6 Hz, 3.2 Hz, 1 H), 1.44-1.36 (m, 1 H), 1.17-1.08 (m, 1 H), 0.83-0.74 (m, 1 H), 0.80 (d, J = 6.8 Hz, 3 H), 0.66 (d, J = 6.8 Hz, 3 H); ¹³C NMR (100 MHz, CDCl₃, ppm): δ 202.0, 140.4, 136.5, 132.0, 129.2, 129.0, 128.0, 127.7, 126.8, 58.2, 41.3, 32.2, 30.7, 28.1, 22.4, 22.0; MS (EI) m/z (%): 174 (12), 118 (100), 105 (66), 77 (21); Enantiomeric excess is 45% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 90/10, flow rate = 1.0 mL/min, 254 nm): minor isomer: tᵣ = 4.18 min; major isomer: tᵣ = 8.69 min.

1q

2-(cyclohexylmethyl)-1,1-diphenylprop-2-en-1-ol:

¹HNMR (400 MHz, CDCl₃, ppm): δ 7.35-7.25 (m, 10 H), 5.13 (d, J = 0.8 Hz, 1 H), 4.79 (s, 1 H), 2.42 (s, 1 H), 1.96 (d, J = 6.8 Hz, 2 H), 1.75-1.60 (m, 5 H), 1.46-1.36 (m, 1 H), 1.22-1.03 (m, 3 H), 0.83-0.74 (m, 2 H); ¹³C NMR (100 MHz, CDCl₃, ppm): δ 151.3, 145.3, 127.8, 127.2, 114.9, 83.6, 40.1, 36.5, 33.4, 26.6, 26.4; MS (EI) m/z (%): 306 (M⁺, 2), 209 (15), 186 (21), 183 (100), 105 (58), 77 (16).
(S)-3-bromo-2-(cyclohexylmethyl)-1,2-diphenylpropan-1-one:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.40-7.18 (m, 10 H), 4.11 (d, $J = 10.4$ Hz, 1 H), 4.03 (dd, $J = 10.8$ Hz, 1.2 Hz, 1 H), 2.46 (dd, $J = 14.4$ Hz, 5.2 Hz, 1 H), 2.17-2.12 (dd, $J = 14.4$ Hz, 5.2 Hz, 1 H), 1.61-1.45 (m, 4 H), 1.15-0.93 (m, 6 H), 0.75-0.66 (m, 1 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 202.0, 140.8, 136.7, 131.9, 129.5, 128.9, 128.0, 127.7, 126.8, 58.5, 42.1, 39.9, 35.2, 34.5, 33.7, 26.2, 26.3, 26.0; MS (EI) m/z (%): 200 (18), 183 (14), 118 (100), 105 (74), 77 (21); Enantiomeric excess is 55% determined by HPLC (Chiralcel AD, Hexane/Isopropanol 99/1, flow rate = 1.0 mL/min, 254 nm): major isomer: $t_R = 6.91$ min; minor isomer: $t_R = 7.53$ min.

Cyclohexenyldiphenylmethanol:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.33-7.23 (m, 10 H), 5.35 (t, $J = 3.6$ Hz, 1 H), 2.49 (s, 1 H), 2.09-2.06 (m, 2 H), 1.99-1.98 (m, 2 H), 1.66-1.55 (m, 4 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 145.5, 141.8, 127.8, 127.7, 127.0, 126.6, 83.1, 25.6, 25.3, 22.9, 22.2; MS (EI) m/z (%): 264 (M$^+$, 21), 246 (11), 183 (35), 105 (100), 77 (28);

((1S,2R)-2-bromo-1-phenylcyclohexyl)(phenyl)methanone:

$^1$HNMR (400 MHz, CDCl$_3$, ppm): $\delta$ 7.48-7.19 (m, 10 H), 5.30 (s, 1 H), 2.55-2.43 (m, 2 H), 2.38-2.29 (m, 1 H), 2.20-2.16 (m, 1 H), 1.89-1.78 (m, 1 H), 1.59-1.48 (m, 2 H), 1.29-1.19 (m, 1 H); $^{13}$C NMR (100 MHz, CDCl$_3$, ppm): $\delta$ 201.6, 138.3, 138.2, 130.8, 128.9, 128.4, 128.2, 127.8, 127.4, 59.5, 57.9, 31.7, 30.7, 21.5, 20.9; MS (EI) m/z (%): 158 (100), 143 (27), 130 (24), 105 (21), 77
(19); Enantiomeric excess is 57% determined by HPLC (Chiralcel OJ, Hexane/Isopropanol 90/10, flow rate = 1.0 mL/min, 254 nm): minor isomer: $t_R = 11.65$ min; major isomer: $t_R = 17.62$ min.

**X-Ray Ellipsoid Plots of 2a**

The structure of compound 2a was corroborated by single-crystal. The crystal structure has been deposited at the Cambridge Crystallographic Data Centre and allocated the deposition number: 821778.
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$^{1}H$ NMR (CDCl$_3$, $400$ MHz): \delta 2.10, 3.61, 3.90, 4.70, 7.00, 7.60, 8.05, 8.70, 22.78.
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Electronic Supplementary Material (ESI) for Chemical Science
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Peak | Ret Time | Type | Width | Area       | Height | Area |
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### Chart 1

![Chart 1 Image]

**racemic 2e**

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### Chart 2

![Chart 2 Image]

**2e**

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DAD1 D, Sig=254,16 Ref=360,100 (LIHUI\LIHUI488.D)

Peak RetTime Type Width Area Height Area
# [min] [min] [mAU*s] [mAU] %
---|-------|----|-------|----------|----------|--------|
1 6.518 PV 0.2661 1.91171e4 1114.76587 47.4784
2 7.099 VB 0.3300 2.11477e4 971.19739 52.5216

DAD1 D, Sig=254,16 Ref=360,100 (LIHUI\LIHUI402.D)

Peak RetTime Type Width Area Height Area
# [min] [min] [mAU*s] [mAU] %
---|-------|----|-------|----------|----------|--------|
1 6.618 PV 0.2604 971.72626 57.72239 4.7982
2 7.245 VB 0.3221 1.92800e4 913.19739 95.2018
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<th>Area %</th>
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</tr>
</tbody>
</table>
### Electronic Supplementary Material (ESI) for Chemical Science

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**Figure 1:**

**Top Panel:**
- **Compound:** racemic 2i
- **Retention Time:** 15.301 min
- **Width:** 1.2406 min
- **Area:** 9972.84 mAU*s
- **Height:** 133.97 mAU
- **Percentage:** 51.18%

**Bottom Panel:**
- **Compound:** 2i
- **Retention Time:** 15.824 min
- **Width:** 1.5821 min
- **Area:** 4.67109e4 mAU*s
- **Height:** 492.07779 mAU
- **Percentage:** 91.93%

**Table 1:**

| Peak RetTime Type | Width | Area     | Height     | Area
<table>
<thead>
<tr>
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| Peak RetTime Type | Width | Area     | Height     | Area
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**Electronic Supplementary Material (ESI) for Chemical Science**

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**DAD1 C, Sig=254,8 Ref=360,100 (LIHUI\LIHUI019.D)**

![Graph](image1)

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**DAD1 D, Sig=254,16 Ref=360,100 (LIHUI\LIHUI392.D)**

![Graph](image2)

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<tr>
<td>1    4.791 BV     0.1467</td>
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<td>[mAU]</td>
<td>%</td>
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