Supporting Information

Stannylated allyl carbonates as versatile building blocks for the diversity oriented synthesis of allylic amines and amides

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S2
Ethyl 2-(tributylstannyl)allyl carbonate (1a): In a flame-dried 100 mL three-necked flask equipped with a reflux condenser with connection to high vacuum and nitrogen via a Schlenk line, a dropping funnel, a septum and a magnetic stir bar were placed tris-(tert-butylisonitril)-tricarbonyl-molybdän (258 mg, 0.6 mmol, 3 mol%) and hydroquinone (220 mg, 2.0 mmol, 10 mol%) under nitrogen. Then the nitrogen atmosphere was evacuated and CO was added via a ballon and a syringe. Subsequently THF and ethyl propargyl carbonate (2.56 g, 20 mmol, 1 equiv) were added and the resulting mixture was stirred for 15 min vigorously. Tributyl tin hydride (11.6g, 40 mmol, 2 equiv) was then added via the dropping funnel and the reaction mixture was heated to 60° C for 4 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99:0:1–98:1:1) the pure product was obtained in 89 % yield (7.46 g, 17.8 mmol) with a regioisomeric ratio: α/β-(E)/β-(Z) = 95/4/1. 1H NMR: δ = 5.91 (ddt, J_{Sn} = 122.2 Hz, J = 1.9 Hz, J = 1.9 Hz, 1 H), 5.31 (ddt, J_{Sn} = 58.9 Hz, J = 2.1 Hz, J = 1.7 Hz, 1 H), 4.74 (ddd, J_{Sn} = 28.4 Hz, J = 1.7 Hz, 2 H), 4.20 (q, J = 7.1 Hz, 2 H), 1.60 – 1.40 (m, 6 H), 1.36 – 1.27 (m, 9 H), 0.96 – 0.92 (m, 6 H), 0.89 (t, J = 7.3 Hz, 9 H). 13C NMR: δ = 155.1, 148.8, 125.6, 74.0, 63.8, 29.0 (J_{Sn} = 20.2 Hz), 27.3 (J_{Sn} = 58.3 Hz), 14.3, 13.6, 9.5 (J_{Sn} = 335.3 Hz). 119Sn NMR: δ = −41.9. (E)-Ethyl 3-(tributylstannyl)allyl carbonate (β-E-1) (selected signals): 1H NMR: δ = 6.31 (dt, J = 19.1 Hz, J = 1.4 Hz, 1H), 6.05 (dt, J = 19.1 Hz, J = 5.3 Hz, 1H), 4.63 (dd, J = 5.3 Hz, J = 1.4 Hz, 2H). HRMS (CI) m/z calcld for C_{14}H_{27}O_{3}Sn (M-Bu)^+: 363.0982, found: 363.0986.

1-(2-(Tributylstannyl)allyl)morpholine (2b): Following the general procedure for allylic aminations 2b was obtained from morpholine (24 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after 2 h at 0° C. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 87 % yield (91 mg, 0.219 mmol) as a colorless oil. 1H NMR: δ = 5.79 (dt, J_{Sn} = 135.6 Hz, J = 2.8, J = 1.4 Hz, 1 H), 5.22 (dt, J_{Sn} = 61.5 Hz, J = 2.8, J = 1.4 Hz, 1 H), 3.67 (t, J = 4.6 Hz, 4 H), 3.05 (dd, J_{Sn} = 46.5 Hz, J = 1.2 Hz, J = 1.2 Hz, 2 H), 2.36 (m, 4 H), 1.47 (m, 6 H), 1.32 (tq, J = 7.4, J = 7.2 Hz, 6 H), 0.81 – 0.98 (m, 15 H). 13C NMR: δ = 154.1, 126.3, 69.4, 67.1, 53.7, 29.2 (J_{Sn} = 19.4 Hz), 27.5 (J_{Sn} = 57.3 Hz), 13.7, 9.6 (J_{Sn} = 328.8 Hz). 119Sn NMR: δ = −48.9. HRMS (Cl) m/z calcld for C_{19}H_{39}NOSn_{120} [M]^+: 417.2054, found: 417.2044.

1-(2-(Tributylstannyl)allyl)pyrrolidine (2c): Following the general procedure for allylic aminations 2c was obtained from pyrrolidine (20 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after 2 h at 0° C. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 86 % yield (86 mg, 0.215 mmol) as a colorless oil. 1H NMR: δ = 5.79 (dt, J_{Sn} = 139.1 Hz, J = 2.7, J = 1.3 Hz, 1 H), 5.14 (dt, J_{Sn} = 63.3 Hz, J = 2.6 Hz, J = 1.3 Hz, 1 H), 3.17 (m, J_{Sn} = 44.9 Hz, 2 H), 2.39 (m, 4 H), 1.71 (m, 4
H), 1.49 (m, 6 H), 1.31 (tq, J = 7.4, J = 7.2 Hz, 6 H), 0.79–0.96 (m, 15 H). \(^{13}\)C NMR: \(\delta = 152.5, 123.8, 66.1, 54.0, 29.2, 27.5, 23.6, 13.7, 9.5\). \(^{119}\)Sn NMR: \(\delta = –49.0\). HRMS (CI) calcd for C\(_{19}\)H\(_{39}\)NSn\(_{120}\) [M]+: 401.2104, found: 401.2152.

\(\text{N},\text{N}-\text{Diethyl-1-} (2-(\text{tributylstannyl})\text{allyl})\text{-amine (2d):}\) Following the general procedure for allylic aminations 2d was obtained from diethylamine (20 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after 2 h at 0°C. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt\(_3\) 99:0:1–97:2:1) the desired product could be isolated in 90% yield (90 mg, 0.224 mmol) as a colorless oil. \(^{1}\)H NMR: \(\delta = 5.79 (m, J_{Sn} = 138.7 \text{ Hz}, 1 \text{ H}), 5.18 (m, J_{Sn} = 63.0 \text{ Hz}, 1 \text{ H}), 3.11 (dd, J_{Sn} = 47.1 \text{ Hz}, J = 1.4 \text{ Hz}, 2 \text{ H}), 2.43 (q, J = 7.1 \text{ Hz}, 4 \text{ H}), 1.49 (m, 6 \text{ H}), 1.31 (tq, J = 7.3, 7.2 Hz, 6 H), 0.96 (t, J = 7.1 Hz, 6 H), 0.80–0.94 (m, 15 H). \(^{13}\)C NMR: \(\delta = 156.2, 124.9 (J_{Sn} = 27 \text{ Hz}), 64.1 (J_{Sn} = 34 \text{ Hz}), 45.9, 29.2 (J_{Sn} = 19 \text{ Hz}), 27.5 (J_{Sn} = 58 \text{ Hz}), 13.7, 11.0, 9.5 (J_{Sn} = 328 \text{ Hz}). \(^{119}\)Sn NMR: \(\delta = –49.4\). HRMS (CI) calcd for C\(_{19}\)H\(_{41}\)NSn\(_{120}\) [M]+: 403.2261, found: 403.2265.

\(\text{N},\text{N}-\text{Diallyl-1-} (2-(\text{tributylstannyl})\text{allyl})\text{-amine (2e):}\) Following the general procedure for allylic aminations 2e was obtained from diallylamine (27 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after 2 h at 0°C. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt\(_3\) 99:0:1–97:2:1) the desired product could be isolated in 84% yield (90 mg, 0.211 mmol) as a colorless oil. \(^{1}\)H NMR: \(\delta = 5.64 – 5.98 (m, 3 \text{ H}), 5.22 (dt, J_{Sn} = 60.5 \text{ Hz}, J = 2.9, J = 1.5 \text{ Hz}, 1 \text{ H}), 5.10–5.15 (m, 4 \text{ H}), 3.13 (dd, J_{Sn} = 46.4 \text{ Hz}, J = 1.3 \text{ Hz} = 1.3 \text{ Hz}, 2 \text{ H}), 2.00 (ddd, J = 6.5, J = 1.6, J = 1.6 \text{ Hz}, 4 \text{ H}), 1.49 (m, 6 \text{ H}), 1.31 (tq, J = 7.3, J = 7.2 Hz, 6 H), 0.81 – 0.98 (m, 15 H). \(^{13}\)C NMR: \(\delta = 155.2, 135.9, 126.0, 117.2, 64.1 (J_{Sn} = 34 \text{ Hz}), 56.3, 29.2 (J_{Sn} = 19 \text{ Hz}), 27.5 (J_{Sn} = 58 \text{ Hz}), 13.7, 9.5 (J_{Sn} = 329 \text{ Hz}). \(^{119}\)Sn NMR: \(\delta = –49.3\). HRMS (CI) calcd for C\(_{21}\)H\(_{41}\)NSn\(_{120}\) [M]+: 427.2261, found: 427.2293.

\(\text{N},\text{N}-\text{Dibenzyl-1-} (2-(\text{tributylstannyl})\text{allyl})\text{-amine (2f):}\) Following the general procedure for allylic aminations 2f was obtained from dibenzylamine (54 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0°C to r.t. over 16 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt\(_3\) 99:0:1–97:2:1) the desired product could be isolated in 53% yield (70 mg, 0.133 mmol) as a colorless oil. \(^{1}\)H NMR: \(\delta = 7.41 – 7.30 (m, 8 \text{ H}), 7.26 (m, 2 \text{ H}), 6.01 (dt, J_{Sn} = 134.2 \text{ Hz}, J = 2.9, 1.4 \text{ Hz}, 1 \text{ H}), 5.34 (m, J_{Sn} = 61.6 \text{ Hz}, 1 \text{ H}), 3.53 (s, 4 \text{ H}), 3.20 (m, J_{Sn} = 43.5 \text{ Hz}, 2 \text{ H}), 1.45 (m, 6 \text{ H}), 1.28 (tq, J = 7.3, 7.1 \text{ Hz}, 6 \text{ H}), 0.97 – 0.81 (m, 15 H). \(^{13}\)C NMR: \(\delta = 153.8, 139.0, 129.1, 128.1, 127.2 (J_{Sn} = 25 \text{ Hz}), 126.8 (J_{Sn} = 27 \text{ Hz}), 64.2 (J_{Sn} = 34 \text{ Hz}), 57.9, 29.1 (J_{Sn} = 19 \text{ Hz}), 27.4 (J_{Sn} = 58 \text{ Hz}), 13.7, 9.5 (J_{Sn} = 335
N,N-Dicyclohexyl-1-(2-(Tributylstannyl)allyl)-amine (2g): Following the general procedure for allylic aminations 2g was obtained from dicyclohexylamine (50 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0 °C to r.t. over 16 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 17 % yield (22 mg, 0.043 mmol) as a colorless oil. 1H NMR: δ = 5.88 (dt, $J_{Sn} = 139.2$ Hz, $J = 3.1$, $J = 1.5$ Hz, 1 H), 5.17 (dt, $J_{Sn} = 63.2$ Hz, $J = 3.1$, $J = 1.5$ Hz, 1 H), 3.33 (dd, $J_{Sn} = 43.8$ Hz, $J = 1.4$ = 1.4 Hz, 2 H), 2.49 (m, 2 H), 1.80 – 1.54 (m, 12 H), 1.46 (m, 6 H), 1.31 (tq, $J = 7.3$, $J = 7.2$ Hz, 6 H), 1.19 (m, 8 H), 0.98 – 0.81 (m, 15 H). 13C NMR: δ = 156.2, 125.2, 56.8, 55.7 ($J_{Sn} = 41$ Hz), 31.6, 29.2 ($J_{Sn} = 19$ Hz), 27.5 ($J_{Sn} = 58$ Hz), 26.5, 26.3, 13.7, 9.5 ($J_{Sn} = 332$ Hz). 119Sn NMR: δ = −46.7. HRMS (CI) calcd for C$_{29}$H$_{45}$NSn$_120$ [M]$^+$: 527.2574, found: 527.2602.

1-(2-(Tributylstannyl)allyl)aniline (2h): Following the general procedure for allylic aminations 2h was obtained from aniline (26 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0 °C to r.t. over 16 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 25 % yield (26 mg, 0.062 mmol) as a colorless oil. 1H NMR: δ = 7.16 (m, 2 H), 6.69 (tt, $J = 7.3$, $J = 1.0$ Hz, 1 H), 6.60 (m, 2H), 5.95 (dt, $J_{Sn} = 131.0$ Hz, $J = 2.2$, $J = 1.7$ Hz, 1 H), 5.29 (dt, $J_{Sn} = 60.9$ Hz, $J = 2.3$, $J = 1.5$ Hz, 1 H), 3.90 (dd, $J_{Sn} = 32.8$ Hz, $J = 1.6$ = 1.6 Hz, 2 H), 3.77 (bs, 1 H), 1.49 (m, 6 H), 1.30 (tq, $J = 7.3$, $J = 7.2$ Hz, 6 H), 1.00 – 0.83 (m, 15 H). 13C NMR: δ = 153.0, 148.3, 129.1, 125.3 ($J_{Sn} = 23$ Hz), 117.3, 113.0, 53.1, 29.2 ($J_{Sn} = 20$ Hz), 27.4 ($J_{Sn} = 58$ Hz), 13.7, 9.5 ($J_{Sn} = 329$ Hz). 119Sn NMR: δ = −44.9. HRMS (CI) calcd for C$_{21}$H$_{37}$NSn$_{120}$ [M]$^+$: 366.1244, found: 366.1252.

1-(2-(Tributylstannyl)allyl)-4-methoxy-aniline (2i): Following the general procedure for allylic aminations 2i was obtained from 4-methoxyaniline (34 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0 °C to r.t. over 16 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 58 % yield (66 mg, 0.146 mmol) as a colorless oil. 1H NMR: δ = 6.77 (m, 2 H), 6.57 (m, 2H), 5.95 (dt, $J_{Sn} = 131.7$ Hz, $J = 2.2$, 1.8 Hz, 1 H), 5.29 (dt, $J_{Sn} = 61.2$ Hz, $J = 2.3$, 1.6 Hz, 1 H), 3.86 (dd, $J_{Sn} = 33.6$ Hz, $J = 1.6$, 1.6 Hz, 2 H), 3.75 (s, 3 H), 3.63 (bs, 1 H), 1.48 (m, 6 H), 1.30 (tq, $J = 7.3$, 7.2 Hz, 6 H), 0.99 – 0.82 (m, 15 H). 13C NMR: δ = 153.6; 152.1, 148.3, 129.1, 125.3 ($J_{Sn} = 23$ Hz), 117.3, 113.0, 53.1, 29.2 ($J_{Sn} = 20$ Hz), 27.4 ($J_{Sn} = 58$ Hz), 13.7, 9.5 ($J_{Sn} = 329$ Hz). 119Sn NMR: δ = −44.9. HRMS (CI) calcd for C$_{21}$H$_{37}$NSn$_{120}$ [M]$^+$: 366.1244, found: 366.1252.
(\(J_{\text{Sn}} = 58 \text{ Hz}\)), 13.7, 9.6 (\(J_{\text{Sn}} = 330 \text{ Hz}\)). \(^{119}\text{Sn}\) NMR: \(\delta = -45.2\). HRMS (Cl) calcd for \(\text{C}_{22}\text{H}_{39}\text{NSn}_{120}\) \([M]^+\): 453.2054, found: 453.2060.

\textbf{N-Benzyl-1-(2-(Tributylstannyl)allyl)-amine (2k):} Following the general procedure for allylic aminations 2k was obtained from benzyamine (29 mg, 0.275 mmol, 1.1 equiv) and 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0\(^\circ\) C to r.t. over 16 h. After evaporation of the solvent \textit{in vacuo} and flash chromatography (hexanes/EtOAc/NEt\(_3\) 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 51 % yield (56 mg, 0.128 mmol) as a colorless oil. In addition 34 % (32 mg, 0.042 mmol) of the diallylated product 2k’ were obtained as a colorless oil. Analysis data 2k: \(^1\)H NMR: \(\delta = 7.29 – 7.34 \text{ (m, 4 H)}, 7.24 \text{ (m, 1 H)}, 5.84 \text{ (dt, } J_{\text{Sn}} = 135.8 \text{ Hz, } J = 2.6, J = 1.6 \text{ Hz, 1 H}), 5.23 \text{ (dt, } J_{\text{Sn}} = 62.6 \text{ Hz, } J = 2.6, J = 1.4 \text{ Hz, 1 H}), 3.76 \text{ (s, 2 H)}, 3.41 \text{ (dd, } J_{\text{Sn}} = 39.7 \text{ Hz, } J = 1.5 = 1.5 \text{ Hz, 2 H)}, 1.49 \text{ (m, 6 H)}, 1.31 \text{ (tq, } J = 7.3, J = 7.1 \text{ Hz, 6 H}), 0.96 – 0.83 \text{ (m, 15 H)}. \(^{13}\text{C NMR: } \delta = 154.8, 140.6, 128.2, 128.1, 126.8, 126.4 \text{ (} J_{\text{Sn}} = 25 \text{ Hz}), 58.7, 53.5, 29.2 \text{ (} J_{\text{Sn}} = 20 \text{ Hz)}, 27.4 \text{ (} J_{\text{Sn}} = 57 \text{ Hz)}, 13.7, 9.5 \text{ (} J_{\text{Sn}} = 329 \text{ Hz)}. \(^{119}\text{Sn NMR: } \delta = -47.2\). HRMS (Cl) calcd for \(\text{C}_{22}\text{H}_{39}\text{NSn}_{120}\) \([M]^+\): 437.2104, found: 437.2117.

\textbf{\textit{N}-Cyclohexyl-1-(2-(Tributylstannyl)allyl)-amine (2l):} Following the general procedure for allylic aminations 2l was obtained from cyclohexylamine (27 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0\(^\circ\) C to r.t. over 16 h. After evaporation of the solvent \textit{in vacuo} and flash chromatography (hexanes/EtOAc/NEt\(_3\) 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 65 % yield (70 mg, 0.163 mmol) as a colorless oil. In addition 19 % (18 mg, 0.024 mmol) of the diallylated product 2l’ were obtained as a colorless oil. Analysis data 2l: \(^1\)H NMR: \(\delta = 5.79 \text{ (dt, } J_{\text{Sn}} = 137.3 \text{ Hz, } J = 3.0, J = 1.5 \text{ Hz, 2 H}), 5.31 \text{ (dt, } J_{\text{Sn}} = 64.6 \text{ Hz, } J = 3.0, J = 1.5 \text{ Hz, 2 H}), 3.54 \text{ (s, 2 H)}, 3.11 \text{ (m, } J_{\text{Sn}} = 31.0 \text{ Hz, 4 H}), 1.44 \text{ (m, 12 H)}, 1.29 \text{ (tq, } J = 7.3, J = 7.1 \text{ Hz, 12 H}), 0.96 – 0.79 \text{ (m, 30 H)}. \(^{13}\text{C NMR: } \delta = 155.5, 123.7 \text{ (} J_{\text{Sn}} = 25 \text{ Hz}), 62.8, 58.2, 29.1 \text{ (} J_{\text{Sn}} = 20 \text{ Hz)}, 27.4 \text{ (} J_{\text{Sn}} = 57 \text{ Hz)}, 13.7, 9.3 \text{ (} J_{\text{Sn}} = 329 \text{ Hz)}. \(^{119}\text{Sn NMR: } \delta = -45.8\). HRMS (Cl) calcd for \(\text{C}_{37}\text{H}_{69}\text{NSn}_{2}\) \([M]^+\): 767.3474, found: 767.3474.
N-(1-Phenylethyl)-1-(2-(Tributylstannyl)allyl)amine (2m): Following the general procedure for allylic aminations 2m was obtained from 1-phenylethyl amine (33 mg, 0.275 mmol, 1.1 equiv) and methyl 2-(tributylstannyl)allyl carbonate 1b (101 mg, 0.25 mmol, 1 equiv) after warming up from 0°C to r.t. over 16 h. After evaporation of the solvent in vacuo and flash chromatography (hexanes/EtOAc/NEt₃ 99 : 0 : 1 – 97 : 2 : 1) the desired product could be isolated in 84% yield (94 mg, 0.209 mmol) as a colorless oil. 

1H NMR: δ = 7.34 – 7.29 (m, 4 H), 7.23 (m, 1 H), 5.77 (dt, $J_{Sn} = 136.5$ Hz, $J = 2.5$, $J = 1.5$ Hz, 1 H), 5.18 (dt, $J_{Sn} = 62.8$ Hz, $J = 2.6$, $J = 1.3$ Hz, 1 H), 3.75 (q, $J = 6.6$ Hz, 1 H), 3.23 (dd, $J_{Sn} = 40.7$ Hz, $J = 1.3$ Hz, 2 H), 1.49 (m, 6 H), 1.35 – 1.27 (m, 9 H), 0.99 – 0.82 (m, 15 H). 

13C NMR: δ = 154.9, 145.9, 128.3, 126.8, 126.6, 124.4 ($J_{Sn} = 25$ Hz), 57.8, 57.2, 29.2 ($J_{Sn} = 20$ Hz), 27.4 ($J_{Sn} = 57$ Hz), 24.2, 13.7, 9.7 ($J_{Sn} = 329$ Hz). 

119Sn NMR: δ = −46.8. HRMS (CI) calcd for C_{23}H_{41}NSn_{120} [M]+: 451.2261, found: 451.2271.

N-(2-Benzylallyl)piperidin (3c): In a Schlenk flask [allylPdCl]₂ (2.0 mg, 5.0 μmol, 2 mol%) and PPh₃ (3.0 mg, 11 μmol, 4 mol%) were dissolved in dry THF (1 mL) under nitrogen and stirred for 15 min at r.t. after which a yellow solution was obtained. In a second Schlenk flask compound 2a (83 mg, 0.20 mmol, 1 equiv) and benzylbromide (86 mg, 0.4 mmol, 2 equiv) were dissolved in dry THF (1 mL). This solution was heated to 60°C, then the catalyst solution was added and the resulting mixture was stirred at 60°C for 3 d. The reaction mixture was allowed to cool to r.t. before KF (58 mg, 1 mmol, 4 equiv) and water (5 mL) were added. The mixture was stirred for 16 h and then diluted with ethylacetate. The organic phase was separated, the aqueous phase was extracted with ethylacetate (3 times) and the combined organic phase were dried over Na₂SO₄ and concentrated in vacuo. The desired product could be isolated after flash chromatography (hexanes/EtOAc 95 : 5 – 80 : 20) in 37% yield (20 mg, 0.093 mmol) as a colorless oil. 

1H NMR: δ = 7.28 (m, 2 H), 7.17–7.23 (m, 3 H), 4.97 (m, 1 H), 4.82 (m, 1 H), 3.39 (s, 2 H), 2.77 (s, 2 H), 2.30 (m, 4 H), 1.58 (tt, $J = 5.5$ Hz = 5.5 Hz, 4 H), 1.43 (m, 2 H). 

13C NMR: δ = 146.8, 140.0, 129.2, 128.1, 125.9, 113.1, 63.9, 54.5, 41.0, 26.1, 24.5. MS (CI) m/z 216 (100, M⁺+1), 137 (2), 124 (9), 98 (91), 84 (4). HRMS (CI) m/z calcd for C_{15}H_{21}N (M)+: 215.1674, found: 215.1676.
(hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 96 % yield (50 mg, 0.240 mmol) as a colorless oil with an (E/Z)-ratio of 9:91. $^1$H NMR: $\delta = 6.45$ (dd, $J = 12.5$ Hz, $J = 1.0$ Hz, 1H), 5.80 (d, $J = 12.5$ Hz, 1H), 5.33 (m, 2H), 4.17 (q, $J = 7.1$ Hz, 2H), 3.10 (s, 2H), 2.32 (m, 4H), 1.52 (m, 4H), 1.40 (m, 2H, 1-H), 1.29 (t, $J = 7.1$ Hz, 3H). $^{13}$C NMR: $\delta =$ 167.4, 145.4, 141.4, 124.7, 119.2, 61.0, 60.3, 54.6, 26.0, 24.4, 14.3. Selected signals of the $E$-isomer: $^1$H NMR: $\delta =$ 7.30 (d, $J = 15.9$ Hz, 1H), 6.21 (d, $J = 15.9$ Hz, 1H), 5.46 (s, 2H). MS (CI) $m/z$ 223 (30, M+), 194 (2), 178 (7), 136 (17), 98 (100). HRMS (CI) $m/z$ calcld for C$_{13}$H$_{21}$NO$_2$ (M)$^+$: 223.1572, found: 223.1526.

1-(2-(4-Nitrophenyl)allyl)piperidine (3e): Following the general procedure for one-pot allylic aminations/Stille couplings 3e was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and 1-bromo-4-nitrobenzene (101 mg, 0.50 mmol, 2 equiv) with Pd(PPh$_3$)$_4$ as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 1 h and then to 90 °C for 1h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 80 % yield (49 mg, 0.199 mmol) as a yellow oil. $^1$H NMR: $\delta =$ 8.16 (m, 2H), 7.70 (m, 2H), 5.59 (d, $J = 1.1$ Hz, 1H), 5.38 (dd, $J = 1.1$ Hz = 1.1 Hz, 1H), 3.30 (d, $J = 1.1$, 2H), 2.37 (m, 4H), 1.52 (m, 4H), 1.41 (m, 2H). $^{13}$C NMR: $\delta =$ 147.1, 147.0, 143.2, 127.2, 123.3, 118.5, 63.7, 54.4, 26.0, 24.4. MS (Cl) $m/z$ 246 (10, M+), 199 (1), 148 (2), 115 (2), 98 (100). HRMS (CI) $m/z$ calcld for C$_{14}$H$_{18}$N$_2$O$_2$ (M)$^+$: 246.1368, found: 246.1362. Elemental analysis calcld (%) for C$_{14}$H$_{18}$N$_2$O$_2$: C 68.27, H 7.37, N 11.37 and found: C 67.83, H 7.27, N 11.37.

4-(3-(Piperidin-1-yl)prop-1-en-2-yl)benzaldehyde (3f): Following the general procedure for one-pot allylic aminations/Stille couplings 3f was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and 4-bromobenzaldehyde (56 mg, 0.30 mmol, 1.2 equiv) with [allylPdCl]$_2$ (0.9 mg, 2.5 $\mu$mol, 1 mol%) and PPh$_3$ (5.2 mg, 20 $\mu$mol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 95 % yield (54 mg, 0.238 mmol) as a colorless oil. $^1$H NMR: $\delta =$ 10.00 (s, 1H), 7.84 – 7.81 (m, 2H), 7.71 – 7.68 (m, 2H), 5.58 (d, $J = 1.3$ Hz, 1H), 5.37 (d, $J = 1.2$ Hz, 1H), 3.32 (s, 2H), 2.40 (bs, 4H), 1.56 – 1.51 (m, 4H), 1.44 – 1.39 (m, 2H). $^{13}$C NMR: $\delta =$ 193.2, 143.1, 135.4, 127.7, 125.2, 117.7, 63.5, 54.4, 25.9, 24.4. MS (Cl) $m/z$ 229 (10, M+), 201 (1), 115 (3), 98 (100). HRMS (Cl) $m/z$ calcld for C$_{15}$H$_{19}$NO (M)$^+$: 229.1467, found: 229.1466.

1-(2-(Naphthalen-2-yl)allyl)piperidine (3g): Following the general procedure for one-pot allylic aminations/Stille couplings 3g was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and 4-bromobenzaldehyde (104 mg, 0.50 mmol, 2 equiv) with [allylPdCl]$_2$ (0.9 mg, 2.5 $\mu$mol, 1
mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 62 % yield (39 mg, 0.155 mmol) as a colorless oil. ¹H NMR: δ = 8.00 (m, 1H), 7.85 – 7.77 (m, 3H), 7.67 (dd, J = 8.6 Hz, J = 1.8 Hz, 1H), 7.48 – 7.42 (m, 2H), 5.60 (m, 1H), 5.35 (m, 1H), 3.41 (s, 2H), 2.46 (m, 4H), 1.56 (m, 4H), 1.43 (m, 2H). ¹³C NMR: δ = 144.4.; 138.0, 133.3, 132.8, 128.2, 127.4, 125.9, 125.6, 125.0, 124.8, 115.4, 63.7, 54.6, 26.0, 24.4. MS (CI) m/z 251 (25, M⁺), 168 (14), 152 (6), 98 (100). HRMS (CI) m/z calcd for C₁₈H₂₁N (M)⁺: 251.1674, found: 251.1662.

5-(3-(Piperidin-1-yl)prop-1-en-2-yl)pyrimidine (3h): Following the general procedure for one-pot allylic aminations/Stille couplings 3h was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and 5-bromopyrimidine (79 mg, 0.50 mmol, 2 equiv) with [allylPdCl]₂ (0.9 mg, 2.5 μmol, 1 mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 90 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 97 % yield (49 mg, 0.243 mmol) as a colorless oil. ¹H NMR: δ = 9.09 (s, 1H), 8.91 (s, 2H), 5.55 (m, 1H), 5.34 (m, 1H), 3.27 (m, 2H), 2.37 (m, 4H), 1.50 (m, 4H), 1.41 (m, 2H). ¹³C NMR: δ = 157.4, 154.6, 139.4, 133.3, 117.8, 63.4, 54.1, 25.9, 24.3. MS (CI) m/z 204 (43, M⁺+1), 98 (100). HRMS (CI) m/z calcd for C₁₂H₁₇N₃ (M)⁺: 203.1422, found: 203.1400. Elemental analysis calcd (%) for C₁₂H₁₇N₃: C 70.90, H 8.43, N 20.67 and found: C 70.54, H 8.31, N 20.25.

1-(2-(4-Methoxyphenyl)allyl)piperidine (3i): Following the general procedure for one-pot allylic aminations/Stille couplings 3i was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and 1-bromo-4-methoxybenzene (94 mg, 0.50 mmol, 2 equiv) with [allylPdCl]₂ (0.9 mg, 2.5 μmol, 1 mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 100 °C for 6 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 69 % yield (40 mg, 0.173 mmol) as a slightly yellow oil. ¹H NMR: δ = 7.49 (d, J = 8.9 Hz, 2H), 6.85 (d, J = 8.9 Hz, 2H), 5.38 (m, 1H), 5.14 (m, 1H), 3.81 (s, 3H), 3.26 (s, 2H), 2.40 (m, 4H), 1.55 (m, 4H), 1.41 (m, 2H). ¹³C NMR: δ = 158.9, 133.2, 128.0, 127.4, 126.3, 113.3, 63.9, 55.2, 54.5, 26.0, 24.4. MS (CI) m/z 232 (100, M⁺+1), 201 (19), 148 (14), 98 (100). HRMS (CI) m/z calcd for C₁₅H₂₁NO (M)⁺: 231.1623, found: 231.1636. Elemental analysis calcd (%) for C₁₅H₂₁NO: C 77.88, H 9.15, N 6.05 and found: C 77.70, H 9.04, N 5.72.

1-(2-Methylene-4-phenylbut-3-enyl)piperidine (3k): Following the general procedure for one-pot allylic aminations/Stille couplings 3k was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv)
and β-bromostyrene (55 mg, 0.30 mmol, 1.2 equiv) with [allylPdCl]₂ (0.9 mg, 2.5 μmol, 1 mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product was isolated in 95 % yield (54 mg, 0.238 mmol) as a yellow oil. ¹H NMR: δ = 7.44 (m, 2H), 7.33 (m, 2H), 7.23 (m, 1H), 6.90 (d, J = 16.3 Hz, 1H), 6.82 (d, J = 16.3 Hz, 1H), 5.26 (m, 1H), 5.24 (m, 1H), 3.18 (s, 2H), 2.41 (m, 4H), 1.59 (m, 4H), 1.45 (m, 2H). ¹³C NMR: δ = 142.3, 137.6, 130.0, 128.9, 128.5, 127.4, 126.5 118.1, 61.2, 54.6, 25.9, 24.4. MS (CI) m/z 228 (50, M⁺+1), 136 (14), 98 (100). HRMS (CI) m/z calcld for C₁₆H₂₁N (M⁺): 227.1674, found: 227.1662.

Ethyl 2-(3-(piperidin-1-yl)prop-1-en-2-yl)benzoate (3p): Following the general procedure for one-pot allylic aminations/Stille couplings 3p was obtained from piperidine (21.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and ethyl 2-iodobenzoate (138 mg, 0.50 mmol, 2 equiv) [allylPdCl]₂ (0.9 mg, 2.5 μmol, 1 mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 100 °C for 5 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 60 % yield (41 mg, 0.150 mmol) as a colorless oil. ¹H NMR: δ = 7.76 (dd, J = 7.7 Hz, J = 1.2 Hz, 1H), 7.42 (dt, J = 7.5 Hz = 7.5 Hz, J = 1.4 Hz, 1H), 7.31 (dt, J = 7.6 Hz = 7.6 Hz, J = 1.3 Hz, 1H), 7.26 (dd, J = 7.7 Hz, J = 1.1 Hz, 1H), 5.30 (s, 1H), 5.06 (s, 1H), 4.30 (q, J = 7.1, 2H), 3.20 (s, 2H), 2.40 (m, 4H), 1.52 (m, 4H), 1.42 (m, 2H), 1.35 (t, J = 7.1, 3H). ¹³C NMR: δ = 168.1, 143.2, 131.0, 130.5, 130.2, 129.4, 126.8, 115.0, 64.5, 60.9, 54.6, 26.0, 24.4, 14.1. MS (Cl) m/z 273 (60, M⁺), 200 (10), 110 (19), 98 (100). HRMS (Cl) m/z calcld for C₁₇H₂₃NO₂ (M⁺): 273.1729, found: 273.1696. Elemental analysis calcld (%) for C₁₇H₂₃NO₂: C 74.69, H 8.48, N 5.12 and found: C 74.68, H 8.21, N 5.50.

1-(2-Phenylallyl)morpholine (4a): Following the general procedure for one-pot allylic aminations/Stille couplings 4a was obtained from morpholine (21.8 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]₂ (0.9 mg, 2.5 μmol, 1 mol%) and PPh₃ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 96 % yield (48 mg, 0.235 mmol) as a colorless oil. ¹H NMR: δ = 7.54 (m, 2H), 7.35 – 7.27 (m, 3H), 5.50 (m, 1H), 5.25 (m, 1H), 3.68 (t, J = 4.6 Hz, 4H), 3.34 (s, 2H), 2.48 (m, 4H). ¹³C NMR: δ = 143.6, 140.2, 128.1, 127.5, 126.2, 115.5, 67.0, 63.5, 53.5. MS (Cl) m/z 203 (34, M⁺), 118 (13), 100 (100). HRMS (Cl) m/z calcld for C₁₃H₁₇NO (M⁺): 203.1310, found: 203.1300.
1-(2-Phenylallyl)pyrrolidine (5a): Following the general procedure for one-pot allylic aminations/Stille couplings 5a was obtained from pyrrolidine (17.8 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]_2 (0.9 mg, 2.5 μmol, 1 mol%) and PPh_3 (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 91 % yield (43 mg, 0.228 mmol) as a colorless oil. ¹H NMR: δ = 7.51 (m, 2H), 7.34 – 7.24 (m, 3H), 5.42 (m, 1H), 5.28 (m, 1H), 3.48 (s, 2H), 2.54 (m, 4H), 1.76 (m, 4H). ¹³C NMR: δ = 143.7, 140.6, 128.2, 127.4, 126.2, 114.6, 60.6, 54.2, 23.6. MS (Cl) m/z 187 (23, M+1), 118 (9), 84 (100), 70 (4). HRMS (Cl) m/z calcd for C₁₃H₁₇N (M)+: 187.1361, found: 187.1385.

N,N-Diethyl-2-phenylprop-2-en-1-amine (6a): Following the general procedure for one-pot allylic aminations/Stille couplings 6a was obtained from diethylamine (18.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]_2 (0.9 mg, 2.5 μmol, 1 mol%) and PPh_3 (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 74 % yield (35 mg, 0.185 mmol) as a colorless oil. ¹H NMR: δ = 7.50 (m, 2H), 7.33 – 7.24 (m, 3H), 5.42 (m, 1H), 5.28 (m, 1H), 3.41 (s, 2H), 2.54 (q, J = 7.1 Hz, 4H), 1.01 (t, J = 7.1 Hz, 6H). ¹³C NMR: δ = 146.0, 140.7, 128.0, 127.3, 126.3, 114.6, 57.6, 46.7, 11.5. MS (Cl) m/z 189 (14, M+), 172 (30), 86 (100). HRMS (Cl) m/z calcd for C₁₃H₁₉N (M)+: 189.1517, found: 189.1497.

N,N-Diallyl-2-phenylprop-2-en-1-amine (7a): Following the general procedure for one-pot allylic aminations/Stille couplings 7a was obtained from diallylamine (24.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]_2 (0.9 mg, 2.5 μmol, 1 mol%) and PPh_3 (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16 h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product could be isolated in 66 % yield (35 mg, 0.185 mmol) as a colorless oil. ¹H NMR: δ = 7.47 (m, 2H), 7.33 – 7.24 (m, 3H), 5.84 (ddt, J = 17.1 Hz, J = 10.3 Hz, J = 6.4 Hz, 2H), 5.43 (m, 1H), 5.29 (m, 1H), 5.18 (m, 1H), 5.14 (m, 1H), 3.42 (s, 2H), 3.10 (m, 4H). ¹³C NMR: δ = 145.6, 140.5, 135.8, 128.0, 127.3, 126.4, 117.2, 114.9, 57.6, 56.4. MS (Cl) m/z 213 (24, M+), 110 (100). HRMS (Cl) m/z calcd for C₁₅H₁₉N (M)+: 213.1517, found: 213.1542.

N-tert-Butyl-2-phenylprop-2-en-1-amine (8a): Following the general procedure for one-pot allylic aminations/Stille couplings 8a was obtained from tert-butylamine (18.3 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv)
and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]$_2$ (0.9 mg, 2.5 μmol, 1 mol%) and PPh$_3$ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product was isolated in 89 % yield (42 mg, 0.223 mmol) as a colorless oil. $^1$H NMR: δ = 7.47 (m, 2H), 7.36 (m, 2H), 7.30 (m, 1H), 5.39 (m, 1H), 5.25 (m, 1H), 3.64 (m, 2H), 1.15 (s, 9H), 1.12 (bs, 1H). $^{13}$C NMR: δ = 147.2, 140.2, 128.3, 127.5, 126.1, 113.0, 50.5, 46.6, 29.0. MS (CI) m/z 190 (42, M$^{++}$2), 174 (100), 117 (11), 86 (6). HRMS (CI) m/z calc'd for C$_{13}$H$_{19}$N (M)$^+$: 189.1517, found: 189.1500.

2-Phenyl-N-(1-phenylethyl)prop-2-en-1-amine (9a): Following the general procedure for one-pot allylic aminations/Stille couplings 9a was obtained from 1-phenylethanamine (43 mg, 0.25 mmol, 1.0 equiv), ethyl 2-(tributylstannyl)allyl carbonate 1a (109 mg, 0.26 mmol, 1.05 equiv) and phenyliodide (102 mg, 0.5 mmol, 2 equiv) with [allylPdCl]$_2$ (0.9 mg, 2.5 μmol, 1 mol%) and PPh$_3$ (5.2 mg, 20 μmol, 8 mol%) as catalyst. For the Stille coupling the reaction mixture was heated up to 65 °C for 16h. After work-up and flash chromatography (hexanes/EtOAc 9 : 1 – 1 : 1) the product was isolated in 73 % yield (43 mg, 0.183 mmol) as a colorless oil. $^1$H NMR: δ = 7.40 – 7.22 (m, 10H), 5.39 (m, 1H), 5.21 (m, 1H), 3.82 (q, J = 6.6 Hz, 1H), 3.56 (d, J = 14.3 Hz, 1H), 3.47 (d, J = 14.1 Hz, 1H), 1.75 (bs, 1H), 1.33 (d, J = 6.6 Hz, 3H). $^{13}$C NMR: δ = 146.5, 145.4, 139.9, 128.4, 128.4, 127.6, 126.9, 126.8, 126.2, 113.3, 57.4, 51.3, 24.2. MS (CI) m/z 238 (88, M$^+$+1), 222 (100), 134 (17), 105 (70), 98 (82). HRMS (CI) m/z calc'd for C$_{17}$H$_{19}$N (M)$^+$: 237.1517, found: 237.1538.
NMR Spectra of product 1a.
NMR Spectra of product 2a.
NMR Spectra of product 2b.
NMR Spectra of product 2c.
NMR Spectra of product 2d.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 2e.
NMR Spectra of product 2f.
NMR Spectra of product \(2g\).
NMR Spectra of product 2h.
NMR Spectra of product 2i.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 2k.

![NMR Spectra of product 2k.](image-url)
NMR Spectra of product 2k'.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry

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NMR Spectra of product 2l.
NMR Spectra of product 2l'.

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NMR Spectra of product 2m.

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NMR Spectra of product 3a.
NMR Spectra of product 3b.
NMR Spectra of product 3c.
NMR Spectra of product 3d.

[Diagram of NMR spectra with peaks labeled]

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NMR Spectra of product 3e.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 3f.

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NMR Spectra of product 3g.
NMR Spectra of product 3h.
NMR Spectra of product 3i.
NMR Spectra of product 3k.
NMR Spectra of product 3l.
NMR Spectra of product 3m.
NMR Spectra of product 3n.

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NMR Spectra of product 3o.

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NMR Spectra of product 3p.
NMR Spectra of product 4a.
NMR Spectra of product 5a.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 6a.

ppm (t1)
7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0
7.51 7.49 7.47 7.32 7.30 7.24
7.33 7.30 7.28 5.42 5.28
3.41 2.57 2.55 2.53 2.52 1.03
1.01 0.99

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 7a.
NMR Spectra of product 8a.
NMR Spectra of product 9a.
NMR Spectra of product 9b.
NMR Spectra of product 9c.
NMR Spectra of product 10a.

Supplementary Material (ESI) for Organic & Biomolecular Chemistry
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NMR Spectra of product 10b.
NMR Spectra of product 11a.