Paired Electrolysis-Enabled Nickel-Catalyzed Enantioselective Reductive Cross-Coupling Between α-Chloroesters and Aryl Bromides

(Supplementary Information)

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# Table of Contents

1. Supplementary Notes ........................................................................................................... 2

2. Supplementary Discussion .................................................................................................... 3
   2.1 Optimization of the Reaction Conditions ................................................................. 3
   2.2 Preparation of Substrate ............................................................................................. 10
   2.3 Suboptimal and Unsuccessful Substrates ................................................................. 18
   2.4 General Procedure for Electrochemical C-C Coupling ........................................... 19
   2.5 Preparation and X-ray Diffraction of Nickel Pre-Catalyst ........................................... 23
   2.6 Cyclic Voltammetry ..................................................................................................... 27
   2.7 Characterization Data for the Products ................................................................. 31
   2.8 Radical Probe Experiments and Structural Confirmation of Cyclized Products .............. 70
   2.9 EPR Experiments and Data ...................................................................................... 72

3. Supplementary Figures ........................................................................................................ 74
   3.1 X-Ray Structures and Data ...................................................................................... 74
   3.2 NMR Spectra and Chromatograms .......................................................................... 78
   3.3 HPLC Spectra Data .................................................................................................. 160

4. Supplementary References ................................................................................................ 226
1. Supplementary Notes

Commercially available materials were used without further purification. Column chromatography was performed using either 100-200 Mesh or 300-400 Mesh silica gel. Visualization of spots on the TLC plate was accomplished with UV light (254 nm) and staining over the I\textsubscript{2} chamber.

All commercial reagents were purchased from TCI, Sigma-Aldrich, Adams-beta, J&K, and Energy Chemical of the highest purity grade. They were used without further purification unless specified. Tetrabutylammonium bromide (TBAB, 99.0\%) was purchased from TCI Chemical and was used without further purification. Nickel(II) bromide ethylene glycol dimethyl ether (≥97.0\%) was purchased from Sigma-Aldrich and was used as received. 2,6-Lutidine, Pyridine, DBU (1,8-Diazabicyclo[5.4.0]undec-7-ene), DBN (1,5-Diazabicyclo[4.3.0]non-5-ene), DABCO (bicyclo(2.2.2)-1,4-diazaoctane), DIPEA (N, N-diisopropylethylamine), DMEDA (N, N-dimethyl ethylene diamines), TTMSS (tri(trimethylsilyl)silane) was purchased from Alfa Aesar and was used without further purification; DMAc (99.8\%, SuperDry) was purchased from Acros and was used without further purification. \textsuperscript{1}H NMR and \textsuperscript{13}C NMR spectra were recorded on Agilent AV 400, Varian Inova 400 (400 MHz and 100 MHz, respectively). \textsuperscript{19}F NMR spectra were recorded on Agilent AV 400, Varian Inova 400 (376 MHz) instrument and were reported relative to the CFCl\textsubscript{3} as the internal standard. The peaks were internally referenced to TMS (0.00 ppm) or residual undeuterated solvent signal. The following abbreviations were used to explain multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, and br = broad. Infrared spectra were obtained on a Bio-Rad FTS-185 instrument. High-resolution mass spectra were recorded at the Center for Mass Spectrometry, Shanghai Institute of Organic Chemistry. Analytical and spectral data of all those known compounds were exactly matching with the reported values.
2. Supplementary Discussion

2.1 Optimization of the Reaction Conditions

Supplementary Table 1: Optimization of the racemic reaction conditions.

Screening of electrodes:

| Entry | Electrode (Anode-Cathode) | Yield (%)
|-------|---------------------------|---------|
| 1     | RVC (1.5 x 1.5 cm)-Ni foam (2.0 x 3.0 cm) | 15      |
| 2     | Fe-Ni foam (2.0 x 3.0 cm) | NR      |
| 3     | Al-Ni foam (2.0 x 3.0 cm) | NR      |
| 4     | Mg-Ni foam (2.0 x 3.0 cm) | NR      |
| 5     | C (1.5 x 1.5 cm)-Ni foam (2.0 x 3.0 cm) | 8       |
| 6     | Pt (1.0 x 1.0 cm)-Ni foam (2.0 x 3.0 cm) | 20      |
| 7     | RVC (1.5 x 1.5 cm)-Pt (1.0 x 1.0 cm) | trace   |

Optimization of the reaction conditions. aReaction conditions: 1a (0.2 mmol), 1b (2.0 equiv), NiBr₂•glyme (10.0 mol%), dtbbpy (15.0 mol%), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu₄NBF₄ (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using different electrodes, argon. Yield was determined by ¹H NMR using CH₂Br₂ as an internal standard.
**Supplementary Table 2**: Optimization of the racemic reaction conditions.

Screening of bases:

| Entry | Base         | Yield (%)<sup>a</sup> |
|-------|--------------|------------------------|
| 1     | DBU          | NR                     |
| 2     | DBN          | NR                     |
| 3     | Pyridine     | <5                     |
| 4     | 2,6-lutidine | 91                     |
| 5     | LiOH         | <5                     |
| 6     | Na<sub>2</sub>CO<sub>3</sub> | 14          |
| 7     | TMG          | <5                     |

Optimization of the reaction conditions. *Reaction conditions: 1a (0.2 mmol), 1b (2.0 equiv), NiBr<sub>2</sub>*glyme (10.0 mol%), dtbbpy (15.0 mol%), Base (2.0 equiv), Tris(trimethylsilyl)isilane (2.0 equiv), n-Bu<sub>4</sub>NBF<sub>4</sub> (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm<sup>2</sup>) and Ni foam (2.0×3.0 cm<sup>2</sup>) electrodes, argon. Yield was determined by <sup>1</sup>H NMR using CH<sub>2</sub>Br<sub>2</sub> as an internal standard.
Supplementary Table 3: Procedure for chiral ligand evaluation

| Ligand | Reaction Conditions | Yield | Enantiomeric Excess (ee) |
|--------|---------------------|-------|--------------------------|
| L1     | 10% yield, 44% ee   |       |                          |
| L9     | < 5% yield, --       |       |                          |
| L10    | 10% yield, < 5% ee  |       |                          |
| L11    | < 5% yield, --       |       |                          |
| L12    | 20% yield, 20% ee   |       |                          |
| L13    | < 5% yield, --       |       |                          |
| L14    | < 5% yield, 13% ee  |       |                          |
| L15    | 10% yield, 15% ee   |       |                          |
| L16    | < 5%, --             |       |                          |

Optimization of the reaction conditions. aReaction conditions: 1a (0.2 mmol), (rac)-1b (2.0 equiv), NiBr₂·glyme (10.0 mol%), Ligand (15.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu₄NBF₄ (1.0 equiv), DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm²) and Ni foam (2.0×3.0 cm²) electrodes, argon. Yield was determined by ¹H NMR using CH₂Br₂ as an internal standard. Enantioselectivities were determined by chiral HPLC analysis.
## Supplementary Table 4: Procedure for chiral Biox-ligand evaluation\textsuperscript{a}

| Ligand | Reaction Conditions | Yield | Enantioselectivity |
|--------|---------------------|-------|-------------------|
| L1     | NiBr\textsubscript{2}•glyme (10.0 mol%) | 10%   | 44% ee            |
| L2     | NiBr\textsubscript{2}•glyme (10.0 mol%), (rac)-1b (2.0 equiv), NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 20% | 72% ee |
| L3     | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 37% | 46% ee |
| L5     | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | < 5% | -- |
| L4     | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 25% | 77% ee |
| L18    | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | < 5% | -- |
| L19    | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 15% | 70% ee |
| L20    | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 10% | 71% ee |
| L17    | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | < 5% | -- |
| L18    | NiBr\textsubscript{2}•glyme (10.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. | 25% | 30% ee |

Optimization of the reaction conditions. \textsuperscript{a}Reaction conditions: 1a (0.2 mmol), (rac)-1b (2.0 equiv), NiBr\textsubscript{2}•glyme (10.0 mol%), Ligand (15.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu\textsubscript{4}NBF\textsubscript{4} (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm\textsuperscript{2}) and Ni foam (2.0×3.0 cm\textsuperscript{2}) electrodes, argon. Yield was determined by \textsuperscript{1}H NMR using CH\textsubscript{2}Br\textsubscript{2} as an internal standard. Enantioselectivities were determined by chiral HPLC analysis.
Supplementary Table 5: Procedure for α-chloro ester evaluation<sup>a</sup>

![Chemical structure](image)

| Compound | Yield (%) | ee (%) |
|----------|-----------|--------|
| 1b-2     | 15%       | 76%    |
| 1b-3     | 15%       | 77%    |
| 1b-4     | <5%       | --     |
| 1b-5     | <5%       | --     |
| 1b-6     | 20%       | 67%    |
| 1b-7     | 10%       | 84%    |

Optimization of the reaction conditions. <sup>a</sup>Reaction conditions: 1a (0.2 mmol), (rac)-1b (2.0 equiv), NiBr<sub>2</sub>-glyme (10.0 mol%), L<sub>21</sub> (15.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu₄NBF₄ (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell subject to 6.0 mA of current for 6.0 h using platinum electrodes (1.0×1.0 cm<sup>2</sup>) and Ni foam (2.0×3.0 cm<sup>2</sup>) electrodes, argon. Yield was determined by <sup>1</sup>H NMR using CH<sub>2</sub>Br<sub>2</sub> as an internal standard. Enantioselectivities were determined by chiral HPLC analysis.
**Supplementary Table 6: Optimization of the reaction conditions.**

| entry | deviation from above conditions | yield (%)$^a$ |
|-------|---------------------------------|--------------|
| 1     | none                            | 11 (89% ee)  |
| 2     | $U_{\text{cell}}$ 2.4 V in lieu of 6.0 mA | 22.5         |
| 3     | $U_{\text{cell}}$ 2.5 V in lieu of 6.0 mA | 31.5         |
| 4     | $U_{\text{cell}}$ 2.6 V in lieu of 6.0 mA | 42           |
| 5     | $U_{\text{cell}}$ 2.7 V in lieu of 6.0 mA | 40           |
| 6     | $U_{\text{cell}}$ 2.8 V in lieu of 6.0 mA | 39           |
| 7     | $U_{\text{cell}}$ 2.9 V in lieu of 6.0 mA | 33           |
| 8     | $U_{\text{cell}}$ 3.0 V in lieu of 6.0 mA | 33           |
| 9     | 1a:1b = 2:1 in lieu of 1a:1b = 1:2 | 20           |
| 10    | 1a:1b = 1:3 in lieu of 1a:1b = 1:2 | 30           |
| 11    | 8.0 mA in lieu of 6.0 mA         | 28           |

Optimization of the reaction conditions. $^a$Reaction conditions: 1a (0.2 mmol, 1.0 equiv), (rac)-1b, NiBr$_2$•glyme (10.0 mol%), L22 (15.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu$_4$NBF$_4$ (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell for 6.0 h using platinum electrodes (1.0×1.0 cm$^2$) and Ni foam (2.0×3.0 cm$^2$) electrodes, argon. Yield was determined by $^1$H NMR using CH$_2$Br$_2$ as an internal standard. Enantioselectivities were determined by chiral HPLC analysis.
### Supplementary Table 7: Optimization of the reaction conditions.

Optimization of the reaction conditions. *Reaction conditions: 1a (0.2 mmol, 1.0 equiv), (rac)-1b (2.0 equiv), NiBr₂•glyme (10.0 mol%), L₇ (15.0 mol%), 2,6-lutidine (2.0 equiv), Tris(trimethylsilyl)silane (2.0 equiv), n-Bu₄NBF₄ (1.0 equiv), and DMAc (2.0 mL) at rt, in an undivided cell for 6.0 h using platinum electrodes (1.0×1.0 cm²) and Ni foam (2.0×3.0 cm²) electrodes, argon. Yield was determined by ¹H NMR using CH₂Br₂ as an internal standard. Enantioselectivities were determined by chiral HPLC analysis.*

| entry | deviation from above conditions | yield (%)<sup>a</sup> |
|-------|---------------------------------|----------------------|
| 1     | none                            | 30 (90% ee)          |
| 2     | U<sub>cell</sub> 2.8 V in lieu of 6.0 mA | 30                   |
| 3     | U<sub>cell</sub> 2.9 V in lieu of 6.0 mA | 33                   |
| 4     | U<sub>cell</sub> 3.0 V in lieu of 6.0 mA | 33                   |
| 5     | 3.0 equiv TTMSS in lieu of 2.0 equiv TTMSS | 60                   |
| 6     | 3.5 equiv TTMSS in lieu of 2.0 equiv TTMSS | 69 (90% ee)          |
| 7     | 4.0 equiv TTMSS in lieu of 2.0 equiv TTMSS | 61                   |
| 8     | 2.5 equiv Lutidine in lieu of 2.5 equiv Lutidine | 66 (90% ee)          |
| 9     | 3.0 equiv Lutidine in lieu of 2.5 equiv Lutidine | 66 (91% ee)          |
| 10    | 3.5 equiv Lutidine in lieu of 2.5 equiv Lutidine | 56                   |
| 11    | Ni(cod)₂ in stead of NiBr₂•glyme | 46 (91% ee)          |
2.2 Preparation of Substrate

The compound was prepared according to the reported literature procedure\cite{1}:

\[
\begin{align*}
\text{R-CH(OH)-NH}_2 & \quad \text{NaNO}_2 (1.6 \text{ equiv) } \\
\text{HCl, H}_2\text{O} & \quad \text{Cl-CH(OH)-OH} \\
\text{1) (COCl)}_2 (1.2 \text{ equiv) DMAP (1.5 equiv) ROH (1.0 equiv) THF, 0 °C to rt} & \quad \text{S1} \\
\text{2) DMF (0.1 equiv) THF, 0 °C to rt} & \quad \text{S2}
\end{align*}
\]

In a 250.0 mL over dried round-bottomed flask equipped with a Teflon-coated stir bar were added HCl (6 \text{ N}, 65.0 mL), DL-Amino acid (50.0 mmol). The mixture is cooled to 0 °C in an ice/sodium chloride bath and a precooled solution of 5.5 g (1.6 mmol) of sodium nitrite in 20.0 mL of water is added dropwise at a rate of about 2.0 mL/min under vigorous stirring and efficient cooling so that the temperature of the reaction mixture is kept below 5 °C. After 5.0 h, the bath is removed and the reaction is allowed overnight at room temperature. The mixture was diluted with water. The aqueous layer was extracted with EA and the combined organic layer were washed with brine and dried (Na\textsubscript{2}SO\textsubscript{4}), filtered, and concentrated, get the crude S1 and used without further purification.

(COCl\textsubscript{2}) (2.03 mL, 1.2 equiv) was added dropwise to a THF solution (15.0 mL) of S1 (24.0 mmol) and DMF (0.16 mL, 0.10 equiv) at 0 °C, and the mixture was stirred at room temperature for 1 h. After removal of the solvent under reduced pressure (ca. 100 hPa), the crude acyl chloride was obtained as a yellow oil and used without further purification.

2,3,3-Trimethylbutan-2-ol (2.32 g, 20 mmol), DMAP (3.67 g, 1.5 equiv), and THF (30.0 mL) were added to another flask and cooled to 0 °C. The presynthesized acyl chloride was added to this mixture dropwise at 0 °C, and the resulting slurry mixture was stirred at 20 °C for 16.0 h. After the addition of Et\textsubscript{2}O (50.0 mL), the organic layer was washed sequentially with 1.0 M aqueous HCl, saturated aqueous NaHCO\textsubscript{3}, and brine. The organic layer was dried with Na\textsubscript{2}SO\textsubscript{4}, filtered, and concentrated, and the residue was purified by silica-gel column chromatography.
Prepared according to the general procedure using 2-Chloropropionyl chloride and purified by flash column chromatography (SiO₂, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloropropanoate.

**1H NMR (400 MHz, CDCl₃)** δ 4.31 (q, J = 7.0 Hz, 1H), 1.66 (d, J = 6.8 Hz, 3H), 1.52 (s, 3H), 1.52 (s, 3H), 0.99 (s, 9H).

All the resonances in \(^1\)H NMR spectrum were consistent with the reported values.\(^{[1]}\)

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl 3-(benzyloxy)-2-chloropropanoate

Prepared according to the general procedure using O-Benzyl-DL-Serine and purified by flash column chromatography (SiO₂, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 3-(benzyloxy)-2-chloropropanoate.

**1H NMR (400 MHz, CDCl₃)** δ 7.37 – 7.27 (m, 5H), 4.59 (s, 2H), 4.33 (t, J = 6.2 Hz, 1H), 3.88 (dd, J = 10.2, 6.5 Hz, 1H), 3.78 (dd, J = 10.2, 6.0 Hz, 1H), 1.52 (s, 3H), 1.52 (s, 3H), 0.97 (s, 9H).

**13C NMR (101 MHz, CDCl₃)** δ 166.7, 137.3, 128.3, 127.8, 127.6, 89.6, 73.4, 71.2, 56.3, 38.3, 25.0, 20.2.

**HRMS (ESI)** calcd for C₁₇H₂₅O₃Cl₁Na₁ \([M+Na]^+\): 335.1384, found: 335.1382.

\(^1\)H and \(^{13}\)C NMR spectra are provided below.
Prepared according to the general procedure using DL-homophenylalanine and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-3-(4-methoxyphenyl)propanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.19 – 7.12 (m, 2H), 6.87 – 6.81 (m, 2H), 4.30 (t, $J$ = 7.4 Hz, 1H), 3.79 (s, 3H), 3.26 (dd, $J$ = 14.0, 7.4 Hz, 1H), 3.09 (dd, $J$ = 14.0, 7.4 Hz, 1H), 1.48 (s, 3H), 1.42 (s, 3H), 0.92 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 168.2, 158.8, 130.4, 128.1, 113.9, 89.5, 59.2, 55.3, 40.5, 38.4, 25.1, 20.3, 20.2.

HRMS (ESI) calcd for C$_{17}$H$_{25}$O$_3$Cl$_1$Na$_1$ [M+Na]$^+$: 335.1384, found: 335.1382.

$^1$H and $^{13}$C NMR spectra are provided below.

Prepared according to the general procedure using DL-phenylalanine and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-3-phenylpropanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.34 – 7.28 (m, 2H), 7.28 – 7.20 (m, 3H), 4.36 (t, $J$ = 7.4 Hz, 1H), 3.32 (dd, $J$ = 14.0, 7.4 Hz, 1H), 3.15 (dd, $J$ = 14.0, 7.4 Hz, 1H), 1.48 (s, 3H), 1.41 (s, 3H), 0.91 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 168.12, 136.1, 129.3, 128.5, 127.2, 89.6, 59.0, 41.4, 38.4, 25.0, 20.3, 20.2.

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[2]}$ $^1$H and $^{13}$C NMR spectra are provided below.

Prepared according to the general procedure using DL-homophenylalanine and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-
trimethylbutan-2-yl 2-chloro-4-phenylbutanoate.

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.33 – 7.27 (m, 2H), 7.24 – 7.18 (m, 3H), 4.15 (dd, $J = 8.2$, 5.6 Hz, 1H), 2.85 – 2.72 (m, 2H), 2.36 – 2.27 (m, 1H), 2.34 – 2.15 (m, 1H), 1.53 (s, 6H), 0.99 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 168.39, 140.11, 128.57, 128.50, 126.31, 89.39, 58.23, 38.49, 36.59, 32.04, 25.11, 20.32.

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[2]}$ $^1$H and $^{13}$C NMR spectra are provided below.

\[
\begin{align*}
\text{MeS} & \quad \text{Cl} & \quad \text{O} \\
\end{align*}
\]

Prepared according to the general procedure using 2-Chloropentanoyl chloride and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-4-(methylthio)butanoate.

$^1$H NMR (400 MHz, CDCl$_3$) δ 4.40 (dd, $J = 8.6$, 5.2 Hz, 1H), 2.71 – 2.57 (m, 2H), 2.32 – 2.22 (m, 1H), 2.21 – 2.13 (m, 1H), 2.11 (s, 3H), 1.53 (s, 3H), 1.52 (s, 3H), 0.99 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 168.2, 89.7, 57.5, 38.5, 34.2, 30.3, 25.1, 20.4, 20.3, 15.4.

HRMS (ESI) calcd for C$_{12}$H$_{23}$O$_2$ClSNa [M+Na]$^+$: 289.0999, found: 289.0996.

$^1$H and $^{13}$C NMR spectra are provided below.

\[
\begin{align*}
\text{Cl} & \quad \text{O} \\
\end{align*}
\]

Prepared according to the general procedure using 2-Chloropentanoyl chloride and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chlorohept-6-enoate.
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 5.83 – 5.72 (m, 2H), 5.22 – 4.87 (m, 2H), 4.19 (dd, $J$ = 7.8, 6.2 Hz, 1H), 2.16 – 2.04 (m, 2H), 2.04 – 1.83 (m, 2H), 1.61 – 1.48 (m, 2H), 1.52 (s, 6H), 0.99 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 168.6, 137.8, 115.3, 89.3, 58.9, 38.5, 34.4, 32.9, 25.09, 25.08, 20.32, 20.30.

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$[^1]$ $^1$H and $^{13}$C NMR spectra are provided below.

![Chemical Structure](image)

Prepared according to the general procedure using 2-Chlorobutyryl chloride and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chlorobutanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 4.14 (dd, $J$ = 7.2, 6.0 Hz, 1H), 2.07 – 1.98 (m, 1H), 1.97 – 1.89 (m, 1H), 1.52 (s, 3H), 1.52 (s, 3H), 1.03 (t, $J$ = 7.4 Hz, 3H), 0.99 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 168.5, 89.2, 60.5, 38.5, 28.5, 25.1, 20.32, 20.28, 10.4.

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$[^1]$ $^1$H and $^{13}$C NMR spectra are provided below.

![Chemical Structure](image)

Prepared according to the general procedure using 2-Chloropentanoyl chloride and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chlorohexanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 4.17 (dd, $J$ = 7.6, 6.4 Hz, 1H), 2.04 – 1.94 (m, 1H), 1.94 – 1.81 (m, 1H), 1.53 (s, 3H), 1.52 (s, 3H), 1.47 – 1.28 (m, 4H), 0.99 (s, 9H), 0.91 (t, $J$ = 7.2 Hz, 3H).
$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 168.7, 89.2, 59.1, 38.5, 34.8, 28.0, 25.1, 22.0, 20.3, 20.2, 13.8.

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[1]}$

$^1$H and $^{13}$C NMR spectra are provided below.

![Structural formula of compound 1]

Prepared according to the general procedure using DL-Leucine and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-4-methylpentanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 4.23 – 4.16 (m, 1H), 1.84 – 1.75 (m, 3H), 1.52 (s, 3H), 1.51 (s, 3H), 0.99 (s, 9H), 0.97 – 0.94 (m, 3H), 0.94 – 0.91 (m, 3H).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[1]}$

$^1$H and $^{13}$C NMR spectra are provided below.

![Structural formula of compound 2]

Prepared according to the general procedure using 2-Chloro-3-methylbutanoyl chloride and purified by flash column chromatography (SiO$_2$, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-3-methylbutanoate.

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 4.00 (d, $J$ = 6.8 Hz, 1H), 2.31 – 2.22 (m, 1H), 1.53 (s, 3H), 1.53 (s, 3H), 1.04 (s, 3H), 1.03 (s, 3H), 0.99 (s, 9H).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[2]}$

$^1$H and $^{13}$C NMR spectra are provided below.
Prepared according to the general procedure using DL-cyclopentylglycine and purified by flash column chromatography (SiO₂, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclopentylacetate.

**¹H NMR (400 MHz, CDCl₃)** \(\delta\) 4.01 (d, \(J = 8.4\) Hz, 1H), 2.50 – 2.39 (m, 1H), 1.92 – 1.82 (m, 1H), 1.79 – 1.71 (m, 1H), 1.70 – 1.55 (m, 4H), 1.52 (s, 6H), 1.49 – 1.44 (m, 1H), 1.37 – 1.26 (m, 1H), 0.99 (s, 9H).

**¹³C NMR (101 MHz, CDCl₃)** \(\delta\) 168.6, 89.1, 63.8, 44.1, 38.5, 30.3, 29.8, 29.7, 25.8, 25.2, 25.1, 20.3, 20.2.

All the resonances in \(^1\)H NMR spectrum were consistent with the reported values.\[^2\]

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

Prepared according to the general procedure using DL-cyclohexylalanine and purified by flash column chromatography (SiO₂, dry loaded, PE) to afford the 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclohexylacetate.

**¹H NMR (400 MHz, CDCl₃)** \(\delta\) 3.95 (d, \(J = 7.6\) Hz, 1H), 2.01 – 1.84 (m, 2H), 1.81 – 1.74 (m, 2H), 1.70 – 1.63 (m, 2H), 1.53 (s, 3H), 1.52 (s, 3H), 1.30 – 1.06 (m, 5H), 0.99 (s, 9H).

**¹³C NMR (101 MHz, CDCl₃)** \(\delta\) 168.3, 89.2, 64.8, 41.9, 38.45, 29.9, 28.6, 25.9, 25.8, 25.6, 25.1, 20.3, 20.2.

**HRMS** (ESI) calcd for C₁₅H₂₇O₂Cl₁Na₁ [M+Na]⁺: 297.1592, found: 297.1589.

\(^1\)H and \(^{13}\)C NMR spectra are provided below.
Prepared according to the general procedure using L-Menthol and purified by flash column chromatography (SiO₂, dry loaded, PE) to afford the (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 2-chloropropanoate.

\[ \text{H NMR (400 MHz, CDCl}_3\text{) } \delta 4.75 \text{–} 4.68 \text{ (m, 1H), 4.36 (q, } J = 7.0 \text{ Hz, 1H), 2.03 \text{–} 1.94 \text{ (m, 1H), 1.93 \text{–} 1.83 \text{ (m, 1H), 1.72 \text{–} 1.69 \text{ (m, 1H), 1.69 \text{–} 1.66 \text{ (m, 4H), 1.55 \text{–} 1.40 \text{ (m, 2H), 1.11 \text{–} 0.96 \text{ (m, 2H), 0.92 \text{–} 0.88 \text{ (m, 6H), 0.77 \text{–} 0.74 \text{ (m, 3H).}}}}\]

\[ \text{^13C NMR (101 MHz, CDCl}_3\text{) } \delta 169.6, 76.0, 53.0, 47.0, 40.5, 34.1, 31.4, 26.1, 23.3, 22.0, 21.5, 20.7, 16.1. \]

HRMS (ESI) calcd for C\textsubscript{13}H\textsubscript{23}O\textsubscript{2}Cl\textsubscript{1}Na\textsubscript{1} [M+Na]\textsuperscript{+}: 269.1284, found: 269.1286.
2.3. Suboptimal and Unsuccessful Substrates

**Supplementary Table 8: Suboptimal and unsuccessful substrates**

Substrates that did not provide desired products: (low conversion)

- $<5\%$ yield
- $<5\%$ yield
- $<5\%$ yield

Substrates that reacted: (low yield or moderate enantioselective)

- $5\%$ yield, $85\%$ ee
- $14\%$ yield, $91\%$ ee
- $<5\%$ yield

$a$-Chloroesters derived from complex molecules: (low yield or moderate enantioselective)

- $30\%$ yield, $80\%$ ee
- $36\%$ yield, $52\%$ ee
- $50\%$ yield, $72\%$ ee

**Standard condition:** aryl bromide/iodine/chloride ($0.2 \text{ mmol}$), (rac)-$a$-chloroesters ($2.0 \text{ equiv}$), NiBr$_2$ glycine ($10.0 \text{ mol\%}$), Ligand ($15.0 \text{ mol\%}$), DMAC (0.1 M), n-Bu$_4$NBF$_4$ (1.0 equiv), TMSS (3.5 equiv), 2,6-lutidine (3.0 equiv), platinum electrodes (§) and Ni foam (¶), constant voltage ($U_{\text{cell}} = 2.9 \text{ V}$, 6.0 h for 0.2 mmol scale), rt, isolated yield.
2.4 General Procedure for Electrochemical C-C Coupling

Procedure for the electrochemical, nickel catalyzed C–C coupling from Aryl Bromide

Racemic Reaction:

\[
\text{Me} \to \text{Cl} \to \text{O} \to \text{R} \\
\begin{array}{c}
\text{Br} \\
\text{R} = 2,3,3\text{-trimethylbutan-2-yl}
\end{array}
\]

Preparation of nickel/ligand stock solution in DMAc (0.01 M, solution A): a screw-capped tube was charged with NiBr₂·glyme (0.1 mmol, 31.0 mg) and 4,4’-di-tert-butyl-2,2’-bipyridine (0.12 mmol, 26.0 mg). This tube was evacuated and backfilled with an argon balloon. DMAc (10 mL) was then added; the resulting mixture was stirred until a homogeneous solution was obtained (heating at 60 °C was found to aid the homogenization process in some cases).

Procedure: In a nitrogen-filled glove box, an over-dried 10 mL hydrogenation tube charged with a stir bar, Aryl bromide (0.2 mmol), solution A (1.0 mL), TBABF₄ (62.0 mg, 0.2 mmol) were added to the electrochemical cell and the mixture was stirred for over 15 mins. Then 2,3,3-trimethylbutan-2-yl 2-chloropropanoate (90.0 mg, 0.4 mmol), 2,6-lutidine (54.0 mg, 0.5 mmol), TTMSS (100.0 mg, 0.4 mmol), DMAc (1.0 mL) were added to the electrochemical cell. The tube was installed with a Ni foam (2.0 x 3.0 cm²) as the cathode and the Pt (1.0 x 1.0 x 0.3 cm³) as the anode. The seal-tube was sealed and removed from the glovebox. The reaction mixture was electrolyzed under a constant current of 2.8 V until the complete consumption of the starting materials as judged by TLC (about 6 hours). After the reaction, The aqueous layer was extracted with EtOAc (3 x equal volume) and the combined organics were washed with sat. brine (4 x equal volume), dried over MgSO₄, filtered, and concentrated \textit{in vacuo}. The crude
product was purified by column chromatography to furnish the desired product.

**Chiral Reaction:**

![Chemical Reaction Diagram]

**Photographic Guide for Electrochemical C-C coupling**

*Easily hand-made electrochemical cell*

*(0.2 mmol for the Aryl halides, 2.0 mL DMAc, \( U_{cell} = 2.9 \text{ V for 6.0 h} \))*

**Procedure:** In a nitrogen-filled glove box, an over-dried 10 mL hydrogenation tube charged with a stir bar, Aryl bromide (0.2 mmol), NiBr₂•glyme (10.0 mol\%, 6.2 mg), \( L \) (15.0 mol\%, 16.0 mg), TBABF₄ (62.0 mg, 0.2 mmol) were added to the electrochemical cell and the mixture was stirred for over 20 mins.

Then 2,3,3-trimethylbutan-2-yl 2-chloropropanoate (90.0 mg, 0.4 mmol), 2,6-lutidine (62.0 mg, 0.6 mmol), TTMSS (175.0 mg, 0.70 mmol), DMAc (1.0 mL) were added to the electrochemical cell. The tube was installed with a Ni foam (2.0 x 3.0 cm²) as the cathode and the Pt (1.0 x 1.0 x 0.3 cm³) as the anode. The seal-tube was sealed and removed from the glovebox. The reaction mixture was electrolyzed under a constant current of 2.9 V until the complete consumption of the starting materials as judged by TLC (about 6 hours). After the reaction, The aqueous layer was extracted with EtOAc (3 x equal volume) and the combined organics were washed with sat. brine (4 x equal volume), dried over MgSO₄, filtered, and concentrated *in vacuo*. The crude product was purified by column chromatography to furnish the desired product.
Step 0. Overview of materials used.
From left to right: 1) an Pt electrode. 2) The Ni foam (as the cathode).

Step 1. Preparation of the electrode
Wrap the Ni foam with copper wire. (as the cathode)
Step 2. Assembling the cell

The stopper was fitted into the tube.

Step 3. Electrolysis

........ (electrolysis)
2.5 Preparation and X-ray Diffraction of Nickel Pre-Catalyst

**Ni pre-catalyst synthesis:**

![Chemical structure of Ni pre-catalyst]

**Procedure:** To an overdried 20.0 mL Vial was added NiBr$_2$•DME (0.1 mmol, 31.0 mg), L7 (0.11 mol, 56.6 mg), and THF (5.0 mL) in a N$_2$-filled glovebox. The mixture was stirred at room temperature for 4 hours to afford a green solution. The resulting solution was filtered and removed under reduced pressure. The remaining oil was washed with Et$_2$O (3.0 X 4.0 mL) and then triturated with Et$_2$O until Nickel pre-catalyst (70% yield, 51.3 mg) was isolated as a pale green solid. The layering of a THF solution with Et$_2$O at an N$_2$-filled glovebox resulted in the formation of a green crystal of Nickel pre-catalyst.
CCDC Number of Nickel pre-catalyst:

CCDC number: 2160390

Table 1. Crystal data and structure refinement for mo_d8v22142_0m.

| Property                  | Value                      |
|---------------------------|----------------------------|
| Identification code       | mo_d8v22142_0m             |
| Empirical formula         | C68 H100 Br4 N8 Ni2        |
| Formula weight            | 1466.61                    |
| Temperature               | 213(2) K                   |
| Wavelength                | 0.71073 Å                  |
| Crystal system            | Monoclinic                 |
Space group       P 21
Unit cell dimensions
a = 14.5404(8) Å    = 90°.
b = 19.8947(12) Å  =108.836(2)°.
c = 15.4738(9) Å    = 90°.

Volume          4236.5(4) Å³
Z                 2
Density (calculated) 1.150 Mg/m³
Absorption coefficient 2.367 mm⁻¹
F(000)          1520
Crystal size     0.120 x 0.100 x 0.050 mm³
Theta range for data collection 2.526 to 25.498°.
Index ranges  -17<=h<=17, -24<=k<=24, -17<=l<=18
Reflections collected 46554
Independent reflections 15704 [R(int) = 0.0842]
Completeness to theta = 25.242°  99.8 %
Absorption correction Semi-empirical from equivalents
Max. and min. transmission 0.7456 and 0.5945
Refinement method Full-matrix least-squares on F²
Data / restraints / parameters 15704 / 99 / 798
Goodness-of-fit on F²   0.904
Final R indices [I>2sigma(I)] R1 = 0.0595, wR2 = 0.1262
R indices (all data) R1 = 0.1111, wR2 = 0.1446
Absolute structure parameter 0.016(9)
Extinction coefficient n/a
Largest diff. peak and hole 0.403 and -0.444 e.Å⁻³
Involvement of the Nickel pre-catalyst complex in the reaction

**Procedure:** In a nitrogen-filled glove box, an over-dried 10 mL hydrogenation tube charged with a stir bar, Aryl bromide (0.2 mmol), Ni-pre-catalyst (5.0 mol%, 7.4 mg), TBABF$_4$ (62.0 mg, 0.2 mmol) were added to the electrochemical cell and the mixture was stirred for over 20 mins.

Then 2,3,3-trimethylbutan-2-yl 2-chloropropanoate (90.0 mg, 0.4 mmol), 2,6-lutidine (62.0 mg, 0.6 mmol), TTMSS (175.0 mg, 0.70 mmol), DMAc (1.0 mL) were added to the electrochemical cell. The tube was installed with a Ni foam (2.0 x 3.0 cm$^2$) as the cathode and the Pt (1.0 x 1.0 x 0.3 cm$^3$) as the anode. The seal-tube was sealed and removed from the glovebox. The reaction mixture was electrolyzed under a constant current of 2.9 V until the complete consumption of the starting materials as judged by TLC (about 6 hours). After the reaction, The aqueous layer was extracted with EtOAc (3 x equal volume) and the combined organics were washed with sat. brine (4 x equal volume), dried over MgSO$_4$, filtered, and concentrated in vacuo. The crude product was purified by column chromatography to furnish the desired product as a colorless oil (28.0 mg, 46% yield, 90% ee).
2.6 Cyclic Voltammetry

Cyclic voltammograms were recorded with a CHI660E potentiostat at room temperature in DMAc. \( n\)-Bu\(_4\)NPF\(_6\) (0.1 M) was used as the supporting electrolyte, and a Glass Carbon electrode was used as the working electrode. The auxiliary electrode was a Pt electrode. All potentials are referenced against the Ag/AgNO\(_3\) (0.1 M in DMAc) redox couple. The scan rate was 100 mV s\(^{-1}\).

Supplementary Figure 1. Cyclic voltammograms of 5mM Ferrocene, DMAc solvent, 0.1M \( n\)-Bu\(_4\)NPF\(_6\) supporting electrolyte, GC working electrode, Pt electrode as counter electrode, 100 mV/s scan rate.
Supplementary Figure 2. Cyclic voltammograms of 10mM TBAB (Blue line), 5mM TTMSS (Red line), DMAc solvent, 0.1M \( n\)-Bu4NPF6 supporting electrolyte, GC working electrode, Pt electrode as counter electrode, 100 mV/s scan rate.

Supplementary Figure 3. Cyclic voltammograms of 10mM Pyridine (Blue line) and 2,6-lutidine (Red line), MeCN solvent, 0.1M \( n\)-Bu4NPF6 supporting electrolyte, GC working electrode, Pt electrode as the counter electrode, 100 mV/s scan rate.
**Supplementary Figure 4.** Cyclic voltammograms of 20.0 mM NiBr₂•glyme, 20.0 mM Ligand (red line), and 10.0 mM p-COOMePhBr (blue line), 20.0 mM p-COOMePhBr (green line), 40.0 mM p-COOMePhBr (Purple line), DMAc solvent, 0.1M n-Bu₄NPF₆ supporting electrolyte, GC working electrode, Pt electrode as counter electrode, 100 mV/s scan rate.
Supplementary Figure 5. Cyclic voltammograms of 20.0 mM NiBr₂·glyme, 20.0 mM Ligand and 20.0 mM \( p \)-\( COOMePhBr \) (green line), \( p \)-\( COOMePhBr \) (Black line), [\( (L)\)Ni(II)(\( p \)-\( COOMePh)Br] and \( p \)-\( COOMePhBr \) (Pink line), DMAc solvent, 0.1M \( n \)-\( Bu_4NPF_6 \) supporting electrolyte, GC working electrode, Pt electrode as counter electrode, 100 mV/s scan rate.
2.7 Characterization Data for the Products

Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2a)

A colorless oil (40.1 mg, 66% yield, 91% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.97 (d, $J = 8.4$ Hz, 2H), 7.33 (d, $J = 8.4$ Hz, 2H), 3.89 (s, 3H), 3.68 (q, $J = 7.2$ Hz, 1H), 1.47 (d, $J = 7.2$ Hz, 3H), 1.45 (s, 3H), 1.36 (s, 3H), 0.80 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.9, 166.9, 146.4, 129.8, 128.67, 127.5, 87.6, 52.0, 47.0, 38.3, 24.9, 20.4, 20.1, 17.9.

IR (neat): 2977, 1721, 1611, 1435, 1375, 1276, 1109, 1019, 967, 848, 747 cm$^{-1}$.

HRMS (ESI) calcd for C$_{18}$H$_{26}$O$_4$Na $[M+Na]^+$: 329.1723, found: 329.1725.

Enantioselective ratio = 95.5:4.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, $T = 25$ °C, $\lambda = 214$ nm): $t_R$ = 8.87 min (major), $t_R$ = 9.69 min (minor).

$[\alpha]D^{30} = -51.05$ (c = 0.2, CHCl$_3$).

Methyl (R)-3-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2b)

A colorless oil (36.7 mg, 60% yield, 90% ee) from methyl 3-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.96 – 7.95 (m, 1H), 7.91 – 7.88 (m, 1H), 7.47 – 7.44 (m, 1H), 7.39 – 7.35 (m, 1H), 3.89 (s, 3H), 3.68 (q, $J = 7.2$ Hz, 3H), 1.48 (d, $J = 7.2$ Hz, 3H), 1.45 (s, 3H), 1.37 (s, 3H), 0.82 (s, 9H).
\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) δ 173.1, 166.9, 141.6, 132.1, 130.3, 128.7, 128.5, 128.1, 87.5, 52.0, 46.7, 38.3, 24.9, 20.4, 20.2, 18.0.

**IR** (neat): 2976, 1721, 1588, 1434, 1282, 1197, 1127, 976, 938, 847, 747 cm\(^{-1}\).

**HRMS** (ESI) calcd for C\(_{18}\)H\(_{26}\)O\(_4\)Na\(_1\) [M+Na]\(^+\): 329.1723, found: 329.1725.

**Enantioselective ratio** = 95.0:5.0, determined by HPLC (Daicel Chiralpak IC-H Column, \(n\)-Hexane: \(i\)-PrOH = 98:2, flow rate 1.0 mL/min, \(T = 25 \, ^\circ\)C, \(\lambda = 214 \, \text{nm}\)): \(t_R = 12.41 \, \text{min}\) (minor), \(t_R = 13.33 \, \text{min}\) (major).

\([\alpha]_D^{29.1} = -36.68 \, (c = 0.2, \text{CHCl}_3)\).

**Methyl (R)-2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2c)**

![Structural formula of (R)-2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2c)](image)

A colorless oil (19.0 mg, 31% yield, 71% ee) from methyl 2-bromobenzoate (43.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) δ 7.88 (dd, \(J = 8.0, 1.6 \, \text{Hz}, \, 1\text{H}\)), 7.49 – 7.45 (m, 1H), 7.36 – 7.33 (m, 1H), 7.30 – 7.26 (m, 1H), 4.53 (q, \(J = 7.2 \, \text{Hz}, \, 1\text{H}\)), 3.88 (s, 3H), 1.50 (d, \(J = 7.2 \, \text{Hz}, \, 3\text{H}\)), 1.46 (s, 3H), 1.40 (s, 3H), 0.72 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) δ 173.6, 168.0, 142.8, 132.1, 130.6, 129.5, 128.5, 126.45, 87.0, 52.0, 43.4, 38.2, 24.8, 20.4, 20.1, 17.9.

**IR** (neat): 2976, 1719, 1601, 1433, 1374, 1242, 1178, 1090, 1058, 848, 711 cm\(^{-1}\).

**HRMS** (ESI) calcd for C\(_{18}\)H\(_{26}\)O\(_4\)Na\(_1\) [M+Na]\(^+\): 329.1723, found: 329.1725.

**Enantioselective ratio** = 14.5:85.5, determined by HPLC (Daicel Chiralpak IC-H Column, \(n\)-Hexane: \(i\)-PrOH = 98:2, flow rate 1.0 mL/min, \(T = 25 \, ^\circ\)C, \(\lambda = 214 \, \text{nm}\)): \(t_R = 6.50 \, \text{min}\) (minor), \(t_R = 6.97 \, \text{min}\) (major).

\([\alpha]_D^{29.3} = -22.11 \, (c = 0.2, \text{CHCl}_3)\).

**Tert-butyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2d)**
A colorless oil (47.0 mg, 65% yield, 90% ee) from tert-butyl 4-bromobenzoate (51.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.93 (d, $J = 8.4$ Hz, 2H), 7.31 (d, $J = 8.0$ Hz, 2H), 3.68 (q, $J = 7.2$ Hz, 1H), 1.58 (s, 9H), 1.46 (t, $J = 3.6$ Hz, 6H), 1.37 (s, 3H), 0.83 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.0, 165.6, 145.9, 130.6, 129.7, 127.31, 87.5, 80.9, 47.0, 38.3, 28.17, 25.0, 20.4, 20.2, 18.0.

IR (neat): 2976, 1712, 1610, 1368, 1289, 1111, 1018, 847, 776, 759 cm$^{-1}$.

HRMS (ESI) calcd for C$_{21}$H$_{32}$O$_4$Na$^+$ [M+Na]$^+$: 371.2193, found: 371.2191.

Enantioselective ratio = 95.0:5.0, determined by HPLC (Daicel Chiralpak IC-H Column, $n$-Hexane: $i$-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 ℃, $\lambda$ = 214 nm):
$t_R$ = 5.68 min (major), $t_R$ = 6.14 min (minor).

$[\alpha]_D^{30.2}$ = -9.35 (c = 1.0, CHCl$_3$).

2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylphenyl)propanoate (2e)

A colorless oil (43.0 mg, 61% yield, 88% ee) from 4-bromobenzophenone (53.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.80 – 7.76 (m, 2H), 7.73 – 7.71 (m, 1H), 7.67 – 7.64 (m, 1H), 7.60 – 7.55 (m, 1H), 7.52 – 7.40 (m, 4H), 3.71 (q, $J = 7.2$ Hz, 1H), 1.49 (d, $J = 7.2$ Hz, 3H), 1.46 (s, 3H), 1.40 (s, 3H), 0.83 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.1, 141.6, 137.8, 137.6, 132.4, 131.5, 130.0, 129.1, 128.6, 128.4, 128.2, 87.5, 46.8, 38.3, 24.9, 20.4, 20.2, 18.1.

IR (neat): 2975, 1722, 1659, 1448, 1312, 1174, 1055, 937, 786, 699 cm$^{-1}$.

HRMS (ESI) calcd for C$_{23}$H$_{28}$O$_3$Na$^+$ [M+Na]$^+$: 375.1931, found: 375.1933.
Enantioselective ratio = 94.0:6.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm): $t_{R} = 25.03$ min (major), $t_{R} = 26.40$ min (minor).

$[\alpha]_{D}^{26.8} = -4.78$ (c = 1.0, CHCl3).

2,3,3-trimethylbutan-2-yl (R)-2-(4-acetylphenyl)propanoate (2f)

![Structural formula of 2f](image)

A colorless oil (42.9 mg, 74% yield, 90% ee) from 4-bromoacetophenone (40.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl3) δ 7.90 (d, $J = 8.4$ Hz, 2H), 7.36 (d, $J = 8.4$ Hz, 2H), 3.69 (q, $J = 7.2$ Hz, 1H), 2.58 (s, 3H), 1.47 (d, $J = 7.2$ Hz, 3H), 1.45 (s, 3H), 1.37 (s, 3H), 0.82 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl3) δ 197.7, 172.8, 146.7, 135.8, 128.6, 127.7, 87.6, 47.0, 38.3, 26.6, 25.0, 20.4, 20.2, 17.9.

Enantioselective ratio = 95.0:5.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_{R} = 23.96$ min (major), $t_{R} = 26.03$ min (minor).

$[\alpha]_{D}^{29.3} = -36.07$ (c = 0.2, CHCl3).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.[2]

$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-(4-(dimethylcarbamoyl)phenyl)propanoate (2g)

![Structural formula of 2g](image)

A colorless oil (41.5 mg, 65% yield, 90% ee) from 4-bromo-N,N-dimethylbenzamide (46.0 mg, 0.2 mmol).
^1H NMR (400 MHz, CDCl₃) δ 7.36 – 7.32 (m, 2H), 7.28 – 7.26 (m, 2H), 3.63 (q, J = 7.2 Hz, 1H), 3.00 (s, 6H), 1.43 (d, J = 7.2 Hz, 3H), 1.44 (s, 3H), 1.36 (s, 3H), 0.80 (s, 9H).

^13C NMR (101 MHz, CDCl₃) δ 173.1, 171.4, 142.8, 134.7, 127.4, 127.3, 87.3, 46.8, 38.3, 24.9, 20.4, 20.1, 17.9.

IR (neat): 2975, 1721, 1631, 1376, 1264, 1127, 1019, 920, 787, 729 cm⁻¹.

HRMS (ESI) calcd for C₁₉H₂₉O₃N₁ [M+H]⁺: 320.2220, found: 320.2218.

Enantioselective ratio = 95.0:5.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 95.0:5.0, flow rate 1.0 mL/min, T = 25 ℃, λ = 214 nm): tᵣ = 14.51 min (major), tᵣ = 17.70 min (minor).

[^α]D²⁶.₆ = -10.73 (c = 0.4, CHCl₃).

2-(methylthio)ethyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2h)

A colorless oil (57.1 mg, 78% yield, 90% ee) from 2-(methylthio)ethyl 4-bromobenzoate (57.0 mg, 0.2 mmol).

^1H NMR (400 MHz, CDCl₃) δ 8.00 – 7.96 (m, 2H), 7.36 – 7.32 (m, 2H), 4.47 (t, J = 7.0 Hz, 2H), 3.68 (q, J = 7.2 Hz, 1H), 2.85 (t, J = 6.8 Hz, 2H), 2.19 (s, 3H), 1.46 (d, J = 7.2 Hz, 3H), 1.45 (s, 3H), 1.36 (s, 3H), 0.81 (s, 9H).

^13C NMR (101 MHz, CDCl₃) δ 172.81, 166.18, 146.62, 129.87, 128.55, 127.56, 87.57, 63.57, 46.98, 38.30, 32.62, 24.94, 20.41, 20.14, 17.89, 15.86.

IR (neat): 2975, 1718, 1610, 1461, 1375, 1268, 1176, 1103, 939, 847, 774 cm⁻¹.

HRMS (ESI) calcd for C₂₀H₃₀O₄S₁Na₁ [M+Na]⁺: 389.1757, found: 389.1755.

Enantioselective ratio = 95:5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 ℃, λ = 214 nm): tᵣ = 11.14 min (major), tᵣ = 11.81 min (minor).
\[ \alpha \]D^{26.4} = -31.98 (c = 0.1, CHCl₃).

2,3,3-trimethylbutan-2-yl (R)-2-(3-methoxy-4-methylphenyl)propanoate (2i)

A colorless oil (36.0 mg, 65% yield, 84% ee) from 4-bromo-2-methoxy-1-methylbenzene (41.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl₃) \( \delta \) 7.05 (d, \( J = 7.4 \) Hz, 1H), 6.77 (dd, \( J = 7.4, 1.6 \) Hz, 1H), 6.74 (d, \( J = 1.6 \) Hz, 1H), 3.82 (s, 3H), 3.59 (q, \( J = 7.2 \) Hz, 1H), 2.18 (s, 3H), 1.47 (s, 3H), 1.46 (d, \( J = 7.2 \) Hz, 3H), 1.40 (s, 3H), 0.87 (s, 9H).

\(^13\)C NMR (101 MHz, CDCl₃) \( \delta \) 173.8, 157.6, 140.0, 130.5, 125.0, 119.3, 109.1, 87.0, 55.2, 47.0, 38.4, 25.0, 20.5, 20.2, 18.2, 15.9.

IR (neat): 2973, 1723, 1613, 1509, 1414, 1329, 1176, 1041, 938, 848, 728 cm\(^{-1}\).

HRMS (ESI) calcd for C₁₈H₂₈O₃Na \([M+Na]^+\): 315.1931, found: 315.1930.

Enantioselective ratio = 8.0:92.0, determined by HPLC (Daicel Chiralpak OJ-H Column, \( n \)-Hexane: \( i \)-PrOH = 99.5:0.5, flow rate 0.5 mL/min, T = 25 °C, \( \lambda = 214 \) nm): \( t_R = 12.16 \) min (minor), \( t_R = 17.47 \) min (major).

\[ \alpha \]D^{26.5} = -5.47 (c = 1.0, CHCl₃).

2,3,3-trimethylbutan-2-yl (R)-2-(4-(tert-butyl)phenyl)propanoate (2j)

A colorless oil (43.2 mg, 71% yield, 87% ee) from 1-bromo-4-tert-butylbenzene (43.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl₃) \( \delta \) 7.35 – 7.30 (m, 2H), 7.22 – 7.18 (m, 2H), 3.62 (q, \( J = 7.2 \) Hz, 1H), 1.47 (d, \( J = 7.2 \) Hz, 3H), 1.47 (s, 3H), 1.40 (s, 3H), 1.31 (s, 9H), 0.85 (s, 9H).
$^{13}$C NMR (101 MHz, CDCl$_3$) δ 173.9, 149.6, 138.2, 127.1, 125.3, 87.0, 46.5, 38.3, 34.4, 31.3, 25.0, 20.4, 20.2, 18.1.

**Enantioselective ratio** = 94:6, determined by HPLC (Daicel Chiralpak OJ-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm): $t_R$ = 7.30 min (major), $t_R$ = 8.70 min (minor).

$[α]_D^{25.6}$ = -3.89 (c = 1.0, CHCl$_3$).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.[2]

$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-([1,1'-biphenyl]-4-yl)propanoate (2k)

A white solid (53.1 mg, 82% yield, 86% ee) from 4-bromobiphenyl (47.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.62 – 7.57 (m, 4H), 7.46 – 7.42 (m, 2H), 7.38 – 7.32 (m, 3H), 3.70 (q, $J$ = 7.2 Hz, 1H), 1.53 (d, $J$ = 7.2 Hz, 3H), 1.50 (s, 3H), 1.43 (s, 3H), 0.88 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 173.6, 140.8, 140.3, 139.7, 128.7, 127.9, 127.1, 127.0, 87.2, 46.6, 38.4, 25.0, 20.5, 20.2, 18.1.

**Enantioselective ratio** = 92.7:7.3, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R$ = 5.14 min (major), $t_R$ = 5.44 min (minor).

$[α]_D^{30.0}$ = -28.66 (c = 0.2, CHCl$_3$).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.[2]

$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-(4-(methylthio)phenyl)propanoate (2l)
A colorless oil (37.4 mg, 75% yield, 89% ee) from 4-bromothioanisole (41.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.20 – 7.18 (m, 4H), 3.59 (q, $J = 7.2$ Hz, 1H), 2.46 (s, 3H), 1.46 (s, 3H), 1.44 (d, $J = 7.2$ Hz, 3H), 1.38 (s, 3H), 0.85 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.5, 138.2, 136.6, 127.9, 126.9, 87.2, 46.4, 38.3, 25.0, 20.4, 20.2, 18.0, 16.0.

IR (neat): 2975, 1722, 1493, 1463, 1373, 1205, 1172, 938, 898, 786 cm$^{-1}$.

HRMS (ESI) calcd for C$_{17}$H$_{26}$O$_2$S$_1$ Na$_1$ [M+Na]$^+$: 317.1546, found: 317.1544.

Enantioselective ratio = 94.5:5.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: $i$-PrOH = 98.0:2.0, flow rate 0.7 mL/min, T = 25 °C, $\lambda$ = 214 nm): $t_R$ = 6.89 min (major), $t_R$ = 7.13 min (minor).

$\lbrack \alpha \rbrack_{D}^{26.4}$ = -8.01 (c = 1.0, CHCl$_3$).

2,3,3-trimethylbutan-2-yl (R)-2-(4-((trifluoromethyl)thio)phenyl)propanoate(2m)

A colorless oil (48.7 mg, 70% yield, 92% ee) from 1-bromo-4-(trifluoromethylthio)benzene (52.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.60 (d, $J = 8.2$ Hz, 2H), 7.32 (d, $J = 8.2$ Hz, 2H), 3.67 (q, $J = 7.2$ Hz, 1H), 1.48 (d, $J = 7.2$ Hz, 3H), 1.46 (s, 3H), 1.38 (s, 3H), 0.80 (s, 9H).

$^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -43.0 (s, 3F).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.8, 144.5, 136.5, 129.6 (q, $J = 309.2$ Hz), 128.7, 122.6 (q, $J = 2.2$ Hz), 87.7, 46.7, 38.3, 24.9, 20.4, 20.2, 17.8.

IR (neat): 2977, 1725, 1465, 1376, 1113, 1085, 1015, 845, 786 cm$^{-1}$.

HRMS (ESI) calcd for C$_{17}$H$_{23}$O$_2$F$_3$S$_1$ [M]$^+$: 348.1365, found: 348.1372.

Enantioselective ratio = 4.0:96.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: $i$-PrOH = 100:0, flow rate 0.4 mL/min, T = 25 °C, $\lambda$ = 214 nm): $t_R$ = 36.63 min (minor), $t_R$ = 37.95 min (major).
\[ \alpha \] D_{29.3}^{29.3} = -4.90 (c = 0.2, CHCl_3).

2,3,3-trimethylbutan-2-yl (R)-2-(4-(phenylsulfonyl)phenyl)propanoate (2n)

A white solid (55.0 mg, 71% yield, 91% ee) from Phenyl 4-bromophenyl sulfone (60.0 mg, 0.2 mmol). M. p.: 54.8 – 65.0 °C

\(^1\)H NMR (400 MHz, CDCl_3) \( \delta \) 7.95 – 7.82 (m, 4H), 7.56 – 7.52 (m, 1H), 7.50 – 7.45 (m, 2H), 7.42 – 7.36 (m, 2H), 3.67 (q, \( J = 7.2 \) Hz, 1H), 1.45 (d, \( J = 7.2 \) Hz, 3H), 1.43 (s, 3H), 1.35 (s, 3H), 0.76 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl_3) \( \delta \) 172.4, 147.0, 141.7, 139.9, 133.1, 129.2, 128.5, 127.9, 127.5, 87.9, 46.8, 38.3, 24.9, 20.4, 20.2, 17.9.

IR (neat): 2974, 1719, 1596, 1447, 1373, 1210, 1153, 1107, 1068, 930, 839, 754 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{22}\)H\(_{28}\)O\(_4\)Na\(_2\)S\(_1\) [M+Na]\(^+\): 411.1600, found: 411.1601.

Enantioselective ratio = 95.5:4.5, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, \( \lambda = 254 \) nm): \( t_R \) = 17.98 min (major), \( t_R \) = 21.78 min (minor).

\[ \alpha \] D_{27.8}^{27.8} = -13.6 (c = 0.25, CHCl_3).

2,3,3-trimethylbutan-2-yl (R)-2-(4-cyanophenyl)propanoate (2o)

A colorless oil (41.0 mg, 75% yield, 92% ee) from 4-bromobenzonitrile (38.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl_3) \( \delta \) 7.60 (d, \( J = 8.2 \) Hz, 2H), 7.37 (d, \( J = 8.2 \) Hz, 2H), 3.68 (q, \( J = 7.2 \) Hz, 1H), 1.47 (d, \( J = 7.2 \) Hz, 3H), 1.45 (s, 3H), 1.37 (s, 3H), 0.81 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl_3) \( \delta \) 172.3, 146.6, 132.3, 128.4, 118.8, 110.8, 88.0, 47.0, 38.3, 24.9, 20.4, 20.2, 17.8.
Enantioselective ratio = 96:4, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 0.5 mL/min, T = 25 °C, λ = 250 nm): \( t_R = 12.68 \) min (major), \( t_R = 13.66 \) min (minor).

\([\alpha]_D^{24} = -16.69 \) (c = 1.5, CHCl\(_3\)).

All the resonances in \(^1\)H NMR spectrum were consistent with the reported values.\(^{[2]}\)

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (\(R\))-2-(4-((tert-butoxycarbonyl)amino)phenyl)propanoate (2p)

![2,3,3-trimethylbutan-2-yl (R)-2-(4-((tert-butoxycarbonyl)amino)phenyl)propanoate (2p)](image)

A colorless oil (30.0 mg, 42% yield, 85% ee) from tert-butyl N-(4-bromophenyl)carbamate (55.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \( \delta \) 7.29 (d, \( J = 8.2 \) Hz, 2H), 7.21 – 7.16 (m, 2H), 6.49 (s, 1H), 3.57 (q, \( J = 7.2 \) Hz, 1H), 1.51 (s, 9H), 1.45 (s, 3H), 1.42 (d, \( J = 7.2 \) Hz, 3H), 1.37 (s, 3H), 0.85 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \( \delta \) 173.7, 152.7, 137.0, 135.9, 128.0, 87.1, 46.3, 38.3, 28.3, 25.0, 20.4, 20.2, 18.1.

IR (neat): 2976, 1703, 1596, 1523, 1367, 1231, 1158, 1127, 1051, 839, 772 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{21}\)H\(_{33}\)O\(_4\)Na \([\text{M+Na}]^+\): 386.2302, found: 386.2300.

Enantioselective ratio = 92.5:7.5, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, \( \lambda = 220 \) nm): \( t_R = 11.74 \) min (major), \( t_R = 13.80 \) min (minor).

\([\alpha]_D^{26.5} = -2.31 \) (c = 0.1, CHCl\(_3\)).

2,3,3-trimethylbutan-2-yl (\(R\))-2-(4-acetamidophenyl)propanoate (2q)

![2,3,3-trimethylbutan-2-yl (R)-2-(4-acetamidophenyl)propanoate (2q)](image)
A colorless oil (39.7 mg, 65% yield, 85% ee) from 4-bromoacetanilide (43.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.58 (s, 1H), 7.43 (d, \(J = 8.4\) Hz, 2H), 7.20 (d, \(J = 8.4\) Hz, 2H), 3.59 (q, \(J = 7.2\) Hz, 1H), 2.14 (s, 3H), 1.45 (s, 3H), 1.43 (d, \(J = 7.2\) Hz, 3H), 1.37 (s, 3H), 0.85 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 173.7, 168.4, 137.0, 136.7, 127.9, 119.9, 87.2, 46.4, 38.3, 25.0, 24.5, 20.4, 20.2, 18.1.

IR (neat): 2973, 1722, 1667, 1513, 1316, 1173, 1126, 1003, 841, 784, 732 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{18}\)H\(_{27}\)O\(_3\)N\(_1\)Na\(_1\) [M+Na]\(^+\): 328.1883, found: 328.1881.

Enantioselective ratio = 92.5:7.5, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 0.6 mL/min, \(T = 25\) ℃, \(\lambda = 254\) nm):

\(t_R = 36.22\) min (major), \(t_R = 29.97\) min (minor).

\([\alpha]_D^{26.5} = -7.63\) (c = 0.6, CHCl\(_3\)).

2,3,3-trimethylbutan-2-yl (R)-2-(4-(2-oxopyrrolidin-1-yl)phenyl)propanoate (2r)

A colorless oil (47.0 mg, 71% yield, 84% ee) from 1-(4-bromophenyl)-2-pyrrolidinone (48.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.57 (d, \(J = 8.8\) Hz, 2H), 7.30 – 7.26 (m, 2H), 3.85 (t, \(J = 7.0\) Hz, 2H), 3.62 (q, \(J = 7.2\) Hz, 1H), 2.60 (t, \(J = 8.0\) Hz, 2H), 2.19 – 2.11 (m, 2H), 1.46 (s, 3H), 1.45 (d, \(J = 7.2\) Hz, 3H), 1.39 (s, 3H), 0.86 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 174.1, 173.6, 138.1, 137.3, 127.8, 119.8, 87.2, 48.7, 46.4, 38.3, 32.7, 25.0, 20.4, 20.2, 18.2, 18.0.

IR (neat): 2963, 1718, 1690, 1460, 1372, 1300, 1171, 1080, 928, 848, 766, 698 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{20}\)H\(_{29}\)O\(_3\)N\(_1\)Na\(_1\) [M+Na]\(^+\): 354.2040, found: 354.2038.
**Enantioselective ratio** = 92:8, determined by HPLC (Daicel Chiralpak AD-H Column, 
n-Hexane: \(i\)-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 °C, \(\lambda = 214\) nm): \(t_R = 9.00\) min (major), \(t_R = 10.39\) min (minor).

\([\alpha]D^{25.8} = -1.34\) (c = 0.1, CHCl₃).

**2,3,3-trimethylbutan-2-yl (R)-2-(4-((trimethylsilyl)ethynyl)phenyl)propanoate (2s)**

![Structure](image)

A colorless oil (44.0 mg, 64% yield, 87% ee) from (4-bromophenylethynyl)trimethylsilane (51.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl₃) \(\delta\) 7.42 – 7.39 (m, 2H), 7.22 – 7.19 (m, 2H), 3.61 (q, \(J = 7.2\) Hz, 1H), 1.45 (s, 3H), 1.44 (d, \(J = 7.2\) Hz, 3H), 1.36 (s, 3H), 0.82 (s, 9H), 0.24 (s, 
9H).

\(^{13}\)C NMR (101 MHz, CDCl₃) \(\delta\) 173.2, 141.7, 132.1, 127.3, 121.5, 105.0, 93.9, 87.3, 46.9, 38.3, 25.0, 20.4, 20.1, 17.8, -0.1.

IR (neat): 2959, 2157, 1725, 1463, 1375, 1249, 1173, 1127, 1071, 862, 840, 759 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{21}\)H\(_{32}\)O\(_2\)Si\(_1\)Na\(_1\) [M+Na]\(^+\): 367.2064, found: 367.2065.

**Enantioselective ratio** = 93.5:6.5, determined by HPLC (Daicel Chiralpak IG-H Column, 
n-Hexane: \(i\)-PrOH = 99.5:0.5, flow rate 0.3 mL/min, T = 25 °C, \(\lambda = 214\) nm): \(t_R = 13.16\) min (major), \(t_R = 13.73\) min (minor).

\([\alpha]D^{25.5} = -5.38\) (c = 0.1, CHCl₃).

**2,3,3-trimethylbutan-2-yl (R)-2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)propanoate (2t)**
A colorless oil (32.6 mg, 66% yield, 90% ee) from 2-(4-bromo-phenyl)-4,4,5,5-tetramethyl-[1,3,2]dioxaborolane (58.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.75 (d, $J = 8.0$ Hz, 2H), 7.28 (d, $J = 8.0$ Hz, 2H), 3.64 (q, $J = 7.2$ Hz, 1H), 1.46(s, 3H), 1.45 (d, $J = 7.0$ Hz, 3H), 1.37 (s, 3H), 1.34 (s, 12H), 0.83 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 173.4, 144.5, 135.0, 126.9, 87.2, 83.7, 47.2, 38.3, 25.0, 24.9, 24.8, 20.5, 20.2, 18.0.

Enantioselective ratio = 95.0:5.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: $i$-PrOH = 98.0:2.0, flow rate 0.5 mL/min, T = 25 °C, $\lambda = 214$ nm): $t_R = 8.49$ min (major), $t_R = 8.82$ min (minor).

$[\alpha]_D^{25.3} = -1.38$ (c = 0.25, CHCl$_3$).

All the resonances in $^1$H NMR spectrum were consistent with the reported values.$^{[2]}$

$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-(4-oxochroman-7-yl)propanoate (2u)

A colorless oil (45.2 mg, 71% yield, 91% ee) from 7-bromo-4-chromanone (46.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.83 (d, $J = 8.0$ Hz, 1H), 6.92 (dd, $J = 8.0$, 1.6 Hz, 1H), 6.88 (d, $J = 1.6$ Hz, 1H), 4.51 (dd, $J = 6.8$, 6.0 Hz, 2H), 3.62 (q, $J = 7.2$ Hz, 1H), 2.78 (dd, $J = 6.8$, 6.0 Hz, 2H), 1.46 (s, 3H), 1.45 (d, $J = 7.2$ Hz, 3H), 1.39 (s, 3H), 0.84 (s, 9H).
$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 191.5, 172.5, 161.9, 150.0, 127.3, 121.0, 120.0, 116.7, 87.8, 67.1, 47.1, 38.3, 37.7, 25.1, 25.1, 25.0, 20.4, 20.2, 17.7.

IR (neat): 2975, 1722, 1691, 1569, 1432, 1254, 1126, 1037, 939, 879, 789 cm$^{-1}$.

HRMS (ESI) calcd for C$_{19}$H$_{26}$O$_4$Na$_1$ [M+Na]$^+$: 341.1723, found: 341.1721.

Enantioselective ratio = 95.5:4.5, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, $\lambda$ = 220 nm): $t_R$ = 8.23 min (major), $t_R$ = 8.99 min (minor).

$[\alpha]_D^{26.7} = -5.24$ (c = 1.0, CHCl$_3$).

Ethyl (R)-5-[(1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl]benzofuran-2-carboxylate (2v)

A colorless oil (53.0 mg, 74% yield, 88% ee) from ethyl(5-bromobenzofuran)-2-carboxylate (54.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.57 (d, $J$ = 1.8 Hz, 1H), 7.51 (d, $J$ = 8.8 Hz, 1H), 7.48 (s, 1H), 7.36 (dd, $J$ = 8.8, 1.8 Hz, 1H), 4.49–4.35 (m, 2H), 3.73 (q, $J$ = 7.2 Hz, 1H), 1.50 (d, $J$ = 7.2 Hz, 3H), 1.45 (s, 3H), 1.41 (t, $J$ = 7.1 Hz, 3H), 1.35 (s, 3H), 0.81 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.6, 159.5, 154.8, 146.0, 137.1, 127.5, 127.1, 121.2, 113.7, 112.2, 87.3, 61.5, 46.7, 38.3, 24.9, 20.4, 20.2, 18.4, 14.3.

IR (neat): 2977, 1719, 1565, 1464, 1370, 1295, 1260, 1176, 1125, 1094, 1016, 944, 846, 765 cm$^{-1}$.

HRMS (ESI) calcd for C$_{21}$H$_{28}$O$_5$Na$_1$ [M+Na]$^+$: 383.1829, found: 383.1829.

Enantioselective ratio = 93.5:6.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 1.0 mL/min, T = 25 °C, $\lambda$ = 254 nm): $t_R$ = 16.67 min (major), $t_R$ = 17.60 min (minor).

$[\alpha]D^{30.2} = -8.61$ (c = 0.1, CHCl$_3$).
2,3,3-trimethylbutan-2-yl (R)-2-(benzofuran-3-yl)propanoate (2w)

A colorless oil (38.1 mg, 61% yield, 80% ee) from 3-bromo-1-benzofuran (40.0 mg, 0.2 mmol).

\[ ^1H \text{NMR (400 MHz, CDCl}_3\text{)} \delta 7.62 - 7.57 (m, 1H), 7.55 (s, 1H), 7.48 - 7.45 (m, 1H), 7.31 - 7.26 (m, 1H), 7.25 - 7.21 (m, 1H), 3.86 - 3.80 (m, 1H), 1.59 (d, \( J = 7.2 \text{ Hz} \), 3H), 1.47 (s, 3H), 1.44 (s, 3H), 0.82 (s, 9H).

\[ ^{13}C \text{NMR (101 MHz, CDCl}_3\text{)} \delta 173.0, 155.3, 141.4, 127.0, 124.3, 122.4, 120.5, 120.0, 111.5, 87.6, 38.3, 37.5, 24.9, 20.34, 20.27, 17.1.

\text{Enantioselective ratio} = 90:10, \text{ determined by HPLC (Daicel Chiralpak IG-H Column,} \ n-\text{Hexane:} \text{-PrOH} = 99.5:0.5, \text{ flow rate 1.0 mL/min,} \ T = 25 \text{ ℃,} \lambda = 214 \text{ nm):} \ t_R = 6.84 \text{ min (minor),} \ t_R = 7.33 \text{ min (major).}

\[ [\alpha]_D^{27} = -6.31 (c = 0.7, \text{ CHCl}_3). \]

All the resonances in \(^1H\) NMR spectrum were consistent with the reported values.\[^2\] \(^1H\) and \(^{13}C\) NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-(dibenzo[b,d]thiophen-3-yl)propanoate (2x)

A colorless oil (55.3 mg, 78% yield, 89% ee) from 3-bromodibenzo[b,d]thiophene (53.0 mg, 0.2 mmol).

\[ ^1H \text{NMR (400 MHz, CDCl}_3\text{)} \delta 8.15 - 8.11 (m, 1H), 8.10 (d, \( J = 8.2 \text{ Hz} \), 1H), 7.88 - 7.82 (m, 1H), 7.81 - 7.78 (m, 1H), 7.47 - 7.43 (m, 2H), 7.41 - 7.38 (m, 1H), 3.81 (q, \( J = 7.2 \text{ Hz} \), 1H), 1.58 (d, \( J = 7.2 \text{ Hz} \), 3H), 1.50 (s, 3H), 1.41 (s, 3H), 0.86 (s, 9H).

\[ ^{13}C \text{NMR (101 MHz, CDCl}_3\text{)} \delta 173.4, 140.1, 139.7, 139.4, 135.3, 126.5, 124.3, 124.1, 122.7, 121.5, 121.5, 121.4, 87.4, 47.1, 38.3, 25.0, 20.5, 20.2, 18.2.

\text{IR (neat):} 2974, 1723, 1443, 1373, 1235, 1126, 1038, 846, 786, 748, 613 \text{ cm}^{-1}.\]
HRMS (ESI) calcd for C_{22}H_{26}O_{2}S_{1}Na_{1} [M+Na]^+: 377.1546, found: 377.1545.

Enantioselective ratio = 94.5:5.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R = 5.73$ min (major), $t_R = 6.05$ min (minor).

$[\alpha]_D^{26} = -8.21$ (c = 0.2, CHCl$_3$).

2,3,3-trimethylbutan-2-yl (R)-2-(2-(methylthio)pyrimidin-5-yl)propanoate (2y)

A colorless oil (38.5 mg, 65% yield, 86% ee) from 5-bromo-2-(methylthio)pyrimidine (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDC$_3$) δ 8.43 (s, 2H), 3.54 (q, $J = 7.2$ Hz, 1H), 2.53 (s, 3H), 1.46 (d, $J = 7.3$ Hz, 3H), 1.45 (s, 3H), 1.39 (s, 3H), 0.86 (s, 9H).

$^{13}$C NMR (101 MHz, CDC$_3$) δ 172.0, 171.2, 156.3, 129.0, 88.4, 42.0, 38.3, 25.0, 20.4, 20.3, 17.7, 14.0.

IR (neat): 2975, 1723, 1582, 1535, 1455, 1397, 1175, 1125, 937, 846, 776 cm$^{-1}$.

HRMS (ESI) calcd for C$_{15}$H$_{25}$O$_2$N$_2$S$_1$ [M+H]^+: 279.1631, found: 279.1630.

Enantioselective ratio = 7.0:93.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm): $t_R = 24.53$ min (minor), $t_R = 28.06$ min (major).

$[\alpha]_D^{26.1} = 0.83$ (c = 1.0, CHCl$_3$).

2,3,3-trimethylbutan-2-yl (R)-2-(9H-fluoren-2-yl)propanoate (2z)

A white solid (60.0 mg, 90% yield, 86% ee) from 2-bromofluorene (50.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDC$_3$) δ 7.79 – 7.75 (m, 1H), 7.73 – 7.71 (m, 1H), 7.55 – 7.52 (m, 1H), 7.47 (s, 1H), 7.37 (td, $J = 7.5$, 1.1 Hz, 1H), 7.39 – 7.35 (m, 1H), 7.31 – 7.26
(m, 2H), 3.88 (s, 2H), 3.71 (q, \( J = 7.2 \) Hz, 1H), 1.52 (d, \( J = 7.2 \) Hz, 3H), 1.48 (s, 3H), 1.39 (s, 3H), 0.85 (s, 9H).

\(^{13}\text{C NMR} (101 \text{ MHz, CDCl}_3) \delta 173.9, 143.5, 143.3, 141.5, 140.4, 139.9, 126.7, 126.5, 126.2, 125.0, 124.1, 119.8, 119.8, 87.1, 47.1, 38.4, 36.8, 25.0, 20.5, 20.2, 18.2.

**Enantioselective ratio** = 93.0:7.0, determined by HPLC (Daicel Chiralpak IC-H Column, \( n \)-Hexane: \( i \)-PrOH = 98:2, flow rate 1.0 mL/min, \( T = 25 \) °C, \( \lambda = 214 \) nm): \( t_R = 4.87 \) min (major), \( t_R = 5.22 \) min (minor).

\([\alpha]_D^{26.4} = -12.1 \) (c = 0.25, CHCl\(_3\)).

All the resonances in \(^1\text{H NMR} \) spectrum were consistent with the reported values.\(^2\)

\(^1\text{H and }^{13}\text{C NMR} \) spectra are provided below.

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2,3,3-trimethylbutan-2-yl \((R,E)-4\)-(4-methoxyphenyl)-2-methylbut-3-enolate (2aa)

A colorless oil (34.0 mg, 56% yield, 55% ee) from \((E)-1\)-(2-bromovinyl)-4-methoxybenzene (43.0 mg, 0.2 mmol).

\(^1\text{H NMR} (400 \text{ MHz, CDCl}_3) \delta 7.31 – 7.27 \) (m, 2H), 6.91 – 6.72 \( (m, 2H) \), 6.40 \( (d, J = 15.8 \) Hz, 1H), 6.12 \( (dd, J = 15.8, 8.0 \) Hz, 1H), 3.80 \( (s, 3H) \), 3.23 – 3.16 \( (m, 1H) \), 1.50 \( (s, 3H) \), 1.49 \( (s, 3H) \), 1.32 \( (d, J = 7.0 \) Hz, 3H), 0.98 (s, 9H).

\(^{13}\text{C NMR} (101 \text{ MHz, CDCl}_3) \delta 173.8, 159.0, 130.1, 129.9, 127.3, 127.3, 113.9, 87.1, 55.2, 44.8, 38.4, 25.1, 20.4, 20.4, 17.4.

**IR** (neat): 2975, 1722, 1505, 1375, 1235, 1169, 1127, 1071, 938, 898, 867, 787 cm\(^{-1}\).

**HRMS (ESI)** calcd for C\(_{19}\)H\(_{28}\)O\(_3\)Na\(_1\) [M+Na]\(^+\): 327.1932, found: 327.1931.

**Enantioselective ratio** = 77.5 : 22.5, determined by HPLC (Daicel Chiralpak OJ-H Column, \( n \)-Hexane: \( i \)-PrOH = 98:2, flow rate 0.4 mL/min, \( T = 25 \) °C, \( \lambda = 214 \) nm): \( t_R = 15.850 \) min (major), \( t_R = 17.462 \) min (minor).

\([\alpha]_D^{26.2} = 3.7 \) (c = 1.0, CHCl\(_3\)).
(R)-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-((R)-1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2ab)

A colorless oil (98.7 mg, 70% yield, 89% dr) from (R)-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-bromobenzoate (123.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 8.23 – 8.20 (m, 2H), 7.46 – 7.43 (m, 2H), 3.76 (q, $J$ = 7.2 Hz, 1H), 2.63 (t, $J$ = 6.8 Hz, 1H), 2.14 (s, 3H), 2.07 (s, 3H), 2.03 (s, 3H), 1.91 – 1.75 (m, 2H), 1.60 – 1.58 (m, 6H), 1.54 (d, $J$ = 7.2 Hz, 3H), 1.51 (s, 3H), 1.44 (s, 3H), 1.48 – 1.36 (m, 4H), 1.38 – 1.20 (m, 11H), 1.19 – 1.03 (m, 6H), 0.89 (s, 9H), 0.91 – 0.85 (m, 12H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 172.8, 165.0, 149.4, 147.0, 140.6, 130.4, 128.2, 127.7, 126.9, 125.1, 123.1, 117.4, 87.7, 75.0, 47.1, 40.4, 39.6, 39.3, 38.3, 37.4, 37.3, 32.8, 32.7, 32.6, 31.2, 31.0, 27.9, 25.0, 24.8, 24.4, 24.2, 23.7, 22.7, 22.6, 21.0, 20.6, 20.4, 20.2, 19.7, 19.6, 18.0, 13.0, 12.1, 11.8.

IR (neat): 2925, 1729, 1460, 1376, 1270, 1176, 1129, 1091, 938, 850, 735 cm$^{-1}$.

HRMS (ESI) calcd for C$_{46}$H$_{72}$O$_5$Na$^+$ [M+Na]$^+$: 727.5272, found: 727.5276.

Enantioselective ratio = 94.5:5.5, determined by HPLC (Daicel Chiralpak IG-H Column, $n$-Hexane: i-PrOH = 98.0:2.0, flow rate 0.4 mL/min, T = 25 °C, $\lambda$ = 214 nm):

$t_R$ = 13.16 min (major), $t_R$ = 14.20 min (minor).

$[\alpha]_D^{27}$ = 0.94 (c = 1.0, CHCl$_3$).

2,3,3-trimethylbutan-2-yl (R)-2-3-((5-((4-fluorophenyl)thiophen-2-yl)methyl)-4-methylphenyl)propanoate (2ac)
A colorless oil (68.5 mg, 76% yield, 86% ee) from 2-(bromo-2-Methylbenzyl)-5-(4-fluorophenyl)thiophene (72.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.51 – 7.44 (m, 2H), 7.19 – 7.10 (m, 3H), 7.06 – 7.00 (m, 3H), 6.65 – 6.63 (m, 1H), 4.12 (s, 2H), 3.62 (q, $J$ = 7.2 Hz, 1H), 2.30 (s, 3H), 1.48 (s, 3H), 1.47 (d, $J$ = 7.0 Hz, 3H), 1.40 (s, 3H), 0.86 (s, 9H).

$^{19}$F NMR (377 MHz, CDCl$_3$) $\delta$ -115.23 – -115.11 (m, 1F).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.7, 139.2, 138.1, 134.8, 130.6, 128.6, 127.1, 127.0, 125.9, 125.8, 122.6, 122.5, 115.7, 115.5, 87.0, 46.5, 38.3, 34.1, 25.0, 20.4, 20.2, 19.0, 18.2.

IR (neat): 2973, 1721, 1508, 1464, 1374, 1230, 1128, 1013, 891, 831, 798, 733 cm$^{-1}$.

HRMS (ESI) calcd for C$_{28}$H$_{33}$O$_2$F$_1$S$_1$Na$_1$ [M+Na]$^+$: 475.2078, found: 475.2078.

Enantioselective ratio = 7:93, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 0.4 mL/min, T = 25 ℃, $\lambda$ = 214 nm): $t_R$ = 17.38 min (major), $t_R$ = 18.67 min (minor).

[$\alpha$]$_D^{25.4}$ = -12.10 (c = 0.1, CHCl$_3$)

2,3,3-trimethylbutan-2-yl (R)-2-(4-(N-(2,6-dimethoxypyrimidin-4-yl)-N-methylsulfamoyl)phenyl)propanoate (2ad)

A colorless oil (77.5 mg, 81% yield, 91% ee) from 4-bromo-N-(2,6-dimethoxypyrimidin-4-yl)-N-methylbenzenesulfonamide (78.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.74 – 7.69 (m, 2H), 7.37 – 7.33 (m, 2H), 6.60 (s, 1H), 3.89 (s, 3H), 3.82 (s, 3H), 3.66 (q, $J$ = 7.2 Hz, 1H), 3.42 (s, 3H), 1.43 (d, $J$ = 7.2 Hz, 3H), 1.41 (s, 3H), 1.31 (s, 3H), 0.73 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.5, 172.2, 164.2, 161.2, 147.1, 136.9, 128.3, 127.3, 89.6, 87.9, 54.6, 54.0, 46.8, 38.2, 34.3, 24.8, 20.3, 20.1, 17.7.

IR (neat): 2950, 1718, 1565, 1452, 1349, 1277, 1127, 1091, 1039, 967, 774, 594 cm$^{-1}$. 
HRMS (ESI) calcd for C_{33}H_{38}O_6N_1{[M+H]^+}: 508.2694, found: 508.2698.

Enantioselective ratio = 96:4, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90.0:10.0, flow rate 1.0 mL/min, T = 25 °C, λ = 250 nm): \( t_R = 11.91 \text{ min (major)}, t_R = 15.37 \text{ min (minor)}. \)

\( [\alpha]D^{26.5} = -8.86 \) (c = 1.0, CHCl_3).

2,3,3-trimethylbutan-2-yl (\( R \))-2-(4-(5-methoxy-3-(2-methoxy-2-oxoethyl)-2-methyl-1H-indole-1-carbonyl)phenyl)propanoate (2ae)

A colorless oil (76.0 mg, 75% yield, 92% ee) from 2-(1-(4-bromobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)acetate (83.4 mg, 0.2 mmol).

\(^1H\) NMR (400 MHz, CDCl_3) \( \delta 7.70 – 7.66 \) (m, 2H), 7.40 – 7.37 (m, 2H), 6.95 (d, \( J = 2.4 \) Hz, 1H), 6.86 (d, \( J = 9.0 \) Hz, 1H), 6.62 (dd, \( J = 9.0, 2.4 \) Hz, 1H), 3.83 (s, 3H), 3.73 (q, \( J = 7.2 \) Hz, 1H), 3.70 (s, 3H), 3.67 (s, 2H), 2.37 (s, 3H), 1.50 (d, \( J = 7.2 \) Hz, 3H), 1.48 (s, 3H), 1.40 (s, 3H), 0.85 (s, 9H).

\(^{13}C\) NMR (101 MHz, CDCl_3) \( \delta 172.7, 171.4, 155.8, 146.6, 136.0, 134.0, 130.9, 130.5, 130.1, 127.8, 114.9, 112.1, 111.5, 101.0, 87.6, 55.6, 52.1, 47.0, 38.4, 30.1, 25.0, 20.4, 20.1, 17.8, 13.2.

IR (neat): 2959, 1731, 1686, 1475, 1371, 1263, 1178, 1127, 1066, 922, 846, 793 cm\(^{-1}\).

HRMS (ESI) calcd for C_{30}H_{38}O_6N_1{[M+H]^+}: 508.2694, found: 508.2698.

Enantioselective ratio = 95.5:4.5, determined by HPLC (Daicel Chiralpak IC-H Column, \( n \)-Hexane: \( i \)-PrOH = 90.0:10.0, flow rate 1.0 mL/min, \( T = 25 \) °C, \( \lambda = 254 \) nm): \( t_R = 23.76 \text{ min (major)}, t_R = 25.4 \text{ min (minor)}. \)

\( [\alpha]D^{25.6} = -2.89 \) (c = 0.1, CHCl_3).
(1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2af)

A colorless oil (64.5 mg, 75% yield, 92% dr) from (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 4-bromobenzoate (67.8 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 8.00 – 7.97 (m, 2H), 7.35 – 7.32 (m, 2H), 4.95 – 4.80 (m, 1H), 3.69 (q, J = 7.2 Hz, 1H), 2.14 – 2.07 (m, 1H), 1.98 – 1.88 (m, 1H), 1.75 – 1.69 (m, 2H), 1.60 – 1.50 (m, 2H), 1.47 (d, J = 7.2 Hz, 3H), 1.46 (s, 3H), 1.38 (s, 3H), 1.15 – 1.07 (m, 2H), 0.92 – 0.89 (m, 7H), 0.85 (s, 9H), 0.78 (d, J = 6.8 Hz, 3H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 172.9&172.8, 165.9, 146.2&146.1, 129.8, 129.4, 127.4, 87.6, 74.7, 47.2, 47.0&46.9, 40.9, 38.3, 34.3, 31.4, 26.5, 25.0, 23.6, 22.0, 20.7, 20.4, 20.2&20.1, 18.1&18.0, 16.5.

IR (neat): 2956, 2871, 1712, 1610, 1455, 1371, 1269, 1176, 982, 962, 846, 746 cm$^{-1}$.

HRMS (ESI) calcd for C$_{27}$H$_{42}$O$_4$Na$^+ _1$ [M+H]$^+$: 453.2975, found: 453.2974.

Enantioselective ratio = 96:4, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R = 7.24$ min (major), $t_R = 8.96$ min (minor).

$[\alpha]_{D}^{26.4} = -43.14$ (c = 1.125, CHCl$_3$).

(3aR,5R,6S,6aR)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-d][1,3]dioxol-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2ag)
A colorless oil (74.8 mg, 70% yield, 90% dr) from \((3a^R,5^R,6^S,6a^R)-5-((R)-2,2\text{-dimethyl-1,3-dioxolan-4-yl})-2,2\text{-dimethyltetrahydrofuro[2,3-}d\text{][1,3]dioxol6-yl 4-bromobenzoate (88.6 mg, 0.2 mmol).}

\(^1\text{H NMR (400 MHz, CDCl}_3\text{)} \delta 7.98 - 7.94 (m, 2H), 7.36 - 7.32 (m, 2H), 5.93 (d, \(J = 3.6\text{ Hz}, 1H\)), 5.48 (d, \(J = 2.6\text{ Hz}, 1H\)), 4.61 (d, \(J = 3.6\text{ Hz}, 1H\)), 4.37 - 4.29 (m, 2H), 4.12 - 4.04 (m, 2H), 3.69 (q, \(J = 7.2\text{ Hz}, 1H\)), 1.54 (s, 3H), 1.46 (d, \(J = 7.2\text{ Hz}, 3H\)), 1.45 (s, 3H), 1.39 (s, 3H), 1.36 (s, 3H), 1.30 (s, 3H), 1.24 (s, 3H), 0.82 (s, 9H).

\(^1\text{C NMR (101 MHz, CDCl}_3\text{)} \delta 172.7\&172.6, 164.9, 147.1&147.0, 130.0, 127.7, 112.2, 109.3, 105.0, 87.6, 83.3, 80.0, 76.5, 72.5, 67.1, 46.9&46.8, 38.3, 26.7, 26.6, 26.1, 25.1, 24.9, 20.4, 20.1&20.0, 17.9&17.8.

\text{IR (neat): 2980, 1722, 1610, 1374, 1263, 1166, 1072, 1017, 846, 734, 702 cm}^{-1}.

\text{HRMS (ESI) calcd for C}_{29}\text{H}_{42}\text{O}_9\text{Na}^{+} [M+Na]^+ : 557.2721, found: 557.2720.

\text{Enantioselective ratio} = 95:5, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: \(i\)-PrOH = 98.0:2.0, flow rate 0.7 mL/min, T = 25 °C, \(\lambda = 214 \text{ nm})\): \(t_R = 10.19\) min (major), \(t_R = 11.62\) min (minor).

\([\alpha]_D^{27.4} = -39.29\) (c = 2.0, CHCl\(\text{_3}\)).

\[2,3,3\text{-trimethylbutan-2-yl (R)-2-(6-methoxynaphthalen-2-yl)propanoate (2ah)}\]

A colorless oil (39.0 mg, 60% yield, 87% ee) from 2-bromo-6-methoxynaphthalene (50.0 mg, 0.2 mmol).
1H NMR (400 MHz, CDCl₃) δ 7.71 – 7.65 (m, 3H), 7.41 – 7.38 (m, 1H), 7.15 – 7.11 (m, 2H), 3.91 (s, 1H), 3.78 (q, J = 7.2 Hz, 1H), 1.56 (d, J = 7.2 Hz, 3H), 1.49 (s, 3H), 1.39 (s, 3H), 0.85 (s, 9H).

13C NMR (101 MHz, CDCl₃) δ 173.8, 157.4, 136.4, 133.5, 129.2, 128.9, 126.9, 126.4, 125.8, 118.8, 118.8, 105.5, 87.1, 55.3, 46.9, 38.3, 25.0, 20.5, 20.2, 18.2.

Enantioselective ratio = 93.5:6.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 0.5 mL/min, T = 25 °C, λ = 254 nm): tᵣ = 18.43 min (major), tᵣ = 19.7 min (minor).

[α]D²⁹ = -24.71 (c = 0.2, CHCl₃).

All the resonances in 1H NMR spectrum were consistent with the reported values.[²] 1H and 13C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl (R)-2-(4-isobutylphenyl)propanoate (2ai)

A colorless oil (39.5 mg, 65% yield, 86% ee) from 1-bromo-4-isobutylbenzene (43.0 mg, 0.2 mmol).

1H NMR (400 MHz, CDCl₃) δ 7.18 – 7.15 (m, 2H), 7.09 – 7.06 (m, 2H), 3.60 (q, J = 7.2 Hz, 1H), 2.44 (d, J = 7.2 Hz, 2H), 1.84 (dp, J = 13.5, 6.8 Hz, 1H), 1.46 (t, J = 3.6 Hz, 6H), 1.38 (s, 3H), 0.88 (d, J = 6.8 Hz, 6H), 0.82 (s, 9H).

13C NMR (101 MHz, CDCl₃) δ 173.9, 140.1, 138.6, 129.1, 127.1, 86.9, 46.6, 45.0, 38.3, 30.2, 24.9, 22.3, 20.4, 20.2, 18.0.

Enantioselective ratio = 93:7.0, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): tᵣ = 7.86 min (major), tᵣ = 9.41 min (minor).

[α]D²⁷ = -8.25 (c = 1.0, CHCl₃).

All the resonances in 1H NMR spectrum were consistent with the reported values.[¹] 1H and 13C NMR spectra are provided below.
2,3,3-trimethylbutan-2-yl \((R)\)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoate (2aj)

A colorless oil (53.0 mg, 78% yield, 90% ee) from 4-bromo-2-fluorobiphenyl (50.0 mg, 0.2 mmol).

\[^1^H\text{ NMR (400 MHz, CDCl}_3\text{) } \delta 7.38 - 7.34 (m, 2H), 7.29 - 7.14 (m, 4H), 6.97 - 6.90 (m, 2H), 3.50 (q, \( J = 7.2 \text{ Hz, 1H}), 1.33 (d, \( J = 7.2 \text{ Hz, 3H}), 1.32 (s, 3H), 1.26 (s, 3H), 0.71 (s, 9H).\)

\[^1^9^F\text{ NMR (376 MHz, CDCl}_3\text{) } \delta -118.04 - -118.00 (m, 1F).\)

\[^1^3^C\text{ NMR (101 MHz, CDCl}_3\text{) } \delta 173.1, 159.6 (d, \( J = 248.1 \text{ Hz}), 142.6 (d, \( J = 7.7 \text{ Hz), 135.6, 130.6 (d, \( J = 4.0 \text{ Hz), 128.9 (d, \( J = 3.0 \text{ Hz), 128.4, 127.6, 127.4 (d, \( J = 13.5 \text{ Hz), 123.6 (d, \( J = 3.4 \text{ Hz), 115.2 (d, \( J = 23.5 \text{ Hz), 87.6, 46.5 (d, \( J = 1.5 \text{ Hz), 38.4, 25.0, 20.5, 20.3, 18.0.\)

Enantioselective ratio = 94.8:5.2, determined by HPLC (Daicel Chiralpak AD-H Column, n-Hexane: \( i\)-PrOH = 99.8:0.2, flow rate 0.5 mL/min, T = 25 \( ^\circ \text{C, } \lambda = 254 \text{ nm)\:}

\( t_R = 12.88 \text{ min (major), } t_R = 14.86 \text{ min (minor).\)

\[^{[\alpha]^D_{30.3}} = -24.61 \text{ (c = 0.2, CHCl}_3\text{).}\)

All the resonances in \(^1^H\text{ NMR spectrum were consistent with the reported values.}^{[2]}\)

\(^1^H\text{ and } ^{13}^C\text{ NMR spectra are provided below.}\)

2,3,3-trimethylbutan-2-yl \((R)\)-2-(3-benzoylphenyl)propanoate (2ak)

A colorless oil (45.8 mg, 65% yield, 92% ee) from 3-bromobenzophenone (53.0 mg, 0.2 mmol).
**1H NMR (400 MHz, CDCl₃)** δ 7.79 – 7.75 (m, 4H), 7.60 – 7.55 (m, 1H), 7.49 – 7.45 (m, 2H), 7.40 – 7.36 (m, 2H), 3.73 (q, J = 7.2 Hz, 1H), 1.51 (d, J = 7.2 Hz, 3H), 1.48 (s, 3H), 1.40 (s, 3H), 0.84 (s, 9H).

**13C NMR (101 MHz, CDCl₃)** δ 196.3, 172.9, 146.0, 137.7, 136.1, 132.3, 130.4, 129.9, 128.2, 127.5, 87.6, 47.0, 38.3, 25.0, 20.4, 20.2, 17.9.

**IR (neat):** 2975, 1722, 1659, 1448, 1281, 1126, 954, 897, 784, 643 cm⁻¹.

**HRMS (ESI) calculated for C₂₃H₂₈O₃Na⁺: 375.1931, found: 375.1933.**

**Enantioselective ratio = 96.0:4.0,** determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): 

\[ t_R = 18.03 \text{ min (minor)}, \ t_R = 23.03 \text{ min (major)}. \]

[\[\alpha\]]_{D}^{25.9} = -13.09 (c = 1.0, CHCl₃).

**2,3,3-trimethylbutan-2-yl (R)-2-(3-phenoxyphe nyl)propanoate (2aI)**

A colorless oil (48.2 mg, 71% yield, 90% ee) from 3-bromophenoxybenzene (50.0 mg, 0.2 mmol).

**1H NMR (400 MHz, CDCl₃)** δ 7.32 – 7.26 (m, 2H), 7.24 – 7.22 (m, 1H), 7.08 – 7.04 (m, 1H), 7.01 – 6.98 (m, 1H), 6.97 – 6.94 (m, 2H), 6.92 – 6.84 (m, 1H), 6.87 – 6.83 (m, 1H), 3.57 (q, J = 7.2 Hz, 1H), 1.43 (s, 3H), 1.41 (d, J = 7.2 Hz, 3H), 1.36 (s, 3H), 0.81 (s, 9H).

**13C NMR (101 MHz, CDCl₃)** δ 173.2, 157.3, 143.4, 129.5, 129.7, 123.1, 122.4, 118.8, 118.1, 117.3, 87.2, 46.8, 38.3, 31.5, 30.1, 25.0, 20.4, 20.2, 18.0.

**Enantioselective ratio = 95.0:5.0,** determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm):

\[ t_R = 5.76 \text{ min (minor)}, \ t_R = 6.43 \text{ min (major)}. \]

[\[\alpha\]]_{D}^{25.9} = -5.16 (c = 1.0, CHCl₃).

All the resonances in 1H NMR spectrum were consistent with the reported values.²

1H and 13C NMR spectra are provided below.
2,3,3-trimethylbutan-2-yl (R)-2-(4-phenoxypyphenyl)propanoate (2am)

A colorless oil (51.5 mg, 76% yield, 87% ee) from 4-bromophenoxybenzene (50.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 7.35 – 7.29 (m, 1H), 7.25 – 7.21 (m, 2H), 7.11 – 7.06 (m, 1H), 7.00 – 6.94 (m, 4H), 3.63 (q, $J = 7.2$ Hz, 1H), 1.48 (d, $J = 7.2$ Hz, 3H), 1.47 (s, 3H), 1.40 (s, 3H), 0.86 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 173.7, 155.8, 136.3, 129.7, 128.8, 123.0, 119.1, 118.5, 87.2, 46.3, 38.4, 25.0, 20.4, 20.2, 18.1.

IR (neat): 2975, 1723, 1590, 1487, 1235, 1127, 1071, 870, 787, 691 cm$^{-1}$.

HRMS (ESI) calcd for C$_{22}$H$_{29}$O$_3$ [M+H]$^+$: 341.2117, found: 341.2119.

Enantioselective ratio = 93.5:6.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R$ = 9.88 min (major), $t_R$ = 10.36 min (minor).

$[\alpha]_D^{28.2} = -9.06$ (c = 0.1, CHCl$_3$).

methyl (S)-4-(3-benzyloxy)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2an)

A colorless oil (57.6 mg, 71% yield, 66% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).
**Methyl (R)-4-(3-(4-methoxyphenyl)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2ao)**

A colorless oil (42.0 mg, 52% yield, 77% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

**$^1$H NMR (400 MHz, CDCl$_3$)**  δ 8.00 – 7.96 (m, 2H), 7.38 – 7.34 (m, 2H), 7.34 – 7.23 (m, 5H), 4.59 – 4.48 (m, 2H), 4.04 (dd, $J = 9.2, 8.0$ Hz, 1H), 3.91 (s, 3H), 3.73 (dd, $J = 9.2, 6.2$ Hz, 1H), 1.48 (s, 3H), 1.38 (s, 3H), 0.84 (s, 9H).

**$^{13}$C NMR (101 MHz, CDCl$_3$)**  δ 171.9, 158.1, 144.5, 130.8, 129.8, 129.7, 128.9, 128.1, 113.7, 87.8, 55.2, 55.0, 52.0, 38.2, 38.2, 25.0, 20.4, 20.1.

**IR** (neat): 2959, 1715, 1514, 1439, 1351, 1275, 1210, 1115, 967, 854, 746 cm$^{-1}$.

**HRMS** (ESI) calcd for C$_{25}$H$_{32}$O$_5$Na$_1$ [M+Na]$^+$: 435.2142, found: 435.2143.
Enantioselective ratio = 89:11, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-ProOH = 99.0:1.0, flow rate 0.8 mL/min, T = 25 °C, λ = 214 nm): $t_R = 17.17$ min (major), $t_R = 18.49$ min (minor).

$[\alpha]_D^{26.5} = -39.88$ (c = 1.0, CHCl$_3$).

Methyl ($R$)-4-(1-oxo-3-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (2ap)

A colorless oil (49.7 mg, 65% yield, 80% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.98 – 7.95 (m, 2H), 7.36 – 7.33 (m, 2H), 7.24 – 7.18 (m, 2H), 7.18 – 7.13 (m, 1H), 7.11 – 7.07 (m, 2H), 3.90 (s, 3H), 3.83 (t, $J = 7.8$ Hz, 1H), 3.41 (dd, $J = 13.8$, 8.0 Hz, 1H), 3.02 (dd, $J = 13.8$, 7.6 Hz, 1H), 1.36 (s, 3H), 1.33 (s, 3H), 0.79 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 171.9, 166.9, 144.4, 138.7, 129.8, 128.9, 128.9, 128.3, 128.0, 126.4, 87.9, 54.8, 52.0, 39.1, 38.3, 25.0, 20.4, 20.1.

IR (neat): 2948, 1712, 1609, 1436, 1366, 1275, 1207, 1112, 1024, 874, 784, 698 cm$^{-1}$.

HRMS (ESI) calcd for C$_{24}$H$_{30}$O$_4$Na$^+$ [M+Na]$^+$: 405.2036, found: 405.2035.

Enantioselective ratio = 90:10, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-ProOH = 98.0:2.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R = 9.37$ min (major), $t_R = 9.94$ min (minor)

$[\alpha]_D^{26.6} = -12.65$ (c = 1.0, CHCl$_3$).

Methyl ($R$)-4-(1-oxo-4-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (2aq)
A colorless oil (65.0 mg, 82% yield, 87% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.10 – 7.98 (m, 2H), 7.38 – 7.33 (m, 2H), 7.31 – 7.26 (m, 2H), 7.22 – 7.18 (m, 1H), 7.16 – 7.12 (m, 2H), 3.91 (s, 3H), 3.53 (t, $J = 7.6$ Hz, 1H), 2.65 – 2.52 (m, 2H), 2.50 – 2.37 (m, 1H), 2.11 – 2.00 (m, 1H), 1.47 (s, 3H), 1.38 (s, 3H), 0.84 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.1, 166.9, 144.7, 141.1, 129.8, 128.9, 128.4, 128.0, 126.0, 87.8, 52.3, 52.0, 38.3, 34.1, 33.5, 25.0, 20.5, 20.2.

IR (neat): 2954, 1721, 1610, 1369, 1276, 1178, 1108, 1019, 966, 848, 744, 699 cm$^{-1}$.

HRMS (ESI) calcd for C$_{25}$H$_{32}$O$_4$Na$_1$ [M+Na]$^+$: 419.2193, found: 419.2191.

Enantioselective ratio = 93.5:6.5, determined by HPLC (Daicel Chiralpak IG-H Column, $n$-Hexane: $i$-PrOH = 98.0:2.0, flow rate 1.0 mL/min, $T = 25$ °C, $\lambda = 214$ nm): $t_R = 12.05$ min (major), $t_R = 21.25$ min (minor).

$[\alpha]_D^{26} = -17.98$ (c = 1.0, CHCl$_3$).

Methyl (R)-4-(4-(methylthio)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (2ar)

A colorless oil (54.1 mg, 74% yield, 84% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).
$^1$H NMR (400 MHz, CDCl$_3$) δ 8.00 – 7.95 (m, 2H), 7.34 – 7.32 (m, 2H), 3.88 (s, 3H), 3.76 – 3.70 (m, 1H), 2.45 – 2.29 (m, 3H), 2.05 (s, 3H), 2.03 – 1.95 (m, 1H), 1.44 (s, 3H), 1.33 (s, 3H), 0.80 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 171.8, 166.8, 144.3, 129.9, 129.0, 128.0, 87.9, 52.0, 51.4, 38.2, 31.7, 31.6, 24.9, 20.4, 20.1, 15.2.

IR (neat): 2956, 1719, 1435, 1370, 1275, 1177, 1109, 1019, 963, 847, 742, 703 cm$^{-1}$.

HRMS (ESI) calcd for C$_{20}$H$_{30}$O$_4$S$_1$Na$_1$ [M+Na]$^+$: 389.1757, found: 389.1758.

Enantioselective ratio = 92:8, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98.0:2.0, flow rate 0.9 mL/min, T = 25 °C, λ = 214 nm): $t_R$ = 12.33 min (major), $t_R$ = 13.25 min (minor).

$[\alpha]_D^{26} = -9.34$ (c = 0.2, CHCl$_3$).

Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate (2as)

A colorless oil (22.0 mg, 30% yield, 91% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) δ 8.01 – 7.96 (m, 2H), 7.35 – 7.32 (m, 2H), 5.79 – 5.69 (m, 1H), 5.01 – 4.95 (m, 1H), 4.95 – 4.91 (m, 1H), 3.90 (s, 3H), 3.51 (t, $J = 7.6$ Hz, 1H), 2.13 – 2.01 (m, 2H), 1.79 – 1.70 (m, 1H), 1.45 (s, 3H), 1.36 (s, 3H), 1.43 – 1.24 (m, 3H), 0.84 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) δ 172.4, 166.9, 145.1, 138.2, 129.8, 128.8, 127.9, 114.8, 87.7, 53.1, 52.0, 38.3, 33.4, 32.2, 26.7, 25.0, 20.5, 20.2.

IR (neat): 2952, 1721, 1611, 1435, 1370, 1275, 1176, 1110, 911, 846, 742 cm$^{-1}$. 
HRMS (ESI) calcd for C$_{22}$H$_{32}$O$_4$Na$_1$ [M+Na]$^+$: 383.2193, found: 383.2196.

Enantioselective ratio = 95.5:4.5, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: $i$-PrOH = 99.0:1.0, flow rate 0.8 mL/min, T = 25 °C, $\lambda$ = 214 nm): $t_R$ = 12.47 min (major), $t_R$ = 13.59 min (minor)

$[\alpha]_D^{26.3}$ = -6.42 (c = 1.0, CHCl$_3$).

Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (2at)

A colorless oil (41.5 mg, 66% yield, 92% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.01 – 7.96 (m, 2H), 7.35 – 7.31 (m, 2H), 3.89 (s, 3H), 3.41 (t, J = 7.8 Hz, 1H), 2.15 – 2.04 (m, 1H), 1.81 – 1.70 (m, 1H), 1.44 (s, 3H), 1.36 (s, 3H), 0.88 (t, J = 7.2 Hz, 3H), 0.84 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.4, 166.9, 145.0, 129.7, 128.8, 127.9, 87.6, 55.0, 52.0, 38.3, 25.9, 25.0, 20.4, 20.1, 12.0.

IR (neat): 2965, 1721, 1611, 1377, 1275, 1175, 1110, 1020, 967, 847, 775, 703 cm$^{-1}$.

HRMS (ESI) calcd for C$_{19}$H$_{28}$O$_4$Na$_1$ [M+Na]$^+$: 343.1880, found: 343.1879.

Enantioselective ratio = 96:4, determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: $i$-PrOH = 98.0:2.0, flow rate 0.5 mL/min, T = 25 °C, $\lambda$ = 214 nm): $t_R$ = 18.45 min (major), $t_R$ = 19.39 min (minor)

$[\alpha]_D^{26.6}$ = -12.65 (c = 1.0, CHCl$_3$).

Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hexan-2-yl)benzoate (2au)
A colorless oil (43.4 mg, 65% yield, 92% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 8.00 – 7.95 (m, 2H), 7.36 – 7.33 (m, 2H), 3.89 (s, 3H), 3.49 (t, \(J = 7.6\) Hz, 1H), 2.11 – 2.02 (m, 1H), 1.79 – 1.68 (m, 1H), 1.44 (s, 3H), 1.36 (s, 3H), 1.34 – 1.11 (m, 4H), 0.86 (t, \(J = 7.2\) Hz, 3H), 0.84 (s, 9H).

\(^13\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 172.5, 167.0, 145.20, 129.8, 128.7, 127.9, 87.6, 53.2, 52.0, 38.3, 32.4, 29.6, 25.0, 22.4, 20.4, 20.2, 13.9.

IR (neat): 2956, 2922, 2851, 1722, 1611, 1435, 1375, 1275, 1175, 1110, 1019, 965, 847, 746 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{21}\)H\(_{32}\)O\(_4\)Na [M+Na]\(^+\): 371.2193, found: 371.2194.

Enantioselective ratio = 96:4, determined by HPLC (Daicel Chiralpak IG-H Column, \(n\)-Hexane: \(i\)-PrOH = 98.0:2.0, flow rate 0.5 mL/min, T = 25 °C, \(\lambda = 214\) nm): \(t_R = 12.29\) min (major), \(t_R = 13.62\) min (minor).

\([\alpha]_D^{27.6} = -20.40\) (c = 1.0, CHCl\(_3\)).

Methyl \((R)\)-4-(4-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)pentan-2-yl)benzoate (2av)

A colorless oil (57.7 mg, 83% yield, 94% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 8.00 – 7.96 (m, 2H), 7.37 – 7.34 (m, 2H), 3.90 (s, 3H), 3.62 (t, \(J = 7.8\) Hz, 1H), 2.03 – 1.93 (m, 1H), 1.68 – 1.56 (m, 1H), 1.52 – 1.42 (m, 1H), 1.44 (s, 3H), 1.36 (s, 3H), 0.92 (s, 3H), 0.90 (s, 3H), 0.85 (s, 9H).
$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.6, 167.0, 145.3, 129.8, 128.8, 128.0, 87.6, 52.0, 51.2, 41.7, 38.3, 25.9, 25.0, 22.6, 22.3, 20.4, 20.2.

IR (neat): 2957, 1722, 1435, 1369, 1611, 1275, 1110, 938, 847, 746, 703 cm$^{-1}$

HRMS (ESI) calcd for C$_{21}$H$_{32}$O$_4$Na$^+$: 371.2193, found: 371.2189.

Enantioselective ratio = 97.0:3.0, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 0.4 mL/min, T = 25 °C, $\lambda$ = 214 nm):
$t_R$ = 21.02 min (major), $t_R$ = 22.31 min (minor)

$[\alpha]_{D}^{26} = -9.95$ (c = 1.0, CHCl$_3$).

Methyl (R)-4-(3-methyl-1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (2aw)

A colorless oil (37.4 mg, 56% yield, 94% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.97 (d, $J$ = 8.2 Hz, 2H), 7.40 – 7.37 (m, 2H), 3.90 (s, 3H), 3.11 (d, $J$ = 10.8 Hz, 1H), 2.40 – 2.28 (m, 1H), 1.44 (s, 3H), 1.36 (s, 3H), 1.07 (d, $J$ = 6.4 Hz, 3H), 0.91 (s, 9H), 0.68 (d, $J$ = 6.8 Hz, 3H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.3, 167.0, 144.2, 129.7, 128.9, 128.5, 87.7, 61.8, 52.0, 38.3, 31.2, 25.1, 21.4, 20.4, 20.2, 20.1.

IR (neat): 2960, 1721, 1610, 1466, 1369, 1275, 1176, 1100, 937, 853, 774, 702 cm$^{-1}$.

HRMS (ESI) calcd for C$_{20}$H$_{30}$O$_4$Na$^+$: 357.2036, found: 357.2037.

Enantioselective ratio = 97.0:3.0, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 0.5 mL/min, T = 25 °C, $\lambda$ = 214 nm):
$t_R$ = 20.70 min (major), $t_R$ = 22.42 min (minor).

$[\alpha]_{D}^{26.3} = -1.41$ (c = 0.5, CHCl$_3$).
Methyl (R)-4-(1-cyclopentyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (2ax)

A colorless oil (36.7 mg, 51% yield, 94% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.02 – 7.91 (m, 2H), 7.43 – 7.36 (m, 2H), 3.89 (s, 2H), 3.24 (d, $J = 11.2$ Hz, 1H), 2.60 – 2.49 (m, 1H), 1.99 – 1.90 (m, 1H), 1.73 – 1.52 (m, 3H), 1.48 – 1.44 (m, 1H), 1.43 (s, 3H), 1.39 – 1.24 (m, 2H), 1.36 (s, 3H), 0.99 – 0.91 (m, 1H), 0.89 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.32, 166.96, 144.76, 129.65, 128.78, 128.24, 87.58, 59.63, 51.98, 42.78, 38.30, 31.48, 30.63, 25.13, 25.08, 24.84, 20.41, 20.14.

IR (neat): 2954, 1721, 1610, 1435, 1369, 1274, 1175, 1020, 996, 848, 749, 702 cm$^{-1}$.

HRMS (ESI) calcd for C$_{19}$H$_{28}$O$_4$Na$_1$ [M+Na]$^+$: 343.1880, found: 343.1879.

Enantioselective ratio = 97.0:3.0, determined by HPLC (Daicel Chiralpak IG-H Column, $n$-Hexane: $i$-PrOH = 98.0:2.0, flow rate 0.5 mL/min, T = 25 ℃, $\lambda$ = 214 nm):

$t_R$ = 11.94 min (major), $t_R$ = 13.30 min (minor)

$[\alpha]_D^{26}$ = -4.87 (c = 1.0, CHCl$_3$).

Methyl (R)-4-(1-cyclohexyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (2ay)

A colorless oil (19.1 mg, 35% yield, 98% ee) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).
**1H NMR (400 MHz, CDCl₃)** δ 7.99 – 7.95 (m, 2H), 7.38 – 7.35 (m, 2H), 3.89 (s, 3H), 3.19 (d, J = 10.8 Hz, 1H), 2.07 – 1.97 (m, 1H), 1.91 – 1.86 (m, 1H), 1.77 – 1.70 (m, 1H), 1.65 – 1.58 (m, 2H), 1.43 (s, 3H), 1.36 (s, 3H), 1.33 – 1.23 (m, 2H), 1.22 – 1.09 (m, 2H), 1.08 – 0.99 (m, 1H), 0.91 (s, 9H), 0.78 – 0.66 (m, 1H).

**13C NMR (101 MHz, CDCl₃)** δ 172.2, 167.0, 143.8, 129.6, 128.8, 128.6, 87.7, 60.5, 52.0, 40.4, 38.3, 31.8, 30.3, 26.2, 26.0, 25.9, 25.1, 20.5, 20.1.

**IR (neat):** 2926, 1721, 1610, 1435, 1370, 1275, 1170, 1020, 938, 848, 775, 750 cm⁻¹.

**HRMS (ESI) calcd for C₂₃H₃₄O₄Na⁺ [M+Na]⁺: 397.2349, found: 397.2348.

**Enantioselective ratio = 99.0:1.0,** determined by HPLC (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm):

- tᵣ = 23.24 min (major), tᵣ = 24.55 min (minor).
- [α]D₂₆ = -1.41 (c = 0.5, CHCl₃).

**A white solid (48.8 mg, quant. yield, 90% ee) from 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid (3)**

![Structure of (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid (3)](image)

A white solid (48.8 mg, quant. yield, 90% ee) from 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoate (72.0 mg, 0.2 mmol).

**1H NMR (400 MHz, CDCl₃)** δ 11.68 (s, 1H), 7.57 – 7.52 (m, 2H), 7.48 – 7.36 (m, 4H), 7.22 – 7.15 (m, 1H), 3.81 (q, J = 7.2 Hz, 1H), 1.58 (d, J = 7.2 Hz, 3H).

**19F NMR (377 MHz, CDCl₃)** δ -117.32 – -117.50 (m, 1F).

**13C NMR (101 MHz, CDCl₃)** δ 180.7, 159.6 (d, J = 248.5 Hz), 140.8 (d, J = 7.6 Hz), 135.3 (d, J = 1.2 Hz), 130.8 (d, J = 4.0 Hz), 128.9 (d, J = 3.0 Hz), 128.4, 128.1 (d, J = 13.6 Hz), 127.7, 123.7 (d, J = 3.4 Hz), 44.8 (d, J = 1.6 Hz), 17.9.

All the resonances in ¹H NMR spectrum were consistent with the reported values.³

¹H and ¹³C NMR spectra are provided below.
Methyl 4-(((1R, 2S)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (racemic-6)

\[ \text{Ar = 4-COOMePh} \]

\(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 7.94 – 7.93 (m, 2H), 7.22 (d, \(J = 8.0\) Hz, 2H), 3.89 (s, 3H), 2.90 (dd, \(J = 13.2, 4.8\) Hz, 1H), 2.82 (q, \(J = 7.2\) Hz, 1H), 2.47 (dd, \(J = 13.2, 10.8\) Hz, 1H), 2.42 – 2.34 (m, 1H), 2.01 – 1.92 (m, 1H), 1.87 – 1.77 (m, 1H), 1.59 – 1.53 (m, 2H), 1.53 (s, 6H), 1.50 – 1.44 (m, 1H), 0.98 (s, 9H).

\(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \(\delta\) 174.4, 167.1, 147.1, 129.6, 128.8, 127.8, 87.0, 51.9, 49.2, 44.7, 38.3, 36.8, 30.3, 27.8, 25.2, 23.2, 20.6, 20.5.

IR (neat): 2954, 1718, 1610, 1435, 1369, 1275, 1176, 1020, 967, 846, 758 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{22}\)H\(_{32}\)O\(_4\)Na \([\text{M+Na}^+]\): 383.2193, found: 383.2196.

Enantioselective ratio = 50:50, determined by HPLC (Daicel Chiralpak IC-H Column, \(n\)-Hexane: i-PrOH = 99.0:1.0, flow rate 1.0 mL/min, \(T = 25^\circ\)C, \(\lambda = 214\) nm): \(t_R = 24.94\) min (major), \(t_R = 26.30\) min (minor)

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

Methyl 4-(((1R, 2R)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (racemic)

\[ \text{Ar = 4-COOMePh} \]

\(^1\)H NMR (600 MHz, CDCl\(_3\)) \(\delta\) 7.93 – 7.91 (m, 2H), 7.23 – 7.21 (m, 2H), 3.89 (s, 3H), 2.90 (dd, \(J = 13.2, 6.0\) Hz, 1H), 2.57 (dd, \(J = 13.2, 8.4\) Hz, 1H), 2.45 – 2.38 (m, 1H),...
2.34 (q, \( J = 8.4 \) Hz, 1H), 1.96 – 1.90 (m, 1H), 1.83 – 1.77 (m, 1H), 1.76 – 1.70 (m, 1H),
1.65 – 1.60 (m, 1H), 1.43 (s, 3H), 1.42 (s, 3H), 1.27 – 1.21 (m, 1H), 0.94 (s, 9H).

\(^{13}\)C NMR (151 MHz, CDCl\(_3\)) \( \delta \) 175.2, 167.1, 146.5, 129.6, 129.0, 127.9, 86.6, 51.9,
51.5, 45.2, 41.1, 38.3, 32.1, 30.1, 25.1, 24.3, 20.4, 20.4.

IR (neat): 2954, 1718, 1610, 1435, 1369, 1275, 1176, 1020, 967, 846, 758 cm\(^{-1}\).

HRMS (ESI) calcd for C\(_{22}\)H\(_{32}\)O\(_4\)Na\(_3\)\([M+Na]^+\): 383.2193, found: 383.2196.

Enantioselective ratio = 50.0:50.0, determined by HPLC (Daicel Chiralpak IG-H Column, n-Hexane: \( i-\)PrOH = 99.0:1.0, flow rate 0.7 mL/min, T = 25 °C, \( \lambda = 214 \) nm):
\( t_R = 32.73 \) min (major), \( t_R = 34.89 \) min (minor)

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

Supplementary: Characterization data for the Suboptimal substrates products

2,3,3-trimethylbutan-2-yl (\( R,E \))-2-methyl-4-phenylbut-3-enoate

A colorless oil (19.0 mg, 36% yield, 52% ee) from (\( E \))-1-(2-bromovinyl)-benzene (36.0 mg, 0.2 mmol).

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \( \delta \) 7.38 – 7.34 (m, 2H), 7.33 – 7.28 (m, 2H), 7.25 – 7.19
(m, 1H), 6.47 (d, \( J = 16.0 \) Hz, 1H), 6.27 (dd, \( J = 16.0, 8.0 \) Hz, 1H), 3.23 (q, \( J = 7.2 \) Hz,
1H), 1.51 (s, 3H), 1.50 (s, 3H), 1.34 (d, \( J = 7.0 \) Hz, 3H), 0.99 (s, 9H).

\(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \( \delta \) 173.6, 137.1, 130.7, 129.4, 128.5, 127.3, 126.2, 87.2,
44.8, 38.4, 25.1, 20.5, 20.4, 17.8.

HRMS (ESI) calcd for C\(_{18}\)H\(_{26}\)O\(_2\)Na\(_3\)\([M+Na]^+\): 297.1825, found: 297.1823.

Enantioselective ratio = 76:24, determined by HPLC (Daicel Chiralpak Cellulose-3 Column, MeCN: H\(_2\)O = 85:15, flow rate 0.7 mL/min, T = 25 °C, \( \lambda = 214 \) nm): \( t_R = 6.340 \) min (major), \( t_R = 6.913 \) min (minor).
$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl ($R$)-2-(1H-inden-2-yl)propanoate

A colorless oil (28.0 mg, 50% yield, 72% ee) from 2-bromoindene (38.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.42 – 7.38 (m, 1H), 7.33 – 7.30 (m, 1H), 7.26 – 7.22 (m, 1H), 7.16 – 7.12 (m, 1H), 7.68 – 7.67 (m, 1H), 3.62 – 3.56 (m, 1H), 3.48 – 3.34 (m, 2H), 1.51 – 1.50 (m, 3H), 1.49 – 1.48 (m, 3H), 1.46 – 1.44 (m, 3H), 0.94 – 0.93 (m, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 173.2, 148.8, 144.8, 143.0, 127.6, 126.3, 124.2, 123.5, 120.5, 87.4, 43.3, 39.6, 38.4, 25.1, 20.4, 20.3, 17.0.

HRMS (ESI) calcd for C$_{19}$H$_{16}$O$_2$Na $[M+Na]^{+}$: 309.1830, found: 309.1831.

Enantioselective ratio = 86.0:14.0, determined by SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO$_2$, 2.5 mL/min, $T = 25$ °C, $\lambda = 230$ nm): $t_R$ = 5.66 min (major), $t_R$ = 6.08 min (minor).

$^1$H and $^{13}$C NMR spectra are provided below.

2,3,3-trimethylbutan-2-yl ($R$)-2-(pyridin-3-yl)propanoate

A colorless oil (14.5 mg, 30% yield, 80% ee) from 3-bromopyridine (31.0 mg, 0.2 mmol).

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.54 – 8.52 (m, 1H), 8.50 – 8.48 (m, 1H), 7.61 (dt, $J = 8.0, 2.0$ Hz, 1H), 7.28 – 7.23 (m, 1H), 3.66 (q, $J = 7.2$ Hz, 1H), 1.50 (d, $J = 7.2$ Hz, 3H), 1.47 (s, 3H), 1.39 (s, 3H), 0.84 (s, 9H).

$^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 172.8, 149.3, 148.3, 136.7, 134.7, 123.4, 87.9, 44.5, 38.3, 25.0, 20.5, 20.2, 17.9.
**HRMS** (ESI) calcd for C_{15}H_{24}O_{1}N_{1} [M+H]^+: 250.1807, found: 250.1809.

**Enantioselective ratio** = 90:10, determined by HPLC (Daicel Chiralpak OD-H Column, n-Hexane: i-PrOH = 95:5, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm): \( t_R \) = 5.43 min (minor), \( t_R \) = 5.81 min (major).

\(^1\)H and \(^{13}\)C NMR spectra are provided below.

**methyl 4-(((S)-1-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate**

![methyl 4-(((S)-1-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate](attachment:structures.png)

A colorless oil (29.0 mg, 60% yield, 50% dr) from methyl 2-bromobenzoate (43.0 mg, 0.2 mmol).

**\(^1\)H NMR (400 MHz, CDCl\(_3\))** \( \delta \) 8.00 – 7.96 (m, 2H), 7.38 – 7.34 (m, 2H), 4.69 – 4.58 (m, 1H), 3.91 (s, 3H), 3.74 (q, \( J = 7.2 \) Hz, 1H), 2.00 – 1.72 (m, 2H), 1.67 – 1.56 (m, 2H), 1.51 – 1.48 (m, 1H), 1.47 – 1.37 (m, 1H), 1.36 – 1.23 (m, 1H), 1.06 – 0.95 (m, 1H), 0.89 – 0.81 (m, 6H), 0.72 – 0.68 (m, 3H), 0.53 – 0.52 (m, 1H).

**\(^{13}\)C NMR (101 MHz, CDCl\(_3\))** \( \delta \) 173.4, 166.9, 146.0, 129.8, 128.9, 127.6, 74.8, 52.1, 47.0, 46.0, 40.7, 34.2, 31.3, 26.2, 23.4, 22.0, 20.6, 18.3, 16.2, 15.9.

**HRMS** (ESI) calcd for C_{21}H_{30}O_{4}N_{1} [M+Na]^+: 369.2042, found: 369.2044.

**Enantioselective ratio** = 75:25, determined by SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO\(_2\), 2.5 mL/min, T = 25 °C, λ = 230 nm): \( t_R \) = 3.88 min (major), \( t_R \) = 4.26 min (minor).

\(^1\)H and \(^{13}\)C NMR spectra are provided below.
2.8 Radical Probe Experiments and Structural Confirmation of Cyclized Products

To gain insights into the mechanism and determine whether this stereo-convergent cross-coupling reaction proceeds via a radical intermediate, we studied the cross-coupling reaction using a radical probe substrate with a terminal alkene group, 2,3,3-trimethylbutan-2-yl 2-chlorohept-6-enoate, and methyl 4-bromobenzoate reagent under the standard conditions.

**Scheme S1.** Crossing-Coupling Reaction Using Radical Probe Substrate (R = 2,3,3-trimethylbut-2-yl)

This substrate provided the direct (uncyclized) cross-coupling product in 30% yield with 91% ee, along with the cyclized cross-coupling product in 61% yield, as racemic mixtures of diastereomers.

The formation of cyclized products strongly suggests that the nickel-catalyzed enantioselective cross-coupling reactions take place via alkyl radical intermediates, as proposed for previous achiral cross-coupling reactions catalyzed by nickel catalyst.

For a related mechanistic study using a nickel catalyst, see: (a) Breitenfeld, J.; Wodrich, M. D.; Hu, X. *Organometallics* **2014**, *33*, 5708. (b) Biswas, S.; Weix, D. J. *J. Am. Chem. Soc.* **2013**, *135*, 16192. (c) Schley, N. D.; Fu, G. C. *J. Am. Chem. Soc.* **2014**, *136*, 16558.
We also studied the cross-coupling reaction using a radical probe substrate with ethyl 2-chloro-2-cyclopropylacetate, and methyl 4-bromobenzoate reagent under the standard conditions.

Methyl (E)-4-(5-ethoxy-5-oxopent-3-en-1-yl)benzoate (8)
A colorless oil (43.0 mg, 80% yield) from methyl 4-bromobenzoate (43.0 mg, 0.2 mmol).

\(^1\text{H NMR (400 MHz, CDCl}_3\) \(\delta\) 8.00 – 7.94 (m, 2H), 7.25 – 7.22 (m, 2H), 6.96 (dt, \(J = 15.6, 6.8\) Hz, 1H), 5.82 (dt, \(J = 15.6, 1.6\) Hz, 1H), 4.17 (q, \(J = 7.2\) Hz, 2H), 3.89 (s, 3H), 2.82 (t, \(J = 7.6\) Hz, 2H), 2.56 – 2.49 (m, 2H), 1.27 (t, \(J = 7.2\) Hz, 3H).

\(^{13}\text{C NMR (101 MHz, CDCl}_3\) \(\delta\) 167.0, 166.4, 147.2, 146.1, 129.8, 128.3, 128.2, 122.2, 60.2, 52.0, 34.3, 33.3, 14.2.

\(\text{IR (neat)}\): 2950, 1713, 1653, 1435, 1274, 1178, 1104, 972, 857, 764, 704 cm\(^{-1}\).

\(\text{HRMS (ESI)}\) calcd for C\(_{15}\)H\(_{19}\)O\(_4\)Na\(_1\) [M+H]\(^+\): 263.1278, found: 263.1277.

\(^1\text{H and}^{13}\text{C NMR spectra are provided below.}\)
2.9 EPR Experiments and Data

Electron paramagnetic resonance (EPR) spectra were recorded on a Bruker ELEXSYS E500 spectrometer (X-bond). The spectra were measured at 298 K. The spectra were listed in below Figure.

General procedure:
In a nitrogen-filled glove box, an over-dried 10 mL hydrogenation tube charged with a stir bar, 2,3,3-trimethylbutan-2-yl 2-chloropropanoate (90.0 mg, 0.4 mmol), solution A (1.0 mL), TBABF₄ (66.0 mg, 0.2 mmol) were added to the electrochemical cell and the mixture was stirred for over 15 mins. Then methyl 4-bromobenzoate 1a (0.2 mmol, 43.0 mg), 2.6-lutidine (64.0 mg, 0.6 mmol), tris(trimethylsilyl)silane (175.0 mg, 0.70 mmol), 5,5-Dimethyl-1-pyrroline N-oxide (DMPO, 25 mg, 0.2 mmol), DMAc (1.0 mL) were added to the electrochemical cell. The tube was installed with a Ni foam (2.0 x 3.0 cm²) as the cathode and Pt (1.0 x 1.0 x 0.3 cm³) as the anode. The seal-tube was sealed and removed from the glovebox. The reaction mixture was electrolyzed under a constant current of 6.0 mA. The examples for EPR detection were collected once per hour during the reaction.
EPR spectra: (1.0 hour):

Red: the experiment spectra of NCR radical adduct.

(g = 2.0052, A_H = 14.29 G, A_N = 22.17 G)

Blue: Simulated spectra of NCR radical adduct.
3. Supplementary Figures

3.1 X-Ray Structures and Data

Crystals suitable for X-ray single-crystal diffraction analysis were obtained from Hexane using slow evaporation under air at room temperature.

Table 1. Crystal data and structure refinement for **Ligand L11**.

| Parameter                        | Value                        |
|----------------------------------|------------------------------|
| Identification code              | mo_d8v21307_0m               |
| Empirical formula                | C34 H50 N4                   |
| Formula weight                   | 514.78                       |
| Temperature                      | 293(2) K                     |
| Wavelength                       | 0.71073 Å                    |
| Crystal system                   | Monoclinic                   |
| Space group                      | C 2                          |
| Unit cell dimensions             | \(a = 23.9660(19) \text{ Å}\) |
Volume \quad 3314.3(4) \text{ Å}^3

Z \quad 4

Density (calculated) \quad 1.032 \text{ Mg/m}^3

Absorption coefficient \quad 0.060 \text{ mm}^{-1}

F(000) \quad 1128

Crystal size \quad 0.200 \times 0.140 \times 0.050 \text{ mm}^3

Theta range for data collection \quad 1.606 \text{ to } 25.493°

Index ranges \quad -28 \leq h \leq 28, -13 \leq k \leq 13, -15 \leq l \leq 15

Reflections collected \quad 22844

Independent reflections \quad 6155 \ [R(int) = 0.0753]

Completeness to theta = 25.242° \quad 99.6 \%

Absorption correction \quad Semi-empirical from equivalents

Max. and min. transmission \quad 0.7456 \text{ and } 0.4237

Refinement method \quad Full-matrix least-squares on F^2

Data / restraints / parameters \quad 6155 / 73 / 414

Goodness-of-fit on F^2 \quad 1.025

Final R indices [I>2sigma(I)] \quad R1 = 0.0746, wR2 = 0.2036
R indices (all data) \quad R1 = 0.1094, wR2 = 0.2414

Absolute structure parameter \quad -0.8(10)

Extinction coefficient \quad 0.022(6)

Largest diff. peak and hole \quad 0.197 \text{ and } -0.166 \text{ e.Å}^{-3}
Crystals suitable for X-ray single-crystal diffraction analysis were obtained from Toluene/Dichloromethane using slow evaporation under air at room temperature.

Table 2. Crystal data and structure refinement for 3.

| Identification code     | mj21485_0m               |
|-------------------------|--------------------------|
| Empirical formula       | C15 H13 F O2             |
| Formula weight          | 244.25                   |
| Temperature             | 212.99 K                 |
| Wavelength              | 1.34139 Å                |
| Crystal system          | Orthorhombic             |
| Space group             | P212121                   |
| Unit cell dimensions    | a = 5.69140(10) Å        |
|                        | b = 13.1880(2) Å         |
|                        | c = 16.2085(3) Å         |
|                        | = 90°                    |
| Volume                  | 1216.58(4) Å³            |
| Z                       | 4                        |
| Density (calculated)    | 1.334 Mg/m³              |
| Absorption coefficient  | 0.516 mm⁻¹               |
| F(000)                  | 512                      |
| Crystal size            | 0.15 x 0.08 x 0.07 mm³   |
| Theta range for data collection | 3.759 to 54.906°     |
| Index ranges            | -6<=h<=6, -16<=k<=12, -19<=l<=19 |
| Reflections collected   | 12382                    |
| Property                                      | Value                                      |
|----------------------------------------------|--------------------------------------------|
| Independent reflections                     | 2246 [R(int) = 0.0301]                     |
| Completeness to theta = 53.594°              | 97.2 %                                     |
| Absorption correction                        | Semi-empirical from equivalents           |
| Max. and min. transmission                   | 0.7508 and 0.6124                          |
| Refinement method                            | Full-matrix least-squares on F^2          |
| Data / restraints / parameters               | 2246 / 0 / 165                             |
| Goodness-of-fit on F^2                       | 1.050                                      |
| Final R indices [I>2sigma(I)]                | R1 = 0.0341, wR2 = 0.0986                  |
| R indices (all data)                         | R1 = 0.0346, wR2 = 0.0991                  |
| Absolute structure parameter                 | -0.01(5)                                   |
| Extinction coefficient                       | n/a                                        |
| Largest diff. peak and hole                  | 0.449 and -0.188 e.Å^-3                    |
3.2 NMR Spectra and Chromatograms

Supplementary Figure 6. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloropropanoate (400 MHz, CDCl$_3$)
Supplementary Figure 7. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 3-(benzyloxy)-2-chloropropanoate (400 MHz, CDCl$_3$)

Supplementary Figure 8. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 3-(benzyloxy)-2-chloropropanoate (101 MHz, CDCl$_3$)
Supplementary Figure 9. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-3-(4-methoxyphenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 10. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-3-(4-methoxyphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 11. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-3-phenylpropanoate (400 MHz, CDCl$_3$)

Supplementary Figure 12. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-3-phenylpropanoate (101 MHz, CDCl$_3$)
Supplementary Figure 13. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-4-phenylbutanoate (400 MHz, CDCl$_3$)

Supplementary Figure 14. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-4-phenylbutanoate (101 MHz, CDCl$_3$)
Supplementary Figure 15. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-4-(methylthio)butanoate (400 MHz, CDCl$_3$)

Supplementary Figure 16. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-4-(methylthio)butanoate (101 MHz, CDCl$_3$)
Supplementary Figure 17. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorohept-6-enoate (400 MHz, CDCl$_3$)

Supplementary Figure 18. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorohept-6-enoate (101 MHz, CDCl$_3$)
Supplementary Figure 19. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorobutanoate (400 MHz, CDCl$_3$)

Supplementary Figure 20. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorobutanoate (101 MHz, CDCl$_3$)
Supplementary Figure 21. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorohexanoate (400 MHz, CDCl$_3$)

Supplementary Figure 22. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chlorohexanoate (101 MHz, CDCl$_3$)
Supplementary Figure 23. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-3-methylbutanoate (400 MHz, CDCl$_3$)

Supplementary Figure 24. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-4-methylpentanoate (400 MHz, CDCl$_3$)
Supplementary Figure 25. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclohexylacetate (400 MHz, CDCl$_3$)

Supplementary Figure 26. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclohexylacetate (101 MHz, CDCl$_3$)
Supplementary Figure 27. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclohexylacetate (400 MHz, CDCl$_3$)

Supplementary Figure 28. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl 2-chloro-2-cyclohexylacetate (101 MHz, CDCl$_3$)
Supplementary Figure 29. $^1$H NMR Spectrum of (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 2-chloropropanoate (400 MHz, CDCl$_3$)

Supplementary Figure 30. $^{13}$C NMR Spectrum of (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 2-chloropropanoate (400 MHz, CDCl$_3$)
Supplementary Figure 31. $^1$H NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 32. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 33. $^1$H NMR Spectrum of Methyl (R)-3-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 34. $^{13}$C NMR Spectrum of Methyl (R)-3-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 35. $^1$H NMR Spectrum of Methyl (R)-2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 36. $^{13}$C NMR Spectrum of Methyl (R)-2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 37. $^1$H NMR Spectrum of Tert-butyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 38. $^{13}$C NMR Spectrum of Tert-butyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 39. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylphenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 40. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 41. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-acetylphenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 42. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-acetylphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 43. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(dimethylcarbamoyl)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 44. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(dimethylcarbamoyl)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 45. $^1$H NMR Spectrum of 2-(methylthio)ethyl ($R$)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 46. $^{13}$C NMR Spectrum of 2-(methylthio)ethyl ($R$)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 47. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-methoxy-4-methylphenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 48. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-methoxy-4-methylphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 49. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-\((4-(\text{tert-butyl})\text{phenyl})\text{propanoate (400 MHz, CDCl}_3)\)

Supplementary Figure 50. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-\((4-(\text{tert-butyl})\text{phenyl})\text{propanoate (101 MHz, CDCl}_3)\)
Supplementary Figure 51. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-((1,1'-biphenyl)-4-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 52. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-((1,1'-biphenyl)-4-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 53. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-(methylthio)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 54. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-(methylthio)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 55. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-((trifluoromethyl)thio)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 56. $^{19}$F NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-((trifluoromethyl)thio)phenyl)propanoate (375 MHz, CDCl$_3$)
Supplementary Figure 57. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-((trifluoromethyl)thio)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 58. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(phenylsulfonyl)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 59. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(phenylsulfonyl)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 60. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-cyanophenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 61. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-cyanophenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 62. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-((tert-butoxycarbonyl)amino)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 63. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-((tert-butoxycarbonyl)amino)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 64. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-acetamidophenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 65. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-acetamidophenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 66. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(2-oxopyrrolidin-1-yl)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 67. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(2-oxopyrrolidin-1-yl)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 68. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-((4-((trimethylsilyl)ethynyl)phenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 69. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-((4-((trimethylsilyl)ethynyl)phenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 70. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)propanoate (400 MHz, CDCl$_3$)

![Supplementary Figure 70. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)propanoate (400 MHz, CDCl$_3$)](image)

Supplementary Figure 71. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)propanoate (101 MHz, CDCl$_3$)
$^{13}$C NMR
Supplementary Figure 72. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-oxochroman-7-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 73. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-oxochroman-7-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 74. $^1$H NMR Spectrum of Ethyl (R)-5-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzofuran-2-carboxylate (400 MHz, CDCl$_3$)

![Supplementary Figure 74](image)

Supplementary Figure 75. $^{13}$C NMR Spectrum of Ethyl (R)-5-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzofuran-2-carboxylate (101 MHz, CDCl$_3$)
Supplementary Figure 76. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(benzofuran-3-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 77. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(benzofuran-3-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 78. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(dibenzo[b,d]thiophen-3-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 79. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(dibenzo[b,d]thiophen-3-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 80. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(2-(methylthio)pyrimidin-5-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 81. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(2-(methylthio)pyrimidin-5-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 82. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(9H-fluoren-2-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 83. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(9H-fluoren-2-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 84. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R,E)-4-(4-methoxyphenyl)-2-methylbut-3-enoate (400 MHz, CDCl$_3$)

Supplementary Figure 85. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R,E)-4-(4-methoxyphenyl)-2-methylbut-3-enoate (101 MHz, CDCl$_3$)
Supplementary Figure 86. $^1$H NMR Spectrum: $(R)$-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl₃)
Supplementary Figure 87. $^{13}$C NMR Spectrum: (R)-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 88. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-((5-(4-fluorophenyl)thiophen-2-yl)methyl)-4-methylphenyl)propanoate (400 MHz)

Supplementary Figure 89. $^{19}$F NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-((5-(4-fluorophenyl)thiophen-2-yl)methyl)-4-methylphenyl)propanoate (375 MHz)
Supplementary Figure 90. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-((5-(4-fluorophenyl)thiophen-2-yl)methyl)-4-methylphenyl)propanoate (101 MHz)
Supplementary Figure 91. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(N-(2,6-dimethoxy pyrimidin-4-yl)-N-methylsulfamoyl)phenyl)propanoate (400 MHz)

Supplementary Figure 92. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-(N-(2,6-dimethoxy pyrimidin-4-yl)-N-methylsulfamoyl)phenyl)propanoate (101 MHz)
Supplementary Figure 93. $^1$H NMR Spectrum: 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-(5-methoxy-3-(2-methoxy-2-oxoethyl)-2-methyl-1H-indole-1-carbonyl)phenyl)propanoate (400 MHz)
Supplementary Figure 94. $^{13}$C NMR Spectrum: 2,3,3-trimethylbutan-2-yl ($R$)-2-(4-(5-methoxy-3-(2-methoxy-2-oxoethyl)-2-methyl-1$H$-indole-1-carbonyl)phenyl)propanoate

Supplementary Figure 95. $^1$H NMR Spectrum: (1$R$,2$S$,5$R$)-2-isopropyl-5-methylcyclohexyl 4-((($R$)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)
Supplementary Figure 96. $^{13}$C NMR Spectrum: \((1R,2S,5R)-2\text{-isopropyl-5-methylcyclohexyl} \ 4-(\text{\((R)\)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl})\)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 97. $^1$H NMR Spectrum of (3a$R$,5$R$,6$S$,6a$R$)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-d][1,3]dioxol-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)
Supplementary Figure 98. $^{13}$C NMR Spectrum of (3aR,5R,6S,6aR)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-d][1,3]dioxol-6-yl 4-((R)-1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 99. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(6-methoxynaphthalen-2-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 100. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl ($R$)-2-(6-methoxynaphthalen-2-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 101. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-isobutylphenyl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 102. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-isobutylphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 103. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-1,1'-biphenyl)-4-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 104. $^{19}$F NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-1,1'-biphenyl)-4-yl)propanoate (376 MHz, CDCl$_3$)
Supplementary Figure 105. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoate (101 MHz, CDCl$_3$)

Supplementary Figure 106. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-benzoylphenyl)propanoate (400 MHz, CDCl$_3$)
Supplementary Figure 107. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-benzoylphenyl)propanoate (101 MHz, CDCl₃)

Supplementary Figure 108. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-phenoxyphenyl)propanoate (400 MHz, CDCl₃)
Supplementary Figure 109. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(3-phenoxyphenyl)propanoate (101 MHz, CDCl$_3$)

Supplementary Figure 110. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-phenoxyphenyl)propanoate (400 MHz, CDCl$_3$)
Supplementary Figure 111. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(4-phenoxyphenyl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 112. $^1$H NMR Spectrum of Methyl (S)-4-(3-(benzyloxy)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 113. $^{13}$C NMR Spectrum of Methyl (S)-4-(3-(benzyloxy)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 114. $^1$H NMR Spectrum of Methyl (R)-4-(3-(4-methoxyphenyl)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 115. $^{13}$C NMR Spectrum of Methyl (R)-4-(3-(4-methoxyphenyl)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 116. $^1$H NMR Spectrum of Methyl (R)-4-(1-oxo-3-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (400 MHz, CDCl3)

Supplementary Figure 117. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-3-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (101 MHz, CDCl3)
Supplementary Figure 118. $^1$H NMR Spectrum of Methyl (R)-4-(1-oxo-4-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 119. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-4-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 120. $^1$H NMR Spectrum of Methyl ($R$)-4-(4-(methylthio)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 121. $^{13}$C NMR Spectrum of Methyl ($R$)-4-(4-(methylthio)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 122. $^1$H NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 123. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 124. $^1$H NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 125. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (101 MHz, CDCl$_3$)
**Supplementary Figure 126.** $^1$H NMR Spectrum of methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hexan-2-yl)benzoate (400 MHz, CDCl$_3$)

**Supplementary Figure 127.** $^{13}$C NMR Spectrum of Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hexitan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 128. $^1$H NMR Spectrum of Methyl (R)-4-(4-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)pentan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 129. $^{13}$C NMR Spectrum of Methyl (R)-4-(4-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)pentan-2-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 130. $^1$H NMR Spectrum of Methyl (R)-4-(3-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (400 MHz, CDCl₃)

Supplementary Figure 131. $^{13}$C NMR Spectrum of Methyl (R)-4-(3-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (101 MHz, CDCl₃)
Supplementary Figure 132. $^1$H NMR Spectrum of Methyl (R)-4-(1-cyclopentyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 133. $^{13}$C NMR Spectrum of Methyl (R)-4-(1-cyclopentyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 134. $^1$H NMR Spectrum of Methyl ($R$)-4-(1-cyclohexyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 135. $^{13}$C NMR Spectrum of Methyl ($R$)-4-(1-cyclohexyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 136. $^1$H NMR Spectrum of Methyl (E)-4-(5-ethoxy-5-oxopent-3-en-1-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 137. $^{13}$C NMR Spectrum of Methyl (E)-4-(5-ethoxy-5-oxopent-3-en-1-yl)benzoate (101 MHz, CDCl$_3$)
Supplementary Figure 138. $^1$H NMR Spectrum of (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid (400 MHz, CDCl$_3$)

Supplementary Figure 139. $^{19}$F NMR Spectrum of (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid (377 MHz, CDCl$_3$)
Supplementary Figure 140. $^{13}$C NMR Spectrum of $(R)$-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid (101 MHz, CDCl$_3$)
Supplementary Figure 141. $^1$H NMR Spectrum of Methyl 4-(((1R,2S)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (600 MHz, CDCl$_3$)

Supplementary Figure 142. $^{13}$C NMR Spectrum of Methyl 4-(((1R,2S)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (151 MHz, CDCl$_3$)
Supplementary Figure 143. $^1$H NMR Spectrum of Methyl 4-(((1R, 2R)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (600 MHz, CDCl$_3$)

Supplementary Figure 144. $^{13}$C NMR Spectrum of Methyl 4-(((1R, 2R)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (151 MHz, CDCl$_3$)
Supplementary: Characterization data for the Suboptimal substrates products

Supplementary Figure 145. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R,E)-2-methyl-4-phenylbut-3-enoate (400 MHz, CDCl$_3$)

Supplementary Figure 146. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R,E)-2-methyl-4-phenylbut-3-enoate (101 MHz, CDCl$_3$)
Supplementary Figure 147. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(1H-inden-2-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 148. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(1H-inden-2-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 149. $^1$H NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(pyridin-3-yl)propanoate (400 MHz, CDCl$_3$)

Supplementary Figure 150. $^{13}$C NMR Spectrum of 2,3,3-trimethylbutan-2-yl (R)-2-(pyridin-3-yl)propanoate (101 MHz, CDCl$_3$)
Supplementary Figure 151. $^1$H NMR Spectrum of methyl 4-((S)-1-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate (400 MHz, CDCl$_3$)

Supplementary Figure 152. $^{13}$C NMR Spectrum of methyl 4-((S)-1-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate (101 Hz, CDCl$_3$)
3.3 HPLC Spectra Data

**Supplementary Figure 153.** HPLC Chromatography of the Racemic Methyl 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yloxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 9.789          | 141.26912    | 49.9   |
| 2    | 10.756         | 126.74439    | 50.1   |

**Supplementary Figure 154.** HPLC Chromatography of the Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yloxy)propan-2-yl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|

160
Supplementary Figure 155. HPLC Chromatography of the Racemic Methyl 3-(1-oxo-1-((2,3,3-trimethylbutan-2-yloxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.654         | 53.52522     | 50.050 |
| 2    | 13.619         | 49.39088     | 49.950 |

Supplementary Figure 156. HPLC Chromatography of the Methyl (R)-3-(1-oxo-1-((2,3,3-trimethylbutan-2-yloxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 157. HPLC Chromatography of the Racemic Methyl 2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.413         | 7.44144      | 5.2398 |
| 2    | 13.332         | 125.03499    | 94.7602|

Supplementary Figure 158. HPLC Chromatography of the Methyl (R)-2-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
Peak | Ret Time [min] | Height [mAU] | Area %
---|---|---|---
1 | 6.497 | 174.68623 | 14.5701
2 | 6.966 | 940.44019 | 85.4299

**Supplementary Figure 159.** HPLC Chromatography of the Racemic tert-butyl 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

Peak | Ret Time [min] | Height [mAU] | Area %
---|---|---|---
1 | 5.679 | 81.24709 | 49.7772
2 | 6.143 | 73.52419 | 50.2228

**Supplementary Figure 160.** HPLC Chromatography of the tert-butyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-
yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 5.6800         | 68.83549     | 94.9611 |
| 2    | 6.141          | 3.22974      | 5.0389  |

Supplementary Figure 161. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-benzoylphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 24.912         | 171.88701    | 49.8524 |
Table 16.11. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylphenyl)propanoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 25.031         | 107.29478    | 94.0639|
| 2    | 26.404         | 5.75726      | 5.9361 |

Figure 162. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)

Table 16.12. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-acetylphenyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 23.609         | 109.59139    | 50.0808|
**Figure 164.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-acetylphenyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 23.961         | 572.73358    | 95.0117 |
| 2    | 26.026         | 32.62696     | 4.9883  |

**Figure 165.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl 2-(4-(dimethylcarbamoyl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 95:5, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 14.423         | 233.32059    | 50.3498 |
Figure 166. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl \((R)\)-2-(4-(dimethylcarbamoyl)phenyl)propanoate

(Daicel Chiralpak AD-H Column, \(n\)-Hexane: \(i\)-PrOH = 95:5, flow rate 1.0 mL/min, \(T = 25^\circ C, \lambda = 214\) nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 14.513         | 84.41722     | 94.7125|
| 2    | 17.703         | 4.52220      | 5.2875 |

Figure 167. HPLC Chromatography of the Racemic 2-(methylthio)ethyl-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, \(n\)-Hexane: \(i\)-PrOH = 98:2, flow rate 0.5 mL/min, \(T = 25^\circ C, \lambda = 214\) nm)
| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 11.073         | 140.54128    | 48.5621 |
| 2    | 11.978         | 128.78978    | 51.4379 |

**Figure 168.** HPLC Chromatography of the 2-(methylthio)ethyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

![HPLC Chromatography](image)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 11.137         | 127.12115    | 95.0365 |
| 2    | 11.805         | 6.11883      | 4.9635  |

**Figure 169.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(3-methoxy-4-methylphenyl)propanoate (Daicel Chiralpak OJ-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 11.938         | 665.92261    | 49.7915|
| 2    | 17.036         | 249.51141    | 50.2085|

**Supplementary Figure 170.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(3-methoxy-4-methylphenyl)propanoate
(Daicel Chiralpak OJ-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)

Supplementary Figure 172. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-(tert-butyl)phenyl)propanoate

(Daicel Chiralpak OJ-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 173. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-([1,1’-biphenyl]-4-yl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.086          | 424.37100    | 49.8905|
| 2    | 5.362          | 403.37738    | 50.1095|

Supplementary Figure 174. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-([1,1’-biphenyl]-4-yl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
|      |                |              |        |
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 6.883          | 138.72688    | 50.1629|
| 2    | 7.126          | 130.60764    | 49.8371|

**Supplementary Figure 175.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(methylthio)phenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)

![HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(methylthio)phenyl)propanoate](image)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 6.883          | 138.72688    | 50.1629|
| 2    | 7.126          | 130.60764    | 49.8371|

**Supplementary Figure 176.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-(methylthio)phenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)
### Supplementary Figure 177

HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-((trifluoromethyl)thio)phenyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 100:0, flow rate 0.4 mL/min, T = 25 °C, λ = 214 nm)
**Supplementary Figure 178.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-((trifluoromethyl)thio)phenyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 100:0, flow rate 0.4 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 36.626         | 19.80121     | 4.1354 |
| 2    | 37.946         | 269.94867    | 95.8646|

**Supplementary Figure 179.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(phenylsulfonyl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
|      |                |              |        |
Supplementary Figure 180. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-phenylsulfonyl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 17.975         | 170.95142    | 95.3153|
| 2    | 21.776         | 7.11616      | 4.6847 |

Supplementary Figure 181. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-cyanophenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 250 nm)
Supplementary Figure 182. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl \((R)-2-(4-cyanophenyl)propanoate\) (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 250 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.495         | 129.10062    | 49.9988|
| 2    | 13.421         | 125.25349    | 50.0012|

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.676         | 119.52631    | 95.7249|
| 2    | 13.664         | 5.08006      | 4.2751 |
Supplementary Figure 183. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-((tert-butoxycarbonyl)amino)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 220 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 11.790         | 41.01945     | 50.2653|
| 2    | 13.780         | 34.64718     | 49.7347|

Supplementary Figure 184. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-((tert-butoxycarbonyl)amino)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 220 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 11.744         | 186.3952     | 92.6492|
Supplementary Figure 185. HPLC Chromatography of the racemic 2,3,3-trimethylbutan-2-yl 2-(4-acetamidophenyl)propanoate

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.6 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 37.296         | 145.98878    | 49.5205|
| 2    | 41.045         | 133.10606    | 50.4795|

Supplementary Figure 186. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-acetamidophenyl)propanoate

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.6 mL/min, T = 25 °C, λ = 254 nm)
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|---------------|--------------|--------|
| 1    | 36.220        | 844.55066    | 92.4640|
| 2    | 39.970        | 65.45313     | 7.5360 |

**Supplementary Figure 187.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(2-oxopyrrolidin-1-yl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|---------------|--------------|--------|
| 1    | 8.937         | 100.42989    | 49.9866|
| 2    | 10.322        | 86.86388     | 50.0134|

**Supplementary Figure 188.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-(2-oxopyrrolidin-1-yl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)
**Supplementary Figure 189.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(trimethylsilyl)ethynyl)phenyl)propanoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 0.3 mL/min, T = 25 ℃, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 8.998          | 139.11676    | 92.1328|
| 2    | 10.391         | 9.79229      | 7.8672 |

**Supplementary Figure 190.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-(trimethylsilyl)ethynyl)phenyl)propanoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 13.143         | 186.57332    | 50.3368|
| 2    | 13.724         | 164.93050    | 49.6632|
(Daicel Chiralpak IG-H Column, $n$-Hexane: $i$-PrOH = 99.5:0.5, flow rate 0.3 mL/min, $T = 25 \, ^{\circ}C$, $\lambda = 214 \, \text{nm}$)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 13.159         | 706.87347    | 93.1100|
| 2    | 13.733         | 51.56929     | 6.8900 |

**Supplementary Figure 191.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)propanoate (Daicel Chiralpak IC-H Column, $n$-Hexane: $i$-PrOH = 98:2, flow rate 0.5 mL/min, $T = 25 \, ^{\circ}C$, $\lambda = 214 \, \text{nm}$)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 8.436          | 196.54277    | 49.2095|
| 2    | 28.063         | 184.84178    | 50.7905|
**Supplementary Figure 192.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl \((R)-2-(4-(4,4,5,5\text{-tetramethyl-1,3,2-dioxaborolan-2-yl})\text{phenyl})\text{propanoate}

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 8.490          | 9.91930      | 5.3656 |
| 2    | 8.823          | 162.42603    | 94.6344|

**Supplementary Figure 193.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-oxochroman-7-yl)propanoate

(Daicel Chiralpak AD-H Column, n-Hexane: \(i\)-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, \(\lambda = 220 \text{ nm}\ ))

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 8.145          | 133.47990    | 49.3821|
| 2    | 8.887          | 118.58511    | 50.6179|
**Supplementary Figure 194.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl \((R)-2-(4-oxochroman-7-yl)propanoate\)

(Daicel Chiralpak AD-H Column, \(\alpha\)-Hexane: \(i\)-PrOH = 98:2, flow rate 1.0 mL/min, \(T = 25 \, ^\circ\text{C}\), \(\lambda = 220 \, \text{nm}\))

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 8.234          | 226.46191    | 95.6397|
| 2    | 8.996          | 9.39463      | 4.3603 |

**Supplementary Figure 195.** HPLC Chromatography of the Racemic ethyl 5-\((1\text{-oxo-1-}((2,3,3\text{-trimethylbutan-2-yl}ox y)propan-2-yl)benzofuran-2-carboxylate\) (Daicel Chiralpak IC-H Column, \(\alpha\)-Hexane: \(i\)-PrOH = 99:1, flow rate 0.5 mL/min, \(T = 25 \, ^\circ\text{C}\), \(\lambda = 220 \, \text{nm}\))

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 52.553         | 272.10599    | 50.0842|
Supplementary Figure 196. HPLC Chromatography of the Ethyl (R)-5-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzofuran-2-carboxylate

| Peak | Ret Time [min] | Height [mAU]   | Area % |
|------|----------------|----------------|--------|
| 1    | 52.333         | 13.62852       | 5.8082 |
| 2    | 55.197         | 189.77037      | 94.1918|

Supplementary Figure 197. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(benzofuran-3-yl)propanoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 7.054          | 239.97792    | 49.8399|
| 2    | 7.598          | 198.38847    | 50.1601|

**Supplementary Figure 198.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(benzofuran-3-yl)propanoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99.5:0.5, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

![HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(benzofuran-3-yl)propanoate](image)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 6.843          | 16.33647     | 10.2167|
| 2    | 7.334          | 110.77312    | 89.7833|

**Supplementary Figure 199.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(dibenzo[b,d]thiophen-3-yl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
### Supplementary Figure 200. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(dibenzo[b,d]thiophen-3-yl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.803          | 282.72635    | 50.0004|
| 2    | 6.148          | 261.77188    | 49.9996|

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.732          | 645.33966    | 94.3323|
| 2    | 6.046          | 36.80598     | 5.6677 |
**Supplementary Figure 201.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(2-(methylthio)pyrimidin-5-yl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 ℃, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 23.762         | 296.02667    | 50.0593 |
| 2    | 27.461         | 201.97737    | 49.9407 |

**Supplementary Figure 202.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(2-(methylthio)pyrimidin-5-yl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 ℃, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
|      |                |              |         |
Supplementary Figure 203. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(9H-fluoren-2-yl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 ℃, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.179          | 359.10635    | 49.9204|
| 2    | 5.614          | 322.60553    | 50.0796|

Supplementary Figure 204. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(9H-fluoren-2-yl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 ℃, λ = 214 nm)
Supplementary Figure 205. HPLC Chromatography of 2,3,3-trimethylbutan-2-yl (E)-4-(4-methoxyphenyl)-2-methylbut-3-enolate (Daicel Chiralpak OJ-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.4 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 206. HPLC Chromatography of 2,3,3-trimethylbutan-2-yl (R,E)-4-(4-methoxyphenyl)-2-methylbut-3-enoate (400 MHz, CDCl$_3$)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 15.850         | 273.46252    | 77.4467|
| 2    | 17.462         | 76.77203     | 22.5533|

Supplementary Figure 207. HPLC Chromatography of the (R)-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, $\lambda$ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 13.279         | 141.24454    | 50.6866|
Supplementary Figure 208. HPLC Chromatography of the (R)-2,5,7,8-tetramethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 13.161         | 147.17885    | 94.5396|
| 2    | 14.195         | 7.24733      | 5.4604 |

Supplementary Figure 209. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl (R)-2-3-((5-(4-fluorophenyl)thiophen-2-yl)methyl)-4-methylphenyl)propanoate (Daicel Chiralpak IG-H Column, α-Hexane: i-PrOH = 98:2, flow rate 0.4 mL/min, T = 25 °C; λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 17.008         | 290.07639    | 49.8822|
Supplementary Figure 210. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-[(5-(4-fluorophenyl)thiophen-2-yl)methyl]-4-methylphenyl)propanoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 17.383         | 35.68076     | 7.0600  |
| 2    | 18.666         | 435.53029    | 92.9400 |

Supplementary Figure 211. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-[(4-(N-(2,6-dimethoxypyrimidin-4-yl)-N-methylsulfamoyl)phenyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 ℃, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 23.169         | 53.33131     | 49.9769 |
Supplementary Figure 212. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-((N-(2,6-dimethoxy)pyrimidin-4-yl)-N-methylsulfamoyl)phenyl)propanoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 23.757         | 117.23232    | 95.4055|
| 2    | 25.401         | 5.37030      | 4.5945 |

Supplementary Figure 213. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-(5-methoxy-3-(2-methoxy-2-oxoethyl)-2-methyl-1H-indole-1-carbonyl)phenyl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 ℃, λ = 250 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 11.861         | 269.96207    | 50.0148|
Supplementary Figure 214. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-(5-methoxy-3-(2-methoxy-2-oxoethyl)-2-methyl-1H-indole-1-carbonyl)phenyl)propanoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 11.910         | 173.16544    | 95.8361 |
| 2    | 15.368         | 6.45716      | 4.1639  |

Supplementary Figure 215. HPLC Chromatography of the (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 ℃, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 7.286          | 71.49884     | 50.7532 |
Supplementary Figure 216. HPLC Chromatography of the (1R,2S,5R)-2-isopropyl-5-methylcyclohexyl 4-((R)-1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 7.244          | 113.67895    | 96.0668|
| 2    | 8.958          | 4.54767      | 3.9332 |

Supplementary Figure 217. HPLC Chromatography of the (3aR,5R,6S,6aR)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-d][1,3]dioxol-6-yl 4-(1-oxo-1-(2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 218. HPLC Chromatography of the (3αR,5R,6S,6αR)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-$d$][1,3]dioxol-6-yl 4-((R)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 10.194         | 321.90137    | 94.8951|
| 2    | 11.616         | 14.70322     | 5.1049 |

Supplementary Figure 219. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(6-methoxynaphthalen-2-yl)propanoate (Daicel Chiralpak IC-H Column, $n$-Hexane: $i$-PrOH = 99:1, flow rate 0.5 mL/min, $T = 25$ °C, $\lambda = 230$ nm)
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 18.851         | 788.51031    | 50.4583|
| 2    | 19.904         | 728.04468    | 49.5417|

**Supplementary Figure 220.** HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(6-methoxynaphthalen-2-yl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 0.5 mL/min, T = 25 °C, λ = 230 nm)

![HPLC Chromatogram](image)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 18.427         | 609.16150    | 93.6668|
| 2    | 19.721         | 39.42362     | 6.3332 |

**Supplementary Figure 221.** HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-isobutylphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)
### Supplementary Figure 222. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-((4-

isobutylphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm )
Supplementary Figure 223. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(2-fluoro-[1,1’-biphenyl]-4-yl)propanoate (Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 99.8:0.2, flow rate 0.5 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.808         | 125.98444    | 50.1471 |
| 2    | 14.944         | 98.84000     | 49.8529 |

Supplementary Figure 224. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(2-fluoro-[1,1’-biphenyl]-4-yl)propanoate

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 99.8:0.2, flow rate 0.5 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
|      |                |              |        |
Supplementary Figure 225. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(3-benzoylephn)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 17.919         | 175.22163    | 49.7472|
| 2    | 22.922         | 133.89783    | 50.2528|

Supplementary Figure 226. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-benzoylephn)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
### Supplementary Figure 227

HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(3-phenoxophenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 228. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(3-phenoxyphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.761          | 49.73722     | 4.6583 |
| 2    | 6.433          | 805.83868    | 95.3417|

Supplementary Figure 229. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(4-phenoxyphenyl)propanoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
|      |                |              |        |
Supplementary Figure 230. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(4-phenoxyphe-}
nyl)propanoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 9.880          | 263.26236    | 93.4022|
| 2    | 10.357         | 18.93966     | 6.5978 |

Supplementary Figure 231. HPLC Chromatography of the Racemic Methyl 4-(3-(benzyloxy)-1-oxo-1-((2,3,3-
trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 232. HPLC Chromatography of the Methyl (S)-4-(3-benzyloxy)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

Supplementary Figure 233. HPLC Chromatography of the Methyl 4-(3-(4-methoxyphenyl)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.8 mL/min, T = 25 ℃, λ = 214 nm)
### Supplementary Figure 234. HPLC Chromatography of the Methyl (R)-4-(3-(4-methoxyphenyl)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 16.902         | 80.07359     | 49.5074 |
| 2    | 18.156         | 80.81141     | 50.4926 |

### Supplementary Figure 235. HPLC Chromatography of the Methyl 4-(1-oxo-3-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane:i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)
Supplementary Figure 236. HPLC Chromatography of the Methyl (R)-4-(1-oxo-3-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)propan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 9.714          | 252.49284    | 49.5207 |
| 2    | 10.264         | 245.17847    | 50.4793 |

Supplementary Figure 237. HPLC Chromatography of the Methyl 4-(1-oxo-4-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 9.369          | 567.95636    | 89.6666 |
| 2    | 9.944          | 61.61660     | 10.3334 |
(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 12.020         | 147.55556    | 49.4371 |
| 2    | 21.027         | 80.16261     | 50.5629 |

Supplementary Figure 238. HPLC Chromatography of the Methyl (R)-4-(1-oxo-4-phenyl-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 12.049         | 159.64944    | 93.5613 |
| 2    | 21.252         | 6.14400      | 6.4387  |
**Supplementary Figure 239.** HPLC Chromatography of the Methyl 4-(4-(methylthio)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.9 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.681         | 97.61547     | 49.6865|
| 2    | 13.953         | 97.49183     | 50.3135|

**Supplementary Figure 240.** HPLC Chromatography of the Methyl (R)-4-(4-(methylthio)-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.333         | 103.13371    | 91.7095|
| 2    | 13.253         | 9.45558      | 8.2905 |
Supplementary Figure 241. HPLC Chromatography of the 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.8 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 12.512         | 114.86185    | 52.8112 |
| 2    | 13.622         | 100.53183    | 47.1888 |

Supplementary Figure 242. HPLC Chromatography of the (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 12.466         | 139.99232    | 95.5411 |
**Supplementary Figure 243.** HPLC Chromatography of the Methyl 4-((1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 18.171         | 118.32067    | 50.1839|
| 2    | 19.103         | 114.19765    | 49.8161|

**Supplementary Figure 244.** HPLC Chromatography of the Methyl (R)-4-((1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)
| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 18.446         | 266.69272    | 95.9747 |
| 2    | 19.388         | 10.23030     | 4.0253  |

**Supplementary Figure 245.** HPLC Chromatography of the Methyl 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hexan-2-yl)benzoate

(Daicel Chiralpak IG-H Column, *n*-Hexane: *i*-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)
**Supplementary Figure 246.** HPLC Chromatography of the Methyl (R)-4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hexan-2-yl)benzoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 12.292         | 422.72397    | 96.0545|
| 2    | 13.623         | 16.15827     | 3.9455 |

**Supplementary Figure 247.** HPLC Chromatography of the Methyl 4-(4-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)pentan-2-yl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 0.4 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 20.345         | 100.00       | 99.999 |
| 2    | 20.545         | 0.48         | 0.001  |
**Supplementary Figure 248.** HPLC Chromatography of the Methyl \((R)\)-4-(4-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)pentan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 21.017         | 125.47861    | 96.7863|
| 2    | 22.306         | 4.92390      | 3.2137 |

**Supplementary Figure 249.** HPLC Chromatography of the Methyl 4-(3-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

(Daicel Chiralpak IC-H Column, \(n\)-Hexane: \(i\)-PrOH = 99:1, flow rate 0.5 mL/min, \(T = 25\) °C, \(\lambda = 214\) nm)
Supplementary Figure 250. HPLC Chromatography of the Methyl (R)-4-(3-methyl-1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)butan-2-yl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 20.861         | 130.16118    | 50.0693 |
| 2    | 22.076         | 132.31940    | 49.9307 |

Supplementary Figure 251. HPLC Chromatography of the Methyl 4-(1-cyclopentyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate

(Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 98:2, flow rate 0.5 mL/min, T = 25 ℃, λ = 214 nm)
Supplementary Figure 251. HPLC Chromatography of the Methyl (R)-4-((1-cyclopentyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 12.114         | 222.16972    | 49.7235 |
| 2    | 13.511         | 203.72284    | 50.2765 |

Supplementary Figure 252. HPLC Chromatography of the Methyl 4-((1-cyclohexyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate

| Peak | Ret Time [min] | Height [mAU] | Area %  |
|------|----------------|--------------|---------|
| 1    | 11.939         | 79.47903     | 96.7106 |
| 2    | 13.298         | 2.11271      | 3.2894  |
(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 23.011         | 112.87428    | 49.3600|
| 2    | 24.235         | 106.54940    | 50.6400|

**Supplementary Figure 254.** HPLC Chromatography of the Methyl (R)-4-((1-cyclohexyl-2-oxo-2-((2,3,3-trimethylbutan-2-yl)oxy)ethyl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 23.244         | 177.15358    | 99.5174|
| 2    | 24.548         | 8.33065e-1   | 0.4826 |
Supplementary Figure 255. HPLC Chromatography of the 4-(1-oxo-1-((2,3,3-trimethylbutan-2-yl)oxy)hept-6-en-2-yl)benzoate

(Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99:1, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|---------------|--------------|--------|
| 1    | 24.941        | 121.65689    | 48.2383 |
| 2    | 26.309        | 113.74099    | 51.7617 |

Supplementary Figure 256. HPLC Chromatography of the Methyl 4-(((1R, 2S)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (Daicel Chiralpak IC-H Column, n-Hexane: i-PrOH = 99.0:1.0, flow rate 1.0 mL/min, T = 25 °C, λ = 214 nm): $t_R = 24.94$ min (major), $t_R = 26.30$ min (minor)
**Supplementary Figure 257.** HPLC Chromatography of the Methyl 4-(((1R, 2R)-2-(((2,3,3-trimethylbutan-2-yl)oxy)carbonyl)cyclopentyl)methyl)benzoate (Daicel Chiralpak IG-H Column, n-Hexane: i-PrOH = 99:1, flow rate 0.7 mL/min, T = 25 °C, λ = 214 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 32.729         | 44.38659     | 50.1372|
| 2    | 34.888         | 29.97759     | 49.8628|
Supplementary Figure 258. HPLC Chromatography of the Racemic 2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 6.736          | 430.26535    | 50.0177|
| 2    | 8.654          | 332.82675    | 49.9823|

Supplementary Figure 259. HPLC Chromatography of the Racemic (R)-2-(2-fluoro-[1,1'-biphenyl]-4-yl)propanoic acid

(Daicel Chiralpak AD-H Column, n-Hexane: i-PrOH = 90:10, flow rate 1.0 mL/min, T = 25 °C, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 6.725          | 1685.18445   | 95.2648|
Supplementary: HPLC data for the Suboptimal substrates products

Supplementary Figure 260. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl (E)-2-methyl-4-phenylbut-3-enoate

(Daicel Chiralpak Cellulose-3 Column, MeCN: H₂O = 85:15, flow rate 0.7 mL/min, T = 25 ℃, λ = 214 nm)

Supplementary Figure 261. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R,E)-2-methyl-4-phenylbut-3-enoate

(Daicel Chiralpak Cellulose-3 Column, MeCN: H₂O = 85:15, flow rate 0.7 mL/min, T = 25 ℃, λ = 214 nm)
| No. | Retention Time (min) | Area (μAU*min) | Height (μAU) | Relative Area (%) | Resolution (E/P) | Asymmetry (E/P) | K' | Plates (E/P) |
|-----|----------------------|----------------|--------------|------------------|------------------|-----------------|----|-------------|
| n.a.| 6.340                | 468,4721       | 2817,4503    | 78.028           | 2.30             | 0.90           | n.a.| 11046       |
| n.a.| 6.913                | 147,7129       | 385,5895     | 22.572           | n.a.             | 0.97           | n.a.| 11617       |
| Total: |                   | 616,185        | 1401,998     |                  |                  |                 |     |             |


Supplementary Figure 262. HPLC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(pyridin-3-yl)propanoate

(Daicel Chiralpak OD-H Column, n-Hexane: i-PrOH = 95:5, flow rate 1.0 mL/min, T = 25 ℃, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.464          | 10331        | 50.217 |
| 2    | 5.849          | 9705         | 49.783 |

Supplementary Figure 263. HPLC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(pyridin-3-yl)propanoate

(Daicel Chiralpak OD-H Column, n-Hexane: i-PrOH = 95:5, flow rate 1.0 mL/min, T = 25 ℃, λ = 254 nm)

| Peak | Ret Time [min] | Height [mAU] | Area % |
|------|----------------|--------------|--------|
| 1    | 5.429          | 23440        | 10.243 |
| 2    | 5.806          | 219559       | 89.757 |
Supplementary Figure 264. SFC Chromatography of the Racemic 2,3,3-trimethylbutan-2-yl 2-(1H-inden-2-yl)propanoate

SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO₂, 2.5 mL/min, T = 25 °C, λ = 230 nm)

Signal 2: DAD1 B, Sig=230,8 Ref=380,60

| Peak | Ret Time | Width | Area (mAU*s) | Height (mAU) | Area % |
|------|----------|-------|--------------|--------------|--------|
| 1    | 5.824    | 0.1034| 825.38147    | 122.78715    | 49.9215|
| 2    | 6.252    | 0.1132| 827.97888    | 114.78175    | 50.0785|

Totals: 1653.36035 237.56889

Supplementary Figure 265. SFC Chromatography of the 2,3,3-trimethylbutan-2-yl (R)-2-(1H-inden-2-yl)propanoate

SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO₂, 2.5 mL/min, T = 25 °C, λ = 230 nm)

Signal 2: DAD1 B, Sig=230,8 Ref=380,60

| Peak | Ret Time | Width | Area (mAU*s) | Height (mAU) | Area % |
|------|----------|-------|--------------|--------------|--------|
| 1    | 5.660    | 0.1365| 824.23224    | 86.26016     | 86.3072|
| 2    | 6.086    | 0.1147| 130.76608    | 13.78380     | 13.6928|

Totals: 954.99832 100.04397
**Supplementary Figure 266.** SFC Chromatography of the Racemic methyl 4-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate

SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO\(_2\), 2.5 mL/min, T = 25 °C, λ = 230 nm)

| Peak | RetTime | Type | Width | Area [mAU*s] | Height [mAU] | Area % |
|------|---------|------|-------|--------------|--------------|--------|
| 1    | 3.938   | BB   | 0.0577| 619.15247   | 165.28320   | 51.6222|
| 2    | 4.319   | BB   | 0.0788| 580.23987   | 113.29196   | 48.3778|

Totals: 1199.39233 278.57516

**Supplementary Figure 267.** SFC Chromatography of the methyl 4-(((S)-1-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)-1-oxopropan-2-yl)benzoate

SFC (Daicel Chiralpak IF-3 Column, 2% i-PrOH in supercritical CO\(_2\), 2.5 mL/min, T = 25 °C, λ = 230 nm)

| Peak | RetTime | Type | Width | Area [mAU*s] | Height [mAU] | Area % |
|------|---------|------|-------|--------------|--------------|--------|
| 1    | 3.880   | BB   | 0.0614| 2089.59009   | 525.83655   | 75.0373|
| 2    | 4.263   | BB   | 0.0828| 695.14496   | 129.04030   | 24.9627|

Totals: 2784.73505 654.87685
4. Supplementary References

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