Supporting Information


Aaron Christopher*, Dahniel Brandes*, Stephen Kelly* and Thomas G. Minehan**

Department of Chemistry and Biochemistry, California State University–Northridge, Northridge, CA 91330

Experimental Procedures pp. S1

Spectroscopic data for compounds:

2a, 2e, 2h, 2j, 3a-3j, 3l-3r, 4f pp. S2-S22

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1H NMR and 13C NMR spectra for compounds:

2a, 2e, 2h, 2j, 3a-3j, 3l-3r, 4f pp. S26-S46
**General Methods.** Distilled water was used in all of the experiments. Organic extracts were dried over Na$_2$SO$_4$, filtered, and concentrated using a rotary evaporator at aspirator pressure (20-30 mmHg). Chromatography refers to flash chromatography and was carried out on SiO$_2$ (silica gel 60, 230-400 mesh). $^1$H and $^{13}$C NMR spectra were measured in CDCl$_3$ at 400 MHz and 100 MHz, respectively, using Me$_4$Si as internal standard. Chemical shifts are reported in ppm downfield ($\delta$) from Me$_4$Si.

A. General procedure for [3,3] sigmatropic rearrangement/ketone trapping of allyl-1,1-dichlorovinyl ethers to form $\beta$-lactones 3a-3j.

The allyl-1,1-dichlorovinyl ether 2a (188 mg, 0.85 mmol) was dissolved in THF (5 mL) and cooled to -78°C. n-BuLi (1.27 mL, 2M in cyclohexane, 2.54 mmol, 3 equivalents) was added dropwise at -78°C and the dark-colored solution was stirred at this temperature for 45 minutes. Then the ketone (1.7 mmol, 2 equivalents) was added and the mixture was stirred at -78°C for another 45 minutes. A solution of saturated NaHCO$_3$ (5 mL) was added, followed by ether (5 mL) and the mixture was allowed to warm to room temperature. The phases were separated and the aqueous layer was further extracted with ether (2 x 25 mL). The combined organic extracts were once washed with 20 ml sat. aq. NaCl, dried over anhydrous Na$_2$SO$_4$ and concentrated under reduced pressure to give a crude oil. Purification of the residue by flash chromatography afforded $\beta$-lactones 3.

B. General procedure for [3,3] sigmatropic rearrangement/ketone trapping of allyl-1,1-dichlorovinyl ethers to form $\gamma$- and $\delta$-lactones 3l-3r.

The allyl-1,1-dichlorovinyl ether 2a (188 mg, 0.85 mmol) was dissolved in THF (5 mL) and cooled to -78°C. n-BuLi (1.27 mL, 2M in cyclohexane, 2.54 mmol, 3 equivalents) was added dropwise at -78°C and the dark-colored solution was stirred at this temperature for 45 minutes. Then the epoxide or oxetane (1.7 mmol, 2 equivalents) was added, followed by BF$_3$•OEt$_2$ (1.7 mmol, 2 equivalents) and the mixture was stirred at -78°C for another 45 minutes. A solution of saturated NaHCO$_3$ (5 mL) was added, followed by ether (5 mL) and the mixture was allowed to warm to room temperature. The phases were separated and the aqueous layer was further extracted with ether (2 x 25 mL). The combined organic extracts were once washed with 20 ml sat. aq. NaCl, dried over anhydrous Na$_2$SO$_4$ and concentrated under reduced pressure to give a crude oil. Purification of the residue by flash chromatography afforded $\gamma$- or $\delta$-lactones 3.
Compound 2a was prepared from 1-octene-2-ol in 68% overall yield according to the procedure in main text reference 4.

See spectra on page S24

$^1$H NMR: (400 MHz, CDCl$_3$)

6.55 (s, 1H); 5.77 (m, 1H); 5.28 (d, $J$=5.2 Hz, 1H); 5.24 (s, 1H); 4.12 (q, $J$=6.8 Hz, 1H); 1.73 (m, 1H); 1.59 (m, 1H); 1.42-1.27 (m, 6H); 0.91 (t, $J$=6.4 Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

141.8; 137.1; 118.1; 103.9; 84.7; 34.7; 31.5; 24.6; 22.6; 22.4; 13.9.

HRMS (ESI): calculated for C$_{10}$H$_{17}$Cl$_2$O$_8$ 223.0656, found 223.0682 (M+H)$^+$

MS spectra were difficult to obtain because dichlorovinyl ethers undergo facile [3,3] sigmatropic rearrangement reactions upon exposure to thermal, ionizing or acidic conditions (Org Lett. 2006, 8, 451). As a result, the [M+H]$^+$ and [M+Na]$^+$ signals for dichlorovinyl ethers 2a, 2e, 2h and 2j are very weak. The thermal rearrangement of allyl-1,1-dichlorovinyl ethers is known (Synthesis 1981, 308).
Compound 2e was prepared from 2-cyclohexylideneethanol\textsuperscript{a} in 51% overall yield according to the procedure in main text reference 4.

See spectra on page S25

\textsuperscript{1}H NMR: (400 MHz, CDCl\textsubscript{3})
6.55 (s, 1H); 5.32 (t, J=6.2 Hz, 1H); 4.42 (s, 1H); 4.40 (s, 1H); 2.22 (m, 2H); 2.16 (m, 1H); 1.73 (m, 2H); 1.58 (m, 4H).

\textsuperscript{13}C NMR: (100 MHz, CDCl\textsubscript{3})
148.0; 143.3; 142.5; 115.5; 72.0; 68.7; 37.0; 34.2; 33.1; 29.1; 28.3; 27.7; 26.5; 26.4; 26.1.

HRMS (ESI): calculated for C\textsubscript{10}H\textsubscript{14}Cl\textsubscript{2}O\textsubscript{Na} 243.0319, found 243.0314 (M+H)+

Compound 2h was prepared from 2-cyclopentyldieneethanol\textsuperscript{b} in 62% overall yield according to the procedure in main text reference 4.

\textit{See spectra on page S26}

\textsuperscript{1}H NMR: (400 MHz, CDCl\textsubscript{3})

\begin{tabular}{c}
6.55 (s, 1H); 5.47 (m, 1H); 4.39 (s, 1H); 4.37 (s, 1H); 2.34 (t, \(J=7.0\) Hz, 2H); 2.27 (t, \(J=7.4\) Hz, 2H); 1.66 (m, 4H).
\end{tabular}

\textsuperscript{13}C NMR: (100 MHz, CDCl\textsubscript{3})

\begin{tabular}{c}
151.5; 142.7; 114.4; 71.1; 33.8; 29.0; 26.2; 25.9.
\end{tabular}

HRMS (ESI): calculated for C\textsubscript{9}H\textsubscript{13}Cl\textsubscript{2}O 207.0343, found 207.0385 (M+H)\textsuperscript{+}

Compound 2j was prepared from 2-cyclohexylidene propan-1-ol\(^c\) in 90\% overall yield according to the procedure in main text reference 4.

*See spectra on page S27*

\(^1\)H NMR: (400 MHz, CDCl\(_3\))

6.51 (s, 1H); 4.43 (s, 2H); 2.25 (m, 4H); 1.74 (s, 3H); 1.57 (m, 6H).

\(^{13}\)C NMR: (100 MHz, CDCl\(_3\))

142.3; 141.3; 119.9; 104.6; 73.1; 30.9; 30.4; 28.4; 27.8; 26.6; 15.8.

HRMS (ESI): calculated for C\(_{11}\)H\(_{16}\)Cl\(_2\)NaO 257.0476, found 257.0467 (M+Na)\(^+\)

Compound 3a was prepared from 2a in 70% yield according to general procedure A outlined above.

See spectra on page S28

$^1$H NMR: (400 MHz, CDCl$_3$)
5.52 (m, 1H); 5.39 (m, 1H); 3.54 (dd, $J$=9.6, 6.3 Hz, 2H); 2.52 (m, 1H); 2.41 (m, 1H); 2.15 (m, 1H); 2.05-1.71 (m, 8H); 1.40-1.25 (m, 6H); 0.91 (t, $J$=6.8 Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)
171.3; 133.5; 125.0; 91.3; 54.4; 37.8; 32.4; 32.0; 31.3; 28.9; 28.8; 23.5; 23.4; 22.4; 13.9.

HRMS (ESI): calculated for C$_{15}$H$_{25}$O$_2$ 237.1855, found 237.1876 (M+H)$^+$
Compound 3b was prepared from 2a in 56% yield according to general procedure A outlined above.

See spectra on page S29

$^1$H NMR: (400 MHz, CDCl$_3$)

5.51 (m, 1H); 5.42 (m, 1H); 3.19 (t, $J=6.7$ Hz, 2H); 2.48 (m, 2H); 2.04 (q, $J=6.9$ Hz, 2H); 1.94 (m, 1H); 1.75-1.60 (m, 10H); 1.38-1.27 (m, 8H); 0.93 (t, $J=4.0$ Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

171.6; 133.4; 125.5; 82.4; 57.8; 37.4; 32.4; 31.4; 31.3; 31.1; 28.9; 27.0; 25.3; 24.9; 22.8; 22.7; 22.5; 22.4; 22.0; 14.0.

HRMS (ESI): calculated for C$_{16}$H$_{26}$NaO$_2$ 273.1830, found 273.1819 (M+Na)$^+$
Compound 3c was prepared from 2a in 85% yield according to the general procedure A outlined above.

See spectra on page S30

$^1$H NMR: (400 MHz, CDCl$_3$)

5.54 (dt, $J=15.2$, 7.0 Hz, 1H); 5.38 (dt, $J=13.5$, 7.5 Hz, 1H); 3.27 (dd, $J=9.5$, 6.6 Hz, 2H); 2.50 (m, 1H); 2.41 (m, 1H); 2.03 (m, 2H); 1.86-1.68 (m, 3H); 1.37-1.24 (m, 9H); 1.00 (t, $J=7.5$ Hz, 3H); 0.94 (m, 6H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

171.5; 133.7; 125.6; 85.2; 56.8; 32.3; 31.3; 29.1; 28.9; 27.4; 24.5; 22.4; 14.0; 8.1; 7.3.

HRMS (ESI): calculated for C$_{15}$H$_{26}$NaO$_2$ 261.1830, found 261.1846 (M+Na)$^+$
Compound 3d was prepared from 2a in 71% yield according to the general procedure A outlined above.

See spectra on page S31; product obtained as a mixture of diastereomers

$^1$H NMR: (400 MHz, CDCl$_3$)

- 7.36 (m, 5H); 5.22 (m, 2H); 3.59 (t, $J$=8.2 Hz, 1H); 1.97 (s, 3H); 2.05-1.90 (m, 4H); 1.28 (m, 6H); 0.91 (t, $J$=6.7 Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

- 170.7; 138.8; 133.5; 128.3; 128.0; 125.3; 124.3; 82.3; 60.5; 32.3; 31.3; 29.3; 28.9; 27.7; 22.4; 14.0.

HRMS (ESI): calculated for C$_{18}$H$_{24}$NaO$_2$ 295.1674, found 295.1669 (M+Na)$^+$
Compound 3e was prepared from 2e in 81% yield according to the general procedure A outlined above.

*See spectra on page S32*

$^1$H NMR: (400 MHz, CDCl$_3$)

5.81 (dd, $J$=17.8, 11.0, 1H); 5.30 (d, $J$=11.0 Hz, 1H); 5.20 (d, $J$=13.8 Hz, 1H); 3.23 (s, 1H); 2.21 (m, $J$=6.4 Hz, 1H); 2.07 (m, 1H); 2.01 (m, $J$=6.4 Hz, 1H); 1.84 (m, $J$=7.3 Hz, 1H); 1.72 (m, 1H); 1.55 (m, 8H); 1.26 (m, 1H); 0.93 (t, $J$=7.3 Hz, 3H); 0.89 (t, $J$=6.4 Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

170.5; 142.2; 116.4; 87.2; 67.7; 40.3; 34.9; 30.2; 25.7; 25.2; 21.9; 21.4; 8.3; 7.5.

HRMS (ESI): calculated for C$_{15}$H$_{24}$NaO$_2$ 259.1674, found 259.1635 (M+Na)$^+$
Compound 3f was prepared from 2e in 84% yield according to the general procedure A outlined above.

See spectra on page S33

$^1$H NMR: (400 MHz, CDCl$_3$)
5.84 (d, $J=11.2$ Hz, 1H); 5.79 (d, $J=10.8$ Hz, 1H); 5.24 (d, $J=10.8$ Hz, 1H); 5.17 (d, $J=18.8$ Hz, 1H); 3.56 (s, 1H); 2.08 (m, 2H); 1.98 (m, 1H); 1.88-1.42 (m, 14H; 1.30 (m, 1H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)
170.5; 141.6; 116.1; 91.5; 63.9; 40.3; 39.7; 34.4; 33.3; 33.2; 25.6; 23.9; 22.1; 21.8; 21.4.

HRMS (ESI): calculated for C$_{15}$H$_{22}$NaO$_2$ 257.1517, found 257.1521 (M+Na)$^+$
Compound 3g was prepared from 2e in 56% yield according to the general procedure A outlined above.

*See spectra on page S34; product obtained as a mixture of diastereomers*

**$^1$H NMR:** (400 MHz, CDCl$_3$)

7.41-7.28 (m, 5H); 5.28 (d, $J$=11 Hz, 1H); 5.23 (d, $J$=10.9 Hz, 1H); 5.06 (d, $J$=10.9 Hz, 1H); 4.88 (d, $J$=18.6 Hz, 1H); 3.64 (s, 1H); 1.92 (s, 3H); 1.66-1.10 (m, 10H)

**$^{13}$C NMR:** (100 MHz, CDCl$_3$)

168.9; 141.1; 139.5; 128.0; 127.7; 126.7; 123.6; 115.8; 82.8; 71.9; 40.5; 35.6; 34.6; 33.1; 32.6; 29.9; 26.1; 25.5; 22.0; 21.6; 21.3.

**HRMS (ESI):** calculated for C$_{18}$H$_{22}$NaO$_2$ 293.1517, found 293.1515 (M+Na)$^+$
Compound 3h was prepared from 2h in 62% yield according to the general procedure A outlined above.

See spectra on page S35

$^1$H NMR: (400 MHz, CDCl$_3$)

5.82 (d, $J$=10.7 Hz, 1H); 5.80 (d, $J$=10.7, Hz, 1H); 5.12 (d, $J$=10.7 Hz, 1H); 5.09 (d, $J$=8.6 Hz, 1H); 3.32 (s, 1H); 2.19 (m, 1H); 1.89 (m, 3H); 1.65 (m, 15H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

170.9; 142.9; 113.4; 84.1; 67.1; 48.0; 38.3; 36.1; 34.9; 31.6; 24.9; 23.1; 22.5; 21.6

HRMS (ESI): calculated for C$_{15}$H$_{22}$NaO$_2$ 257.1517, found 257.1574 (M+Na)$^+$
Compound 3i was prepared from 2h in 91% yield according to general procedure A outlined above.

See spectra on page S36; product obtained as a mixture of diastereomers

$^1$H NMR: (400 MHz, CDCl$_3$)
5.83 (m, 2H); 5.14-5.01 (m, 4H); 5.52 (s, 1H); 3.49 (s, 1H); 2.02 (m, 1H);
1.95-1.62 (m, 19H); 1.55 (s, 3H); 1.51 (s, 3H); 0.99 (q, $J$=7.4 Hz, 3H)

$^{13}$C NMR: (100 MHz, CDCl$_3$)
170.6; 170.4; 142.8; 142.5; 113.7; 113.3; 84.5; 84.2; 67.6; 65.0; 48.1;
37.5; 37.1; 35.1; 34.3; 28.0; 25.0; 24.6; 24.5; 22.5; 22.4; 19.7; 8.4; 7.8.

HRMS (ESI): calculated for C$_{13}$H$_{21}$NaO$_2$ 231.1361, found 231.1311 (M+Na)$^+$
Compound 3j was prepared from 2j in 93% yield according to general procedure A outlined above.

*See spectra on page S37*

$^1$H NMR: (400 MHz, CDCl$_3$)
5.19 (s, 1H); 4.98 (s, 1H); 3.37 (s, 1H); 2.26 (m, 2H); 1.76 (s, 3H); 1.79-1.70 (m, 3H); 1.60 (s, 3H); 1.58 (m, 3H); 1.49 (s, 3H); 1.25 (m, 2H)

$^{13}$C NMR: (100 MHz, CDCl$_3$)
170.8; 143.2; 116.1; 81.9; 65.7; 43.2; 34.2; 30.9; 29.7; 25.7; 22.6; 22.0; 21.6; 19.6.

IR: 1807, 1222, 1069, 899, 802 cm$^{-1}$

HRMS (ESI): calculated for C$_{14}$H$_{22}$NaO$_2$ 245.1517, found 245.1509 (M+Na)$^+$
Compound 4f was prepared from 3f in >95% yield by the following procedure:

Compound 3f (45 mg, 0.19 mmol) was dissolved in CH₂Cl₂ (1 mL) and cooled to -78°C. Then allyltrimethylsilane (0.08 ml, 0.5 mmol) was added, followed by TMSOTf (0.1 mL, 0.5 mmol). The reaction was stirred 10 minutes at -78°C and then saturated aqueous NaHCO₃ solution (5 mL) and ether (5 mL) was added. The phases were separated and the aqueous layer was further extracted with ether (2 x 25 mL). The combined organic extracts were once washed with 20 ml sat. aq. NaCl, dried over anhydrous Na₂SO₄ and concentrated under reduced pressure to give a crude oil. ¹H NMR of the crude oil indicated that product 4f was >95% pure.

See spectra on page S38

¹H NMR: (400 MHz, CDCl₃)
5.88 (dd, J=17.8, 11.0 Hz, 1H); 5.67 (m, 1H); 5.23 (d, J=11.0 Hz, 1H); 5.03 (d, J=17.8 Hz, 1H); 3.29 (s, 1H); 2.42 (m, 2H); 2.35 (m, 2H); 1.85 (m, 3H); 1.65-1.39 (m, 9H).

¹³C NMR: (100 MHz, CDCl₃)
178.4; 142.9; 137.9; 131.0; 115.1; 57.4; 42.7; 36.5; 34.5; 32.8; 30.3; 29.6; 26.1; 23.6; 22.1; 21.9.

HRMS (ESI): calculated for C₁₅H₂₂NaO₂ 257.1517, found 257.1548 (M+Na)⁺
Compounds 3l were prepared from 2a in 56% yield according to general procedure B outlined above.

*See spectra on page S39; product obtained as a mixture of regioisomers*

\[ ^1H\text{ NMR: (400 MHz, CDCl}_3\text{)} \]
5.46 (dt, \(J=8.4, 0.8\text{ Hz}, 1\text{H}\)); 5.29 (dt, \(J=8.0, 6.8\text{ Hz}, 1\text{H}\)); 4.05 (m, 2H); 2.59 (m, 1H); 2.28 (m, 1H); 2.14 (m, 1H); 2.01-1.93 (m, 2H); 1.63-1.50 (m, 2H); 1.42-1.13 (m, 6H); 1.20 (s, 3H); 1.19 (s, 3H); 0.92 (t, \(J=7.6\text{ Hz}, 3\text{H}\))

\[ ^{13}C\text{ NMR: (100 MHz, CDCl}_3\text{)} \]
177.0; 133.5; 126.2; 70.4; 64.3; 44.8; 41.6; 37.1; 32.4; 31.3; 30.6; 30.5; 29.0; 28.4; 22.5; 19.1; 14.0; 13.6.

HRMS (ESI): calculated for \(\text{C}_{14}\text{H}_{25}\text{O}_2\) 225.1855, found 225.1817 (M+H)^+
Compound 3n was prepared from 2e in 78% yield according to general procedure B outlined above.

See spectra on page S41; product obtained as a mixture of diastereomers

\begin{align*}
^{1}H \text{ NMR: } & \text{(400 MHz, CDCl}_3\text{)} \\
& 5.82 (dd, J=17.8, 11.0 \text{ Hz}, 1H); 5.26 (d, J=11.0 \text{ Hz}, 1H); 5.11 (d, J=17.8 \text{ Hz}, 1H); 3.63 (td, J=10.7, 3.5 \text{ Hz}, 1H); 2.36 (d, J=12.0 \text{ Hz}, 1H); 2.17 (m, 3H); 1.87-1.63 (m, 6H); 1.52-1.40 (m, 7H); 1.39-1.28 (m, 3H)
\end{align*}

\begin{align*}
^{13}C \text{ NMR: } & \text{(100 MHz, CDCl}_3\text{)} \\
& 176.2; 142.5; 115.8; 81.9; 54.3; 45.7; 41.7; 34.2; 33.6; 30.6; 30.1; 26.1; 25.5; 23.9; 21.9; 21.8.
\end{align*}

\text{IR: } 1770, 1080, 1035, 912 \text{ cm}^{-1}

\text{HRMS (ESI): calculated for } C_{16}H_{24}NaO_2 \text{ 271.1674, found 271.1689 (M+Na)}^+
Compound 3o was prepared from 2e in 89% yield according to general procedure B outlined above.

See spectra on page S42: product obtained as a mixture of diastereomers

$^1$H NMR: (400 MHz, CDCl$_3$)

5.77 (dd, $J$ = 17.8, 11.0 Hz, 1H); 5.26 (dd, $J$ = 11.0, 1.2 Hz, 1H); 5.08 (dd, $J$ = 17.8, 1.3 Hz, 1H); 4.23 (m, 1H); 2.67 (dd, $J$ = 12.4, 8.6 Hz, 1H); 2.21 (m, 1H); 2.16 (m, 1H); 1.69-1.31 (m, 10H); 0.92 (t, $J$ = 6.8 Hz, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)

176.4; 141.7; 116.1; 48.8; 40.8; 35.8; 35.1; 33.7; 33.2; 30.7; 29.6. 27.3; 26.0; 22.4; 21.9; 21.8; 13.8.

HRMS (ESI): calculated for C$_{16}$H$_{26}$NaO$_2$ 273.1830, found 273.1842 (M+Na)$^+$
Compound **3p** was prepared from **2e** in 65% yield according to general procedure **B** outlined above.

*See spectra on page S43*

**$^1$H NMR**: (400 MHz, CDCl$_3$)
- 5.83 (dd, $J$=17.8, 11.0 Hz, 1H)
- 5.26 (d, $J$=6.5, 1.3 Hz, 1H)
- 5.07 (d, $J$=17.8, 1.3 Hz, 1H)
- 3.86 (m, 2H)
- 2.60 (dd, $J$=10.8, 8.4 Hz, 1H)
- 2.00-1.31 (m, 12H)
- 1.06 (s, 3H)
- 0.99 (s, 3H).

**$^{13}$C NMR**: (100 MHz, CDCl$_3$)
- 172.1; 142.1; 115.7; 70.1; 45.3; 42.4; 35.0; 35.4; 34.6; 32.4; 31.9; 30.6; 30.5; 28.5; 28.2; 26.8; 26.1; 24.0; 22.6; 22.1; 21.9; 14.0.

**IR**: 2927, 1727, 1141.6, 1073, 914 cm$^{-1}$

**HRMS (ESI)**: calculated for C$_{15}$H$_{24}$NaO$_2$ 259.1674, found 259.1626 (M+Na)$^+$
Compound 3q was prepared from 2h in 71% yield according to general procedure B outlined above.

See spectra on page S44: product obtained as a mixture of diastereomers

$^1$H NMR: (400 MHz, CDCl$_3$)
5.81 (dd, $J$=17.4, 10.7 Hz, 1H); 5.17 (d, $J$=10.7 Hz, 1H); 5.09 (d, $J$=17.5 Hz, 1H); 3.67 (td, $J$=14.7, 3.5 Hz, 1H); 2.28 (d, $J$=12.3 Hz, 1H); 2.19 (m, 1H); 1.91 (m, 2H); 1.78 (m, 2H); 1.65 (m, 4H); 1.57-1.40 (m, 3H); 1.37-1.24 (m, 4H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)
176.4; 141.3; 114.7; 82.2; 56.3; 49.7; 47.1; 39.0; 37.0; 35.2; 30.1; 29.2; 25.3; 23.3; 22.9.

HRMS (ESI): calculated for C$_{15}$H$_{24}$NaO$_2$ 257.1517, found 257.1491 (M+Na)$^+$
Compound 3r was prepared from 2j in 68% yield according to general procedure B outlined above.

*See spectra on page S45*

$^1$H NMR: (400 MHz, CDCl$_3$)
- 5.15 (s, 1H); 4.86 (s, 1H); 4.29 (m, 1H); 4.16 (m, 1H); 2.56 (t, $J$=9.6 Hz, 1H); 1.97-1.73 (m, 6H); 1.68 (s, 3H); 1.58-1.46 (m, 5H); 1.27 (m, 3H).

$^{13}$C NMR: (100 MHz, CDCl$_3$)
- 172.3; 145.0; 115.8; 68.9; 46.6; 33.2; 31.3; 30.7; 26.0; 23.1; 22.4; 21.1; 22.0; 20.1.

HRMS (ESI): calculated for C$_{14}$H$_{22}$NaO$_2$ 245.1517, found 245.1573 (M+Na)$^+$
2a

$^{1}H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra
$^{1}H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra
$^{1}H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra
\[ \text{S29} \]

\[ \text{Electronic Supplementary Material (ESI) for Organic \& Biomolecular Chemistry} \]

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$^1$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
3b

$^1$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
$^{1}$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
$^{1}H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra; product obtained as a mixture of diastereomers
$3\text{e}^1\text{H (400 MHz) and } ^{13}\text{C NMR (100 MHz) spectra}$
$3f$ H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
$^\text{1}H$ (400 MHz) and $^{13}\text{C}$ NMR (100 MHz) spectra; product obtained as a mixture of diastereomers
$^{3}h$ $^1$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
product obtained as a mixture of diastereomers
$^{3j}$^1H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
$^1$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
$^{1}H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra
product obtained as a mixture of regioisomers
$^3$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra

product obtained as a mixture of diastereomers
$^1$H (400 MHz) and $^{13}$C NMR (100 MHz) spectra product obtained as a mixture of diastereomers
$\text{H (400 MHz) and } ^{13}\text{C NMR (100 MHz) spectra}$
$^{3q}$ H (400 MHz) and $^{13}$C NMR (100 MHz) spectra
product obtained as a mixture of diastereomers
$^3r$ $^1H$ (400 MHz) and $^{13}C$ NMR (100 MHz) spectra