

**α -Diazo- β -Ketonitriles: Uniquely Reactive Substrates for Arene and Alkene
Cyclopropanation**

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Supporting Information 1 (Experimental Procedures):

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General Procedures. Unless otherwise stated, reactions were performed under a nitrogen atmosphere using freshly dried solvents. Tetrahydrofuran (THF), methylene chloride (CH_2Cl_2), acetonitrile (MeCN), dimethylformamide (DMF), and toluene (PhMe) were dried by passing through activated alumina columns. Triethylamine (Et_3N) was distilled over calcium hydride prior to use. Unless otherwise stated, chemicals and reagents were used as received. *N*-Methyl-2-phenylacetamide was purchased from Acros Organics. Scandium triflate ($\text{Sc}(\text{OTf})_3$), iron acetylacetonate ($\text{Fe}(\text{acac})_3$), palladium acetate ($\text{Pd}(\text{OAc})_2$) and all rhodium and copper catalysts were purchased from either Strem or Sigma-Aldrich. Cobalt and iridium catalysts were purchased from Strem. All reactions were monitored by thin-layer chromatography using EMD/Merck silica gel 60 F254 pre-coated plates (0.25 mm) and were visualized by UV, *p*-anisaldehyde, or KMnO_4 staining. Flash column chromatography was performed either as described by Still et al. (Still, W. C.; Kahn, M.; Mitra, A. J. *Org. Chem.* **1978**, *43*, 2923) using silica gel (partical size 0.032-0.063) purchased from Silicycle or Florisil (100 – 200 mesh) purchased from Sigma-Aldrich. ^1H and ^{13}C NMR spectra were recorded on a Varian 300 MR (at 300 MHz and 75 MHz, respectively) or a Varian Inova 500 (at 500 MHz and 126 MHz, respectively), and are reported relative to internal CHCl_3 (^1H , $\delta = 7.26$) and CDCl_3 (^{13}C , $\delta = 77.0$). Data for ^1H NMR spectra are reported as follows: chemical shift (δ ppm) (multiplicity, coupling constant (Hz), integration). Multiplicity and qualifier abbreviations are as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad, app = apparent. IR spectra were recorded on a Perkin Elmer Paragon 1000 spectrometer and are reported in frequency of absorption (cm^{-1}). HRMS were acquired using an Agilent 6200 Series TOF with an Agilent G1978A Multimode source in electrospray ionization (ESI), atmospheric pressure chemical ionization (APCI), or mixed (MM) ionization mode. Preparative HPLC was performed with an Agilent 1100 Series HPLC utilizing an Agilent Eclipse XDB-C18 5 μm column (9.4 x 250 mm) or an Agilent Zorbax RX-SIL 5 μm column (9.4 x 250 mm). Melting points were determined using a Büchi B-545 capillary melting point apparatus and the values reported are uncorrected. Abbreviations used: Et_2O – diethyl ether; EtOAc – ethyl acetate; DCE – 1,2-dichloroethane.

Catalyst abbreviations:

$\text{Rh}_2(\text{OAc})_4$	Rhodium(II) acetate (Strem Chemicals)
$\text{Rh}_2(\text{cap})_4$	Rhodium(II) caprolactamate ¹
$\text{Rh}_2(\text{tfa})_4$	Rhodium(II) trifluoroacetate (Strem Chemicals)
$\text{Rh}_2(\text{pfb})_4$	Rhodium(II) perfluorobutyrate (Aldrich)
$\text{Cu}(\text{acac})_2$	Copper(II) acetylacetonate (Aldrich)
$\text{Cu}(\text{hfacac})_2$	Copper(II) hexafluoroacetylacetonate (Aldrich)
$\text{Co}(\text{salen})$	1,2-Cyclohexanediamino- <i>N,N'</i> -bis(3,5-di- <i>t</i> -butylsalicylidene)cobalt(II)
$[\text{Ir}[\text{cod}]\text{Cl}]_2$	Chloro-1,5-cyclooctadiene iridium(I) dimer

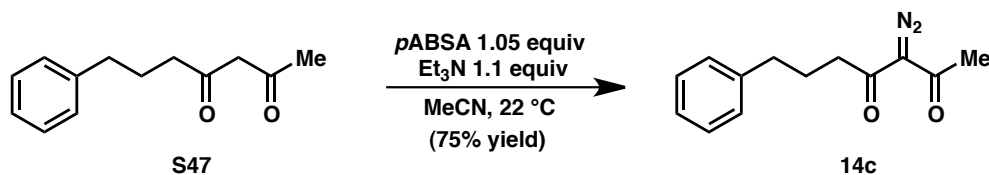
¹ Doyle, M. P.; Westrum, L. J.; Wolthuis, W. N. E.; See, M. M.; Boone, W. P.; Bagheri, V.; Pearson, M. M. *J. Am. Chem. Soc.* **1993**, *115*, 958.

Catalyst Screen: General Procedure for Diazoketone **12a** (Table 1)

Method A (Entries 1-6): A sealed 1 mL microwave vial equipped with a stir bar was flushed with N₂ and charged with a stock solution of α -diazo- β -ketonitrile **12a** (0.005 mmol) and 1,2,4,5-tetrachlorobenzene (0.005 mmol) in CDCl₃ (400 μ L), followed by the catalyst (0.0001 mmol) in CDCl₃ (100 μ L). The solution was heated in a Biotage Initiator microwave reactor to the indicated temperature for 1 min (ramp time required 2 min). TLC analysis confirmed consumption of the starting material. The solution was transferred to a NMR tube and the yield of cyclopropane **13a** was determined relative to the ratio of **12a**:1,2,4,5-tetrachlorobenzene in the stock solution.

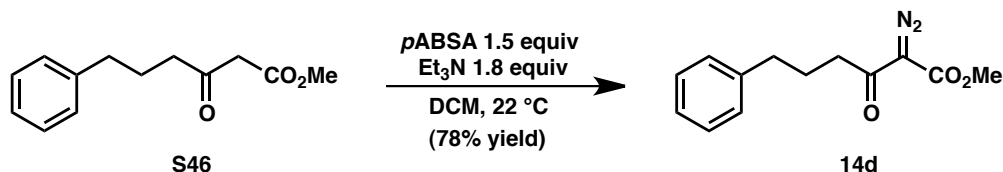
Method B (Entries 7–11): A sealed 1 mL vial equipped with a stir bar was flushed with N₂ and charged with a stock solution of α -diazo- β -ketonitrile **12a** (0.005 mmol) and 1,2,4,5-tetrachlorobenzene (0.005 mmol) in CDCl₃ (400 μ L), followed by the rhodium catalyst (0.0001 mmol) in CDCl₃ (100 μ L). The solution was stirred for 2 hours under nitrogen. TLC analysis confirmed consumption of the starting material. The solution was transferred to an NMR tube and the yield of cyclopropane **13a** was determined relative to the ratio of **12a**:1,2,4,5-tetrachlorobenzene in the stock solution.

Preparation of 3-diazo-7-phenylheptane-2,4-dione (14c)



A 50 mL round bottom flask was charged with diketone **S47**² (0.71 g, 3.48 mmol) and para-acetamidobenzenesulfonyl azide (0.87 g, 1.66 mmol). The headspace was swept with nitrogen and MeCN (12 mL) was charged, followed by cooling to 0 °C in an ice bath. Triethylamine (0.53 mL, 3.82 mmol) was added in one portion and a slurry quickly resulted. The reaction was allowed to warm to room temperature over 1 hour, at which point TLC analysis indicated complete consumption of the starting material. The reaction was quenched with 2M NaOH and extracted with DCM. The organic layer was cut, acidified to pH = 5 with 5% aqueous acetic acid, washed with brine and dried over sodium sulfate. The solvent was concentrated under reduced pressure, and the crude residue was purified by flash chromatography (0→20% EtOAc/hexanes), yielding diazo diketone **14c** (0.60 g, 75% yield) as a bright yellow oil. ¹H NMR (CDCl₃, 500 MHz) δ 7.29 (m, 2H), 7.19 (m, 3H), 2.73 (t, *J* = 7.3 Hz, 2H), 2.68 (t, *J* = 7.6 Hz, 3H), 2.43 (s, 3H), 2.00 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 190.54 (broad), 188.31 (broad), 141.18, 128.35, 128.33, 125.97, 83.95, 39.64, 34.90, 28.50, 25.42; FTIR (NaCl, thin film) 3061, 3026, 2936, 2860, 2117, 1682, 1651, 1496, 1454, 1372, 1286, 1228 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₃O₃ [M-H]⁻-N₂ 201.0921, found 201.0918.

Preparation of methyl 2-diazo-3-oxo-6-phenylhexanoate (14d)

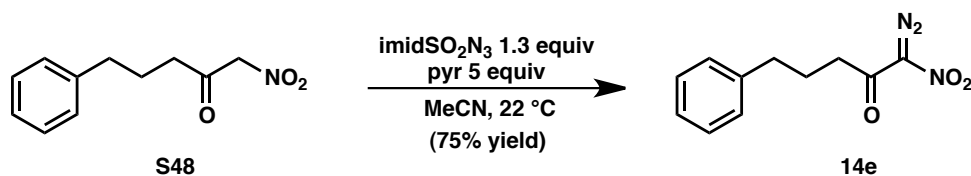


A 25 mL round bottom flask was charged with β-ketoester **S46** (0.25 g, 1.13 mmol) and para-acetamidobenzenesulfonyl azide (0.40 g, 1.66 mmol). The headspace was swept with nitrogen and DCM (20 mL) was charged, followed by cooling to 0 °C in an ice bath. Triethylamine (0.29 mL, 2.06 mmol) was added in one portion and a clear yellow solution resulted. The reaction was allowed to warm to room temperature slowly overnight, during which time a flocculent white precipitate occurred. After TLC analysis indicated complete

² Zhang, Y.; Jiao, J.; Flowers, R. A., II; *J. Org. Chem.* **2006**, *71*, 4516.

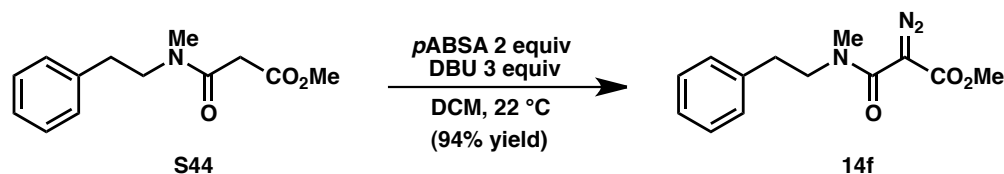
consumption of the starting material, the reaction was quenched with 2M NaOH. The organic layer was cut, acidified to pH = 5 with 5% aqueous acetic acid, washed with brine and dried over sodium sulfate. The solvent was concentrated under reduced pressure, and the crude residue was purified by flash chromatography (0→20% EtOAc/hexanes), yielding α -diazo- β -ketoester **14d** (0.22 g, 94% yield) as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.28 (m, 2H), 7.19 (m, 3H), 3.82 (s, 3H), 2.88 (t, J = 7.3 Hz, 2H), 2.67 (t, J = 7.7 Hz, 2H), 1.98 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 192.27, 161.56, 141.49, 128.32, 128.17, 125.74, 75.60, 51.98, 39.46, 35.06, 25.75; FTIR (NaCl, thin film) 3026, 2952, 2858, 2135, 1731, 1603, 1496, 1435, 1375, 1311, 1223 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{13}\text{N}_2\text{O}_3$ $[\text{M}-\text{H}]^-$ 245.0932, found 245.0929.

Preparation of 1-diazo-1-nitro-5-phenylpentan-2-one (**14e**)



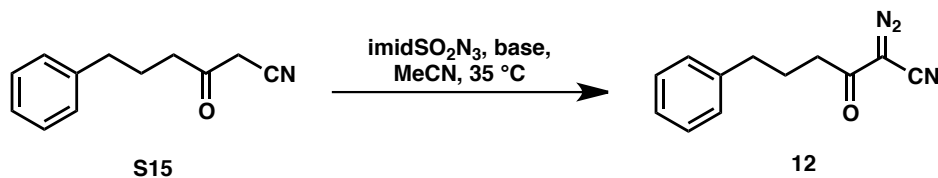
To a 20 mL vial was added the nitro ketone **S48** (115 mg, 0.56 mmol) followed by acetonitrile (2 mL) and imidazole sulfonyl azide (127 mg, 0.80 mmol). Pyridine (210 mg, 2.78 mmol) was charged and dark red mixture was stirred at 22 °C under an air atmosphere. After 30 seconds a white precipitate occurred. After TLC analysis indicated consumption of the starting material (2 hours) the solvent of the dark red mixture was removed by rotary evaporation under reduced pressure. The crude residue was purified by flash chromatography (0→15% EtOAc/hexanes), yielding the α -diazo- β -ketonitro compound **14e** (97 mg, 75% yield) as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.29 (m, 2H), 7.20 (m, 3H), 3.04 (t, J = 7.3 Hz, 2H), 2.71 (t, J = 7.6 Hz, 2H), 2.04 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 186.57, 140.96, 128.39, 126.08, 112.15 (broad), 40.11, 34.84, 25.07; FTIR (NaCl, thin film) 3026, 2938, 2860, 2139, 1664, 1509, 1453, 1317, 1235, 1167 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{11}\text{H}_{12}\text{N}_3\text{O}_3$ $[\text{M}+\text{H}]^+$ 234.0879, found 234.0868.

Preparation of methyl 2-diazo-3-(methyl(phenethyl)amino)-3-oxopropanoate (**14f**)



A 25 mL round bottom flask was charged with β -ketoamide **S44** (0.27 g, 1.18 mmol) and para-acetamidobenzenesulfonyl azide (0.56 g, 2.36 mmol). The headspace was swept with nitrogen and DCM (5 mL) was charged, followed by cooling to 0 °C in an ice bath. 1,8-Diazabicyclo[5.4.0]undec-7-ene (0.52 mL, 3.53 mmol) was added in one portion and a clear yellow solution resulted. The reaction was allowed to warm to room temperature slowly overnight. After TLC analysis indicated complete consumption of the starting material, the reaction was quenched with 2M NaOH. The organic layer was cut, acidified to pH = 5 with 5% aqueous acetic acid, washed with brine and dried over sodium sulfate. The solvent was concentrated under reduced pressure, and the crude residue was purified by flash chromatography (0→40% EtOAc/hexanes), yielding α -diazo- β -amido ester **14f** (0.29 g, 94% yield) as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.30 (m, 2H), 7.22 (m, 3H), 3.79 (s, 3H), 3.60 (m, 2H), 2.98 (s, 3H), 2.91 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 162.63, 161.18, 138.46, 128.73, 128.49, 126.48, 66.11, 59.69, 52.14, 51.50 (broad), 36.43 (broad), 33.74; FTIR (NaCl, thin film) 3026, 2952, 2861, 2223, 1715, 1629, 1483, 1435, 1400, 1301, 1082 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{N}_3\text{O}_3$ $[\text{M}+\text{H}]^+$ 262.1186, found 262.1184.

General procedure 1 for the synthesis of α -diazo- β -keto nitriles.³

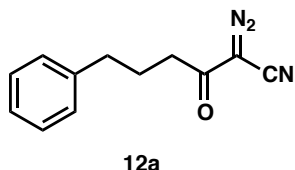


To a 20 mL vial was added the keto nitrile substrate **S15** (0.26 mmol, 1.00 equiv) followed by acetonitrile (2 mL) and either imidazole sulfonyl azide or the corresponding HCl salt (0.29 mmol, 1.10 equiv). Pyridine (1.135 mmol, 5 equiv) was charged and the light yellow mixture was heated to 35 °C sealed under an air atmosphere. After 10 minutes a white precipitate occurred. After TLC analysis indicated consumption of the

³ Goddard-Borger, E. D.; Stick, R. V. *Org. Lett.* **2007**, *9*, 3797.

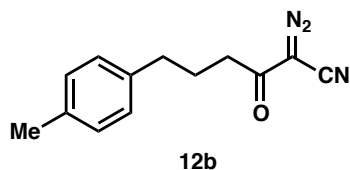
starting material (typically 3 to 6 hours) the solvent of the dark red mixture was removed by rotary evaporation under reduced pressure. The crude residue was purified by silica gel chromatography to afford the α -diazo- β -keto nitriles products, eluting as a distinct yellow band on the column.

2-Diazo-3-oxo-6-phenylhexanenitrile (**12a**)



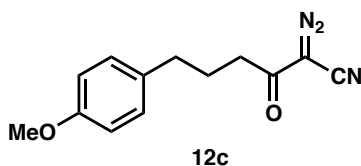
The reaction was run on 3.70 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 500 mg (64% yield) of **12a** as a bright yellow oil, which solidified on standing to a bright yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.30 (m, 2H), 7.20 (m, 3H), 2.68 (t, J = 7.6 Hz, 2H), 2.63 (t, J = 7.3 Hz, 2H), 2.03 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.85, 140.65, 128.43, 128.39, 128.39, 128.37, 126.16, 108.32, 57.20, 38.59, 34.75, 25.59; FTIR (NaCl, thin film) 3062, 3027, 2936, 2863, 2222, 2127, 1682, 1497, 1454, 1372, 1212 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 186.0913, found 186.0924.

2-Diazo-3-oxo-6-(*p*-tolyl)hexanenitrile (**12b**)



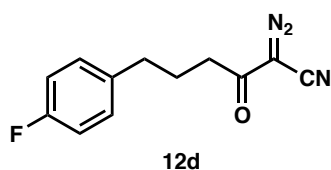
The reaction was run on 0.44 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 82 mg (83% yield) of **12b** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.12 (d, J = 8.1 Hz, 2H), 7.08 (d, J = 8.1 Hz, 2H), 2.63 (m, 4H), 2.33 (s, 3H), 2.01 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.91, 137.54, 135.62, 129.10, 128.26, 108.34, 57.17, 38.62, 34.30, 25.70, 20.93; FTIR (NaCl, thin film) 3192, 2923, 2861, 2221, 2126, 1677, 1515, 1454, 1372, 1212, 1180 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{12}\text{NO}_2$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 200.1070, found 200.1071.

2-Diazo-6-(4-methoxyphenyl)-3-oxohexanenitrile (**12c**)



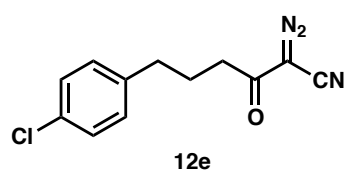
The reaction was run on 0.92 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 164 mg (74% yield) of **12c** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.09 (m, 2H), 6.84 (m, 2H), 3.79 (s, 3H), 2.62 (t, J = 7.4 Hz, 4H), 1.99 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.90, 157.91, 132.66, 129.26, 113.78, 108.33, 57.15, 55.14, 38.54, 33.81, 25.80; FTIR (NaCl, thin film) 3002, 2935, 2833, 2221, 2126, 1675, 1610, 1512, 1454, 1245, 1177 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{13}\text{N}_3\text{O}_2$ $[\text{M}\cdot]^+$ 243.1008, found 243.1015.

2-Diazo-6-(4-fluorophenyl)-3-oxohexanenitrile (**12d**)



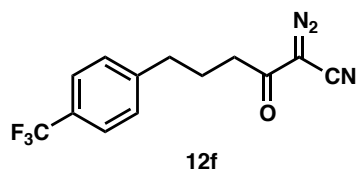
The reaction was run on 1.08 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 200 mg (77% yield) of **12d** as a bright yellow oil. ^1H NMR (CDCl_3 , 300 MHz) δ 7.13 (m, 2H), 6.98 (m, 2H), 2.64 (m, 4H), 2.00 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.73, 161.34 (d, $J_{\text{C-F}} = 243.8$ Hz), 136.30 (d, $J_{\text{C-F}} = 3.2$ Hz), 129.71 (d, $J_{\text{C-F}} = 7.8$ Hz), 115.17 (d, $J_{\text{C-F}} = 21.0$ Hz), 108.30, 57.24, 38.45, 33.91, 25.69; FTIR (NaCl, thin film) 2930, 2862, 2222, 2126, 1676, 1600, 1508, 1218 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{12}\text{H}_{10}\text{FN}_3\text{O}$ [M^\bullet] $^+$ 231.0808, found 231.0817.

6-(4-Chlorophenyl)-2-diazo-3-oxohexanenitrile (**12e**)



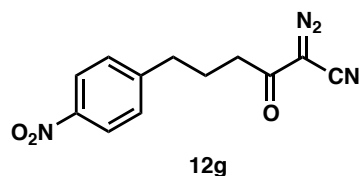
The reaction was run on 0.91 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 110 mg (50% yield) of **12e** as a bright yellow oil. ^1H NMR (CDCl_3 , 300 MHz) δ 7.26 (m, 2H), 7.10 (m, 2H), 2.63 (m, 4H), 2.00 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.71, 139.12, 131.95, 129.74, 128.58, 108.30, 57.30, 38.49, 34.13, 25.50; FTIR (NaCl, thin film) 2935, 2863, 2222, 2128, 1676, 1492, 1407, 1373, 1180 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_9\text{ClN}_3\text{O}$ [M-H] $^-$ 246.0440, found 246.0437.

2-Diazo-3-oxo-6-(4-(trifluoromethyl)phenyl)hexanenitrile (**12f**)



The reaction was run on 0.60 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 111 mg (67% yield) of **12f** as a bright yellow oil. ^1H NMR (CDCl_3 , 300 MHz) δ 7.56 (m, 2H), 7.30 (m, 1H), 2.74 (t, $J = 7.6$ Hz, 2H), 2.65 (t, $J = 7.3$ Hz, 2H), 2.04 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.58, 144.84 (q, $J_{\text{C-F}} = 1.3$ Hz), 128.71, 128.59 (q, $J_{\text{C-F}} = 32.2$ Hz), 125.42 (q, $J_{\text{C-F}} = 3.8$ Hz), 124.20 (q, $J_{\text{C-F}} = 271.7$ Hz), 108.27, 57.36, 38.47, 34.60, 25.29; FTIR (NaCl, thin film) 2934, 2869, 2224, 2129, 1681, 1618, 1417, 1327, 1163 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_9\text{F}_3\text{N}_3\text{O}$ [M-H] $^-$ 280.0703, found 280.0698.

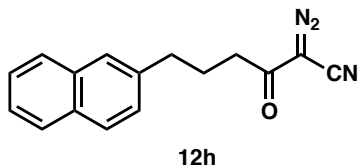
2-Diazo-6-(4-nitrophenyl)-3-oxohexanenitrile (**12g**)



The reaction was run on 0.26 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 39 mg (57% yield) of **12g** as a bright yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 8.15 (m, 2H), 7.34 (m, 2H), 2.78 (t, $J = 7.9$ Hz, 2H), 2.66 (t, $J = 7.2$ Hz, 2H), 2.04 (m,

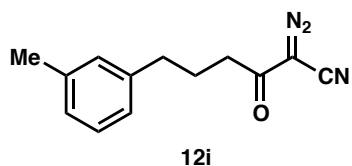
2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.35, 148.57, 146.55, 129.17, 123.75, 108.21, 57.45, 38.34, 34.60, 25.04; FTIR (NaCl, thin film) 3109, 3077, 2937, 2866, 2222, 2130, 1677, 1598, 1515, 1364, 1182 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_9\text{N}_2\text{O}_3$ $[\text{M}-\text{H}]^- - \text{N}_2$ 229.0619, found 229.0629.

2-Diazo-6-(naphthalen-2-yl)-3-oxohexanenitrile (**12h**)



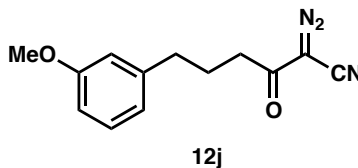
The reaction was run on 0.57 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (85:15 Hexanes:EtOAc) to give 120 mg (80% yield) of **12h** as a bright yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.81 (m, 3H), 7.64 (s, 1H), 7.46 (m, 2H), 7.33 (dd, J = 8.4, 1.7 Hz, 1H), 2.84 (t, J = 7.5 Hz, 2H), 2.66 (t, J = 7.3 Hz, 2H), 2.13 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.80, 138.14, 133.44, 132.05, 128.09, 127.54, 127.37, 126.98, 126.59, 125.99, 125.32, 108.32, 57.22, 38.58, 34.91, 25.48; FTIR (NaCl, thin film) 3027, 2954, 2913, 2867, 2223, 2128, 1674, 1597, 1455, 1400, 1273 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{16}\text{H}_{13}\text{N}_3\text{O}$ $[\text{M}\cdot]^+$ 263.1059, found 263.1069.

2-Diazo-3-oxo-6-(*m*-tolyl)hexanenitrile (**12i**)



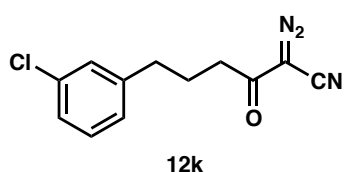
The reaction was run on 0.81 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 159 mg (86% yield) of **12i** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.19 (t, J = 7.5 Hz, 1H), 7.00 (m, 4H), 2.63 (m, 4H), 2.33 (s, 2H), 2.02 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.94, 140.60, 138.05, 129.21, 128.35, 126.91, 125.40, 108.34, 57.19, 38.67, 34.70, 25.64, 21.33; FTIR (NaCl, thin film) 3020, 2924, 2862, 2221, 2126, 1677, 1608, 1456, 1371, 1211, 1182 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 200.1070, found 200.1071.

2-Diazo-6-(3-methoxyphenyl)-3-oxohexanenitrile (**12j**)



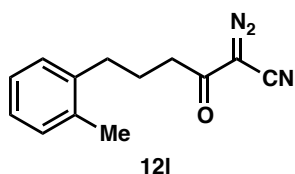
The reaction was run on 0.38 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 72 mg (79% yield) of **12j** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.21 (t, J = 7.8, 1H), 6.75 (m, 3H), 3.80 (s, 3H), 2.64 (m, 4H), 2.02 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.84, 159.63, 142.27, 129.41, 120.74, 114.08, 111.45, 108.32, 57.19, 55.07, 38.56, 34.76, 25.45; FTIR (NaCl, thin film) 3002, 2940, 2836, 2221, 2125, 1682, 1601, 1583, 1488, 1454, 1371, 1258 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 216.1019, found 216.1016.

6-(3-Chlorophenyl)-2-diazo-3-oxohexanenitrile (**12k**)



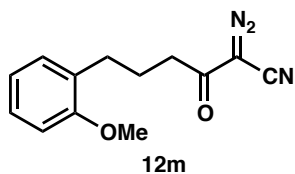
The reaction was run on 0.61 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (85:15 Hexanes:EtOAc) to give 120 mg (80% yield) of **12k** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.20 (m, 3H), 7.05 (m, 1H), 2.64 (m, 4H), 2.00 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.60, 142.73, 134.19, 129.71, 128.46, 126.56, 126.39, 108.26, 57.29, 38.43, 34.39, 25.31; FTIR (NaCl, thin film) 3062, 2937, 2865, 2221, 2127, 1678, 1597, 1574, 1475, 1372, 1205 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{12}\text{H}_{11}\text{N}_3\text{OCl}$ $[\text{M}+\text{H}]^+$ 248.0591, found 248.0585.

2-Diazo-3-oxo-6-(*o*-tolyl)hexanenitrile (**12l**)



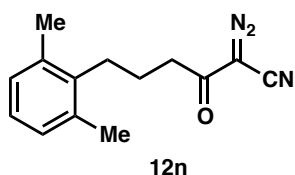
The reaction was run on 1.54 mmol scale for 3 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 277 mg (80% yield) of **12l** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.13 (m, 4H), 2.67 (m, 4H), 2.32 (s, 3H), 1.98 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.78, 138.90, 135.88, 130.25, 128.81, 126.26, 125.95, 108.33, 57.15, 38.88, 32.23, 24.29, 19.13; FTIR (NaCl, thin film) 3016, 2945, 2868, 2221, 2127, 1682, 1493, 1461, 1371, 1168 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{13}\text{H}_{14}\text{N}_3\text{O}$ $[\text{M}+\text{H}]^+$ 228.1173, found 228.1148.

2-Diazo-6-(2-methoxyphenyl)-3-oxohexanenitrile (**12m**)



The reaction was run on 0.35 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 66 mg (78% yield) of **12m** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.20 (td, $J = 7.8, 1.8$ Hz, 1H), 7.12 (dd, $J = 7.4, 1.8$ Hz, 1H), 6.89 (td, $J = 7.4, 1.1$ Hz, 1H), 6.85 (dd, $J = 8.2, 1.1$ Hz, 1H), 3.83 (s, 3H), 2.68 (t, $J = 7.4$ Hz, 2H), 2.63 (t, $J = 7.4$ Hz, 2H), 2.00 (p, $J = 7.4$ Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 190.13, 157.40, 130.01, 129.06, 127.47, 120.39, 110.20, 108.41, 56.98, 55.12, 38.91, 29.26, 24.20; FTIR (NaCl, thin film) 3002, 2938, 2836, 2221, 2126, 1677, 1600, 1586, 1494, 1464, 1370, 1243, 1179 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 216.1019, found 216.1020.

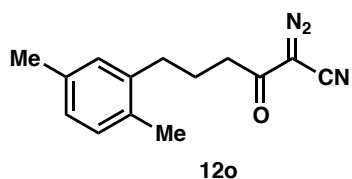
2-Diazo-6-(2,6-dimethylphenyl)-3-oxohexanenitrile (**12n**)



The reaction was run on 2.79 mmol scale for 16 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 525 mg (78% yield) of **12n** as a bright yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.04 (m, 3H), 2.77 (t, $J =$

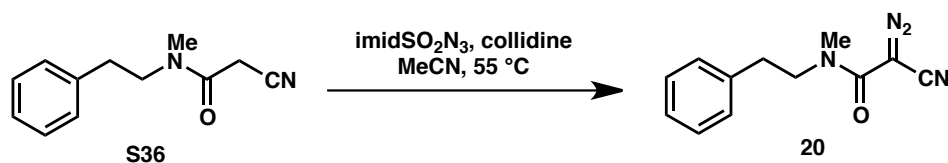
7.1 Hz, 2H), 2.69 (m, 2H), 2.36 (s, 6H), 1.89 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.69, 137.75, 135.99, 128.13, 125.92, 108.36, 57.12, 39.43, 28.85, 23.27, 19.68; FTIR (NaCl, thin film) 3016, 2955, 2221, 2127, 1677, 1467, 1369, 1189 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{14}\text{NO}$ $[\text{M}-\text{H}]^- - \text{N}_2$ 212.1081, found 212.1091.

2-Diazo-6-(2,5-dimethylphenyl)-3-oxohexanenitrile (**12o**)



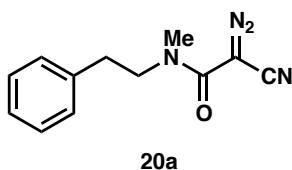
The reaction was run on 0.73 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 150 mg (86% yield) of **12o** as a bright yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.05 (d, J = 8.1 Hz, 1H), 6.96 (m, 2H), 2.69 (t, J = 7.2 Hz, 2H), 2.64 (m, 2H), 2.32 (s, 3H), 2.29 (s, 3H), 1.99 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.83, 138.72, 135.34, 132.68, 130.17, 129.64, 126.92, 108.34, 57.13, 38.91, 32.24, 24.41, 20.85, 18.66; FTIR (NaCl, thin film) 2919, 2868, 2220, 2129, 1672, 1503, 1454, 1376, 1180 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{14}\text{H}_{16}\text{N}_3\text{O}$ $[\text{M}+\text{H}]^+$ 242.1293, found 242.1284.

General procedure 2 for the synthesis of α -diazo-cyanoacetamides.



To a 20 mL vial was added the cyanoacetamide substrate **S36** (1.63 mmol, 1.00 equiv) followed by acetonitrile (5 mL) and either imidazole sulfonyl azide³ or the corresponding HCl salt (1.79 mmol, 1.10 equiv). 2,4,6-Collidine (8.15 mmol, 5.0 equiv) was charged and the light yellow mixture was heated to 55 °C sealed under an air atmosphere. A white precipitate occurred after 3 hours. After TLC analysis indicated consumption of the starting material (typically 24 hours) the solvent of the dark red mixture was removed by rotary evaporation under reduced pressure. The crude residue was purified by silica gel chromatography to afford the α -diazo-cyanoacetamides products, eluting as a distinct yellow band on the column.

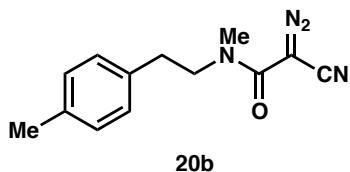
2-Cyano-2-diazo-N-methyl-N-phenethylacetamide (**20a**)



The reaction was run on 1.63 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 273 mg (73% yield) of **20a** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.32 (m, 2H), 7.24 (m, 3H), 3.64 (m, 2H), 3.03 (s, 3H), 2.90 (t, J = 7.6 Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ

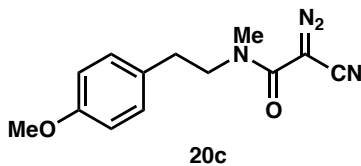
158.90, 137.77 (broad), 128.76, 128.63, 126.72, 109.89, 52.56 (broad), 51.89, 36.31 (broad), 34.08 (broad); FTIR (NaCl, thin film) 3026, 2930, 2860, 2213, 2120, 1636, 1631, 1481, 1453, 1399, 1216 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{13}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 201.1022, found 201.1019.

2-Cyano-2-diazo-*N*-(4-methylphenethyl)-*N*-methylacetamide (**20b**)



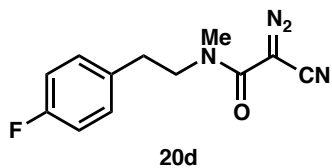
The reaction was run on 0.787 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 140 mg (74% yield) of **20b** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.12 (s, 4H), 3.62 (m, 2H), 3.03 (s, 3H), 2.86 (t, $J = 7.6$ Hz, 2H), 2.32 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 158.83, 136.22, 134.57 (broad), 129.26, 128.61, 109.88, 52.50 (broad), 51.95, 36.24 (broad), 33.62 (broad), 20.92; FTIR (NaCl, thin film) 2923, 2859, 2213, 2120, 1636, 1399, 1214 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 215.1179, found 215.1172.

2-Cyano-2-diazo-*N*-(4-methoxyphenethyl)-*N*-methylacetamide (**20c**)



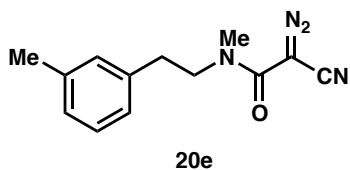
The reaction was run on 3.01 mmol scale for 18 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 530 mg (68% yield) of **20c** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.14 (m, 2H), 6.86 (m, 2H), 3.79 (s, 3H), 3.61 (m, 2H), 3.03 (s, 3H), 2.84 (t, $J = 7.6$ Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 158.83, 158.33, 129.74, 114.00, 109.91, 55.15, 52.53 (broad), 52.04, 36.26 (broad), 33.18 (broad); FTIR (NaCl, thin film) 3030, 2995, 2934, 2835, 2214, 2121, 1636, 1612, 1513, 1481, 1399, 1302, 1247, 1178 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}_2$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 231.1128, found 231.1119.

2-Cyano-2-diazo-*N*-(4-fluorophenethyl)-*N*-methylacetamide (**20d**)



The reaction was run on 4.10 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 624 mg (62% yield) of **20d** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.19 (m, 2H), 7.01 (m, 2H), 3.61 (m, 2H), 3.04 (s, 3H), 2.88 (t, $J = 7.6$ Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 162.58, 160.63, 158.87, 133.35 (broad), 130.17 (d, $J_{\text{C-F}} = 8.0$ Hz), 115.47, 115.30, 109.81, 52.49 (broad), 51.74, 36.19 (broad), 33.14 (broad); FTIR (NaCl, thin film) 3069, 3040, 2934, 2860, 2215, 2122, 1633, 1510, 1482, 1398, 1219 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{12}\text{N}_2\text{FO}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 219.0928, found 219.0936.

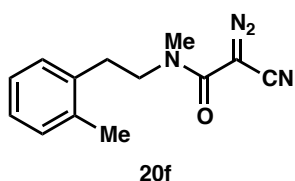
2-Cyano-2-diazo-*N*-methyl-*N*-(3-methylphenethyl)acetamide (**20e**)



The reaction was run on 2.92 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 476 mg (67% yield) of **20e** as a bright yellow oil. ¹H NMR (CDCl₃, 500 MHz) δ 7.21 (m, 1H), 7.05 (m, 3H), 3.63 (m, 2H), 3.04 (s, 3H), 2.86 (t, *J* = 7.7 Hz, 2H), 2.34 (s, 3H);

¹³C NMR (CDCl₃, 126 MHz) δ 158.82, 138.18, 137.61 (broad), 129.49, 128.45, 127.36, 125.67, 109.82, 52.46 (broad), 51.88, 36.23 (broad), 33.92 (broad), 21.21; FTIR (NaCl, thin film) 3014, 2928, 2863, 2214, 2120, 1634, 1482, 1398, 1215 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₅N₂O [M+H]⁺ - N₂ 215.1179, found 215.1171.

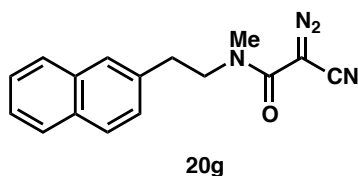
2-Cyano-2-diazo-*N*-methyl-*N*-(2-methylphenethyl)acetamide (**20f**)



The reaction was run on 0.74 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 95 mg (53% yield) of **20f** as a bright yellow solid. ¹H NMR (CDCl₃, 500 MHz) δ 7.16 (m, 4H), 3.59 (t, *J* = 7.7 Hz, 2H, 2H), 3.07 (s, 3H), 2.91 (t, *J* = 7.7 Hz, 2H, 2H), 2.38 (s, 3H); ¹³C NMR

(CDCl₃, 126 MHz) δ 158.94, 136.12, 135.99 (broad), 130.48, 129.53, 126.94, 126.25, 109.87, 52.55 (broad), 50.72, 36.45 (broad), 31.35 (broad), 29.66, 19.19; FTIR (NaCl, thin film) 3014, 2928, 2863, 2214, 2120, 1634, 1482, 1398, 1215 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₅N₂O [M+H]⁺ - N₂ 215.1179, found 215.1171.

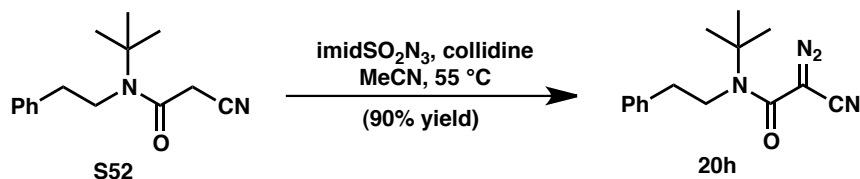
2-Cyano-2-diazo-*N*-methyl-*N*-(2-(naphthalen-2-yl)ethyl)acetamide (**20g**)



The reaction was run on 1.98 mmol scale for 18 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 390 mg (71% yield) of **20g** as a bright yellow solid. ¹H NMR (CDCl₃, 500 MHz) δ 7.81 (m, 3H), 7.68 (s, 1H), 7.47 (m, 2H), 7.37 (m, 1H), 3.73 (m, 2H), 3.06 (m, 5H);

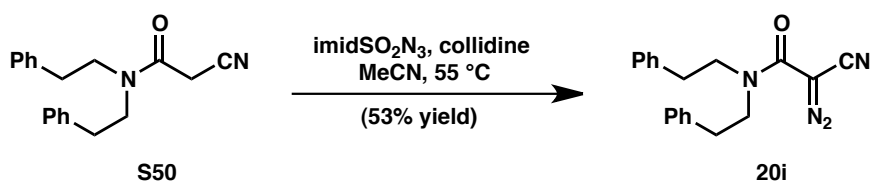
¹³C NMR (CDCl₃, 126 MHz) δ 158.94, 135.24 (broad), 133.46, 132.23, 128.33, 127.58, 127.44, 127.30 (broad), 126.99, 126.14, 125.61, 109.90, 52.58 (broad), 51.83, 36.40 (broad), 34.26 (broad); FTIR (NaCl, thin film) 3051, 3019, 2932, 2859, 2213, 2120, 1636, 1481, 1399, 1309, 1220, 1083 cm⁻¹; HRMS (MM) calc'd for C₁₆H₁₅N₂O [M+H]⁺ - N₂ 251.1179, found 215.1171.

Preparation of *N*-(*t*-butyl)-2-cyano-2-diazo-*N*-phenethylacetamide (**20h**)



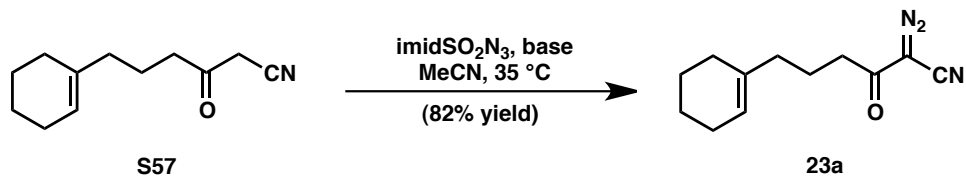
Compound **20h** was synthesized according to general procedure 2. The reaction was run on 0.13 mmol scale for 18 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 31 mg (90% yield) of **20h** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.30 (m, 5H), 3.67 (m, 2H), 2.95 (m, 2H), 1.53 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 159.83, 137.59, 128.83, 128.71, 126.92, 110.67, 59.71, 54.61, 47.28, 37.88, 28.98; FTIR (NaCl, thin film) 3027, 2975, 2928, 2211, 2120, 1633, 1454, 1386, 1364, 1181 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{15}\text{H}_{19}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 243.1492, found 243.1490.

Preparation of 2-cyano-2-diazo-*N,N*-diphenethylacetamide (**20i**)



Compound **20i** was synthesized according to general procedure 2. The reaction was run on 0.68 mmol scale for 24 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 115 mg (53% yield) of **20i** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.31 (m, 4H), 7.22 (m, 6H), 3.56 (t, J = 7.7 Hz, 4H), 2.87 (t, J = 7.7 Hz, 4H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 158.63, 137.76 (broad), 128.78, 128.63, 126.73, 110.09, 52.99, 50.44, 34.55 (broad); FTIR (NaCl, thin film) 3025, 2929, 2859, 2212, 2120, 1638, 1453, 1419, 1217 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{19}\text{H}_{19}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 291.1492, found 291.1483.

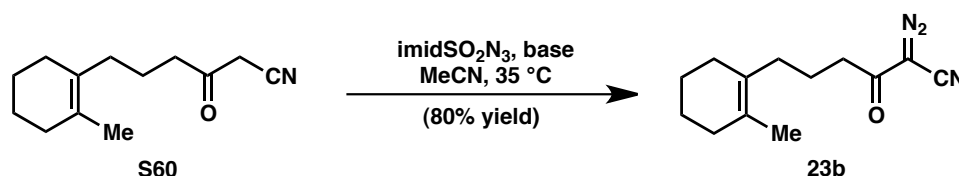
Preparation of 6-(cyclohex-1-en-1-yl)-2-diazo-3-oxohexanenitrile (**23a**)



Compound **23a** was synthesized according to general procedure 1. The reaction was run on 1.05 mmol scale for 3 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 179 mg

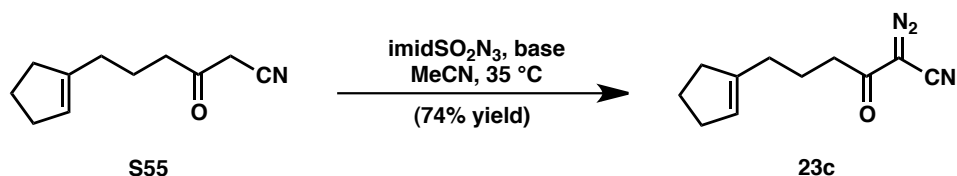
(82% yield) of **23a** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 5.42 (dt, $J = 2.6, 1.2$ Hz, 1H), 2.58 (t, $J = 7.3$ Hz, 2H), 1.99 (m, 4H), 1.89 (m, 3H), 1.81 (m, 2H), 1.60 (m, 2H), 1.54 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 190.20, 136.07, 122.36, 108.41, 57.05, 38.65, 36.95, 27.79, 25.11, 22.76, 22.30, 22.05; FTIR (NaCl, thin film) 2928, 2835, 2221, 2126, 1682, 1438, 1367, 1211 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{15}\text{NO}$ $[\text{M}-\text{H}]^- - \text{N}_2$ 188.1081, found 188.1077.

Preparation of 2-diazo-6-(2-methylcyclohex-1-en-1-yl)-3-oxohexanenitrile (**23b**)



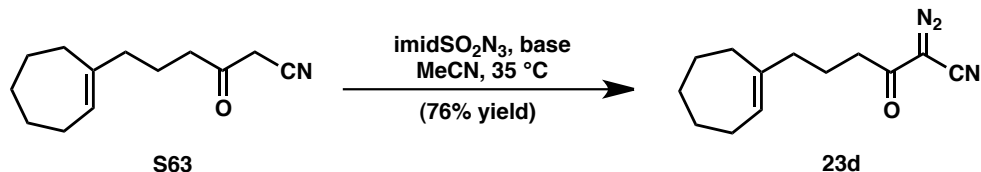
Compound **23b** was synthesized according to general procedure 1. The reaction was run on 0.54 mmol scale for 6 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 98 mg (80% yield) of **23b** as a bright yellow oil. This compound was subjected to preparative HPLC (SiO_2 column, 5% EtOAc/Hexanes, 5 mL/min) to achieve higher isomeric purity. ^1H NMR (CDCl_3 , 500 MHz, compound exists as a >95:5 mixture of alkene isomers, only major **23b** peaks are reported) δ 2.58 (t, $J = 7.4$ Hz, 2H), 2.04 (t, $J = 7.7$ Hz, 2H), 1.90 (m, 4H), 1.75 (m, 2H), 1.59 (s, 3H), 1.55 (m, 4H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a >95:5 mixture of alkene isomers, only major **23b** peaks are reported) δ 190.23, 128.39, 127.62, 108.44, 56.97, 39.06, 32.27, 31.77, 29.24, 23.32, 23.22, 22.63, 19.05; FTIR (NaCl, thin film) 2925, 2858, 2221, 2127, 1684, 1437, 1368, 1238 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{NO}$ $[\text{M}-\text{H}]^- - \text{N}_2$ 202.1237, found 202.1233.

Preparation of 6-(cyclopent-1-en-1-yl)-2-diazo-3-oxohexanenitrile (**23c**)



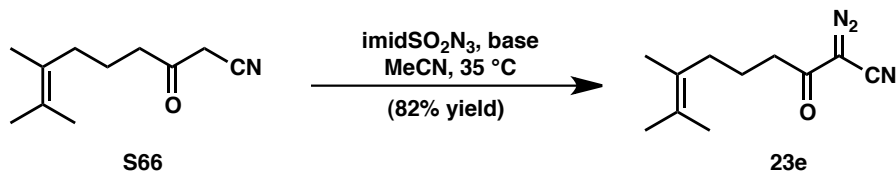
Compound **23c** was synthesized according to general procedure 1. The reaction was run on 1.16 mmol scale for 10 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 174 mg (74% yield) of **23c** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 5.35 (m, 1H), 2.59 (t, $J = 7.4$ Hz, 2H), 2.28 (m, 2H), 2.19 (m, 2H), 2.11 (m, 2H), 1.84 (m, 4H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 190.13, 142.92, 124.69, 108.41, 57.10, 38.89, 34.68, 32.34, 30.12, 23.30, 22.20; FTIR (NaCl, thin film) 2934, 2838, 2221, 2123, 1675, 1438, 1367, 1179 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{12}\text{NO}$ $[\text{M}-\text{H}]^- - \text{N}_2$ 174.0924, found 174.0919.

Preparation of 6-(cyclohept-1-en-1-yl)-2-diazo-3-oxohexanenitrile (**23d**)



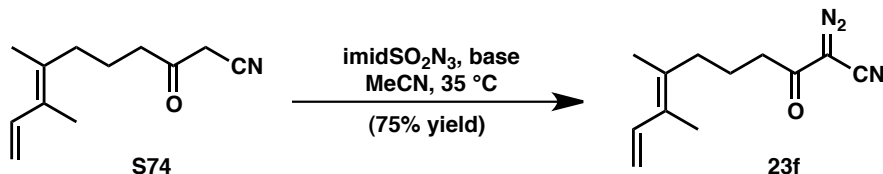
Compound **23d** was synthesized according to general procedure 1. The reaction was run on 1.15 mmol scale for 10 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 200 mg (76% yield) of **23d** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 5.56 (tt, $J = 6.4, 1.2$ Hz, 1H), 2.59 (t, $J = 7.3$ Hz, 2H), 2.07 (m, 4H), 2.01 (t, $J = 7.3$ Hz, 2H), 1.78 (m, 2H), 1.72 (m, 2H), 1.46 (m, 4H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 190.21, 142.84, 127.41, 108.39, 57.07, 39.09, 38.61, 32.44, 32.30, 28.17, 27.13, 26.69, 22.26; FTIR (NaCl, thin film) 2920, 2847, 2221, 2127, 1676, 1446, 1366, 1211, 1180 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{18}\text{NO}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 204.1383, found 204.1375.

Preparation of 2-diazo-7,8-dimethyl-3-oxonon-7-enenitrile (**23e**)



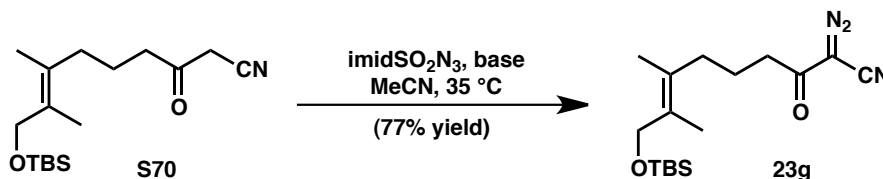
Compound **23e** was synthesized according to general procedure 1. The reaction was run on 0.36 mmol scale for 3 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 500 mg (64% yield) of **23e** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 2.58 (t, $J = 7.4$ Hz, 2H), 2.08 (m, 2H), 1.76 (m, 2H), 1.64 (m, 6H), 1.63 (q, $J = 1.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 190.19, 126.11, 125.57, 108.43, 56.96, 38.95, 33.25, 22.57, 20.51, 20.14, 18.07; FTIR (NaCl, thin film) 2987, 2918, 2861, 2222, 2128, 1676, 1451, 1372, 1216 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{16}\text{NO}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 178.1227, found 178.1228.

Preparation of (*E*)-2-diazo-7,8-dimethyl-3-oxodeca-7,9-dienenitrile (**23f**)



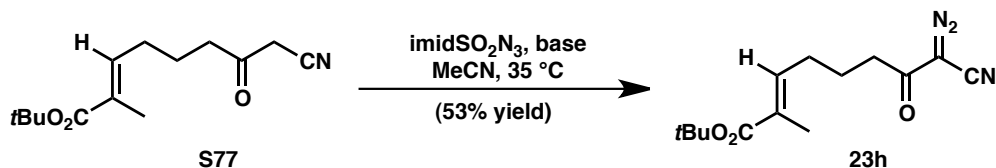
Compound **23f** was synthesized according to general procedure 1. The reaction was run on 0.414 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 67 mg (75% yield) of **23f** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 6.81 (dd, $J = 17.2, 10.9$ Hz, 1H), 5.15 (dd, $J = 17.2, 1.5$ Hz, 1H), 5.02 (dd, $J = 10.9, 1.5$ Hz, 1H), 2.62 (t, $J = 7.3$ Hz, 2H), 2.21 (m, 2H), 1.80 (m, 8H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 189.95, 135.69, 133.64, 127.96, 112.07, 108.40, 57.10, 39.02, 34.56, 22.42, 18.15, 13.39; FTIR (NaCl, thin film) 2954, 2916, 2872, 2220, 2124, 1675, 1374, 1219 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{12}\text{H}_{15}\text{N}_3\text{O}$ $[\text{M}]^+$ 217.1215, found 217.1219.

Preparation of α -diazo- β -ketonitrile (**23g**)



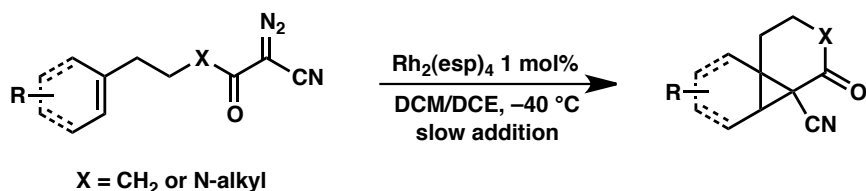
Compound **23g** was synthesized according to general procedure 1. The reaction was run on 0.64 mmol scale for 5 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 500 mg (77% yield) of **23g** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 4.14 (s, 2H), 2.60 (t, $J = 7.3$ Hz, 2H), 2.09 (m, 2H), 1.77 (m, 2H), 1.68 (m, 6H), 0.90 (s, 9H), 0.06 (s, 6H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 190.05, 129.63, 128.79, 108.38, 63.75, 57.04, 39.02, 33.76, 25.94, 22.20, 18.38, 17.64, 15.47, -5.25; FTIR (NaCl, thin film) 2954, 2928, 2856, 2221, 2128, 1679, 1471, 1361, 1251 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{17}\text{H}_{30}\text{NO}_2\text{Si}$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 308.2040, found 308.2038.

Preparation of α -diazo- β -ketonitriles (**23h**)



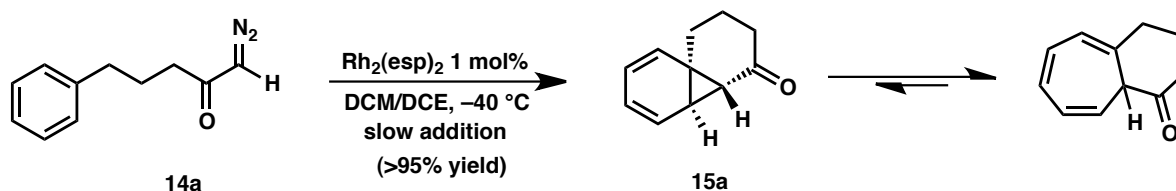
Compound **23h** was synthesized according to general procedure 1. The reaction was run on 0.757 mmol scale for 12 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 111 mg (53% yield) of **23h** as a bright yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 6.59 (tq, $J = 7.5, 1.5$ Hz, 1H), 2.65 (t, $J = 7.3$ Hz, 2H), 2.21 (m, 2H), 1.84 (m, 2H), 1.79 (s, 3H), 1.49 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 189.62, 167.13, 138.79, 130.46, 108.26, 80.10, 57.25, 38.71, 28.00, 27.59, 23.00, 12.40; FTIR (NaCl, thin film) 2977, 2932, 2222, 2129, 1703, 1678, 1456, 1367, 1289, 1160 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{20}\text{NO}_3$ $[\text{M}+\text{H}]^+ - \text{N}_2$ 250.1438, found 250.1443.

General procedure 3 for the synthesis of norcaradienes **13,21** and cyclopropanes **24**



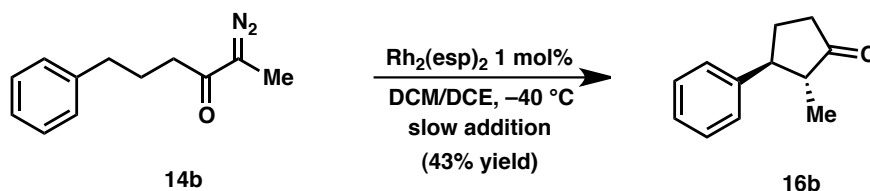
In a glovebox an oven-dried 20 mL vial containing a stirbar was charged with bis[rhodium($\alpha,\alpha,\alpha',\alpha'$ -tetramethyl-1,3-benzenedipropionic acid)] ($\text{Rh}_2(\text{esp})_2$, 0.001 mmol, 0.01 equiv) and anhydrous DCM (3 mL). The diazo compound (0.1 mmol, 1 equiv) was dried azeotropically with benzene, and dissolved with DCM (2.0 mL) in a high recovery vial. The catalyst and diazo solution were cooled to -40°C in appropriately sized well plates by a NesLab chiller. A Free Slate[®] robotic system (<http://www.freeslate.com>), equipped with a needle-bearing robotic arm and a backing solvent line containing 1,2-dichloroethane, was utilized to perform a slow addition of the diazo species to the rhodium catalyst. In a typical experiment 5 μL of the diazo/DCM solution was withdrawn by the robotic arm needle, positioned over the stirring catalyst solution, and dispensed at a rate of 70 $\mu\text{L}/\text{sec}$ with a 10 μL DCE backing solvent wash. A 30 second delay occurred before initiation of another addition cycle. This loop was repeated until the entirety of the diazo solution was transferred to the catalyst (~ 3 hours), and the reaction was allowed to warm to rt, sealed and removed from the glovebox. The solvent was removed by rotary evaporation under reduced pressure, and the crude residue was purified by silica gel chromatography or Florisil (for more sensitive norcaradienes) to afford the norcaradiene (or cyclopropane) products. For certain norcaradiene substrates upon purification the ring opened aromatized product was isolated.

Preparation of cycloheptatriene (15a)



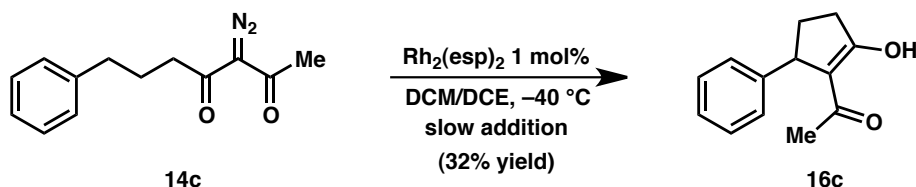
Compound **15a** was synthesized according to general procedure 3. The reaction was run with 28 mg (0.15 mmol) of α -diazoketone **14a**,⁴ and the solvent was removed *in vacuo* to afford 23.5 mg (>95% yield) of **15a** as a white solid, of greater than 95% purity by ^1H NMR. The spectral data is consistent with that reported in the literature.⁴ Product **15a** was unstable to either Florisil or silica gel chromatography.

Preparation of *trans*-2-methyl-3-phenylcyclopentanone (16b)



Compound **16b** was synthesized according to general procedure 3. The reaction was run with 22 mg (0.11 mmol) of α -diazo methyl ketone **14b**,⁴ and the crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) followed by preparative HPLC (9:1 Hexanes:EtOAc) to afford 8.2 mg (43% yield) of **16b** as a white solid. The spectral data is consistent with that reported in the literature.⁴

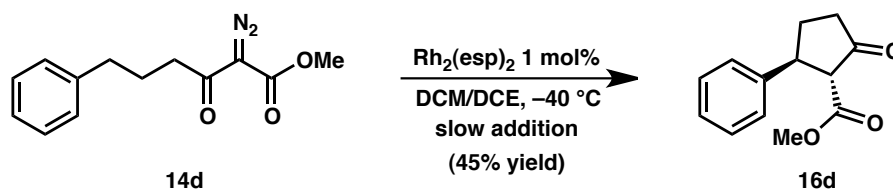
Preparation of 1-(2-hydroxy-5-phenylcyclopent-1-en-1-yl)ethanone (16c)



Compound **16c** was synthesized according to general procedure 3. The reaction was run with 27 mg (0.12 mmol) of α -diazo- β -keto ketone **14c**, and the crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) followed by preparative HPLC (85:15 Hexanes:EtOAc, SiO_2 column, 5 mL/min) to afford 7.6

mg (32% yield) of **16c** as a colorless oil. The *trans* stereochemical relationship in the ketone tautomer product was assigned based coupling constant analysis and comparison to related systems.⁴ ¹H NMR (CDCl₃, 500 MHz, compound exists as a 3:1 mixture of enol : keto tautomers, enol tautomer designated by *, keto tautomer denoted by §) δ 7.31 (m, 2H*, 2H§), 7.20 (m, 3H*, 3H§), 4.07 (dd, *J* = 8.3, 4.8 Hz, 1H*), 3.93 (td, *J* = 11.2, 6.4 Hz, 1H§), 3.55 (d, *J* = 11.2 Hz, 1H§), 2.59 (m, 1H*, 1H§), 2.44 (m, 2H*, 2H§), 2.30 (s, 3H§), 2.00 (m, 1H§), 1.83 (m, 1H*), 1.69 (s, 3H*); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 3:1 mixture of enol : keto tautomers, enol tautomer designated by *, keto tautomer denoted by §) δ 211.26§, 203.13*, 202.06§, 180.91*, 145.47*, 141.92§, 128.76§, 128.73*, 127.01§, 127.00*, 126.98§, 126.50*, 113.34*, 69.89§, 44.77*, 43.82§, 39.35§, 35.12*, 31.38*, 31.30§, 28.40§, 21.52*; FTIR (NaCl, thin film) 3026, 2963, 1742, 1711, 1651, 1614, 1493, 1385, 1235, 1122 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₃O₂ [M+H]⁺ 201.0920, found 201.0912.

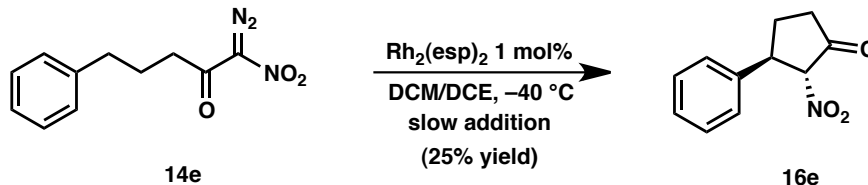
Preparation of *trans*-methyl 2-oxo-5-phenylcyclopentanecarboxylate (**16d**)



Compound **16d** was synthesized according to general procedure 3. The reaction was run with 25 mg (0.10 mmol) of α -diazo- β -keto ester **14d**, and the crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) followed by preparative HPLC (8:2 Hexanes:EtOAc) to afford 10 mg (45% yield) of **16d** as a white solid. The *trans* stereochemical relationship in the product was assigned based coupling constant analysis and compared to related systems.⁴ ¹H NMR (CDCl₃, 500 MHz, compound exists as a >10:1 mixture of keto : enol tautomers, only major keto peaks are reported) δ 7.35 (m, 2H), 7.27 (m, 3H), 3.82 (td, *J* = 12.0, 5.9 Hz, 1H), 3.72 (s, 3H), 3.37 (dd, *J* = 12.0, 1.0 Hz, 1H), 2.60 (m, 1H), 2.47 (m, 2H), 2.01 (m, 1H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a >10:1 mixture of ketone : enol tautomers, only major keto peaks are reported) δ 210.56, 169.10, 140.90, 128.84, 127.25, 126.80, 62.27, 52.57, 46.10, 38.72, 28.98; FTIR (NaCl, thin film) 3029, 2952, 1757, 1726, 1496, 1336, 1277, 1111 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₅O₃ [M+H]⁺ 217.0870, found 217.0874.

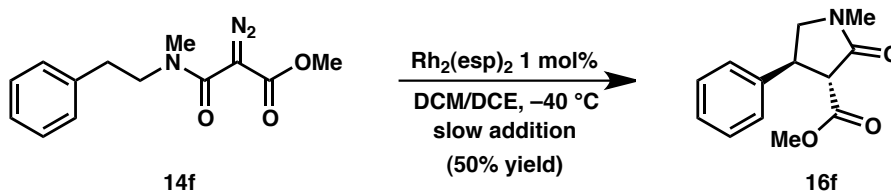
⁴ Kennedy, M.; McKervey, M. A.; Maguire, A. R.; Tuladhar, S. M.; Twohig, M. F.; *J. Chem. Soc., Perkin Trans. I* **1990**, 1047.

Preparation of *trans*-2-nitro-3-phenylcyclopentanone (**16e**)



Compound **16e** was synthesized according to general procedure 3. The reaction was run with 19 mg (0.082 mmol) of α -diazo- β -keto nitro compound **14e**, and the crude material was purified by silica gel chromatography (7:3 EtOAc:hexanes) followed by preparative HPLC (1:1 Hexanes:EtOAc) to afford 4.2 mg (25% yield) of **16e** as a colorless oil. The *trans* stereochemical relationship in the product was assigned based coupling constant analysis and compared to related systems.⁴ ¹H NMR (CDCl₃, 500 MHz, compound exists as a >20:1 mixture of keto : enol tautomers, only major keto peaks are reported) δ 7.38 (m, 2H), 7.33 (m, 1H), 7.28 (m, 2H), 5.24 (d, J = 12.0 Hz, 1H), 4.13 (td, J = 12.2, 6.8 Hz, 1H), 2.65 (m, 3H), 2.14 (m, 1H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a >20:1 mixture of ketone : enol tautomers, only major keto peaks are reported) δ 202.34, 137.65, 129.23, 128.22, 126.64, 95.49, 47.13, 36.54, 25.96; FTIR (NaCl, thin film) 3031, 2952, 2916, 1768, 1550, 1496, 1370, 1115 cm⁻¹; HRMS (MM) calc'd for C₁₁H₁₂NO₃ [M+H]⁺ 206.0817, found 206.0823.

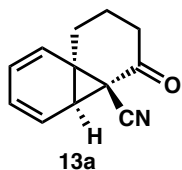
Preparation of *trans*-methyl 1-methyl-2-oxo-4-phenylpyrrolidine-3-carboxylate (**16f**)



Compound **16f** was synthesized according to general procedure 3. The reaction was run with 32.0 mg (0.122 mmol) of α -diazo- β -amido ester **14f**, and the crude material was purified by silica gel chromatography (7:3 EtOAc:hexanes) followed by recrystallization from hexanes/EtOAc to afford 14.3 mg (50% yield) of **16f** as a white solid. The *trans* stereochemical relationship in the product was assigned based coupling constant analysis and compared to related systems.⁵ ¹H NMR (CDCl₃, 500 MHz) δ 7.34 (m, 2H), 7.29 (m, 1H), 7.23 (m, 2H), 4.00 (q, J = 8.4 Hz, 1H), 3.80 (dd, J = 9.8, 8.5 Hz, 1H), 3.78 (s, 3H), 3.60 (d, J = 8.5 Hz, 1H), 3.42 (dd, J = 9.8, 7.6 Hz, 1H), 2.95 (s, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 169.95, 168.72, 140.17, 128.98, 127.50, 126.86, 55.79, 54.73, 52.74, 41.37, 29.95; FTIR (NaCl, thin film) 3027, 2952, 2883, 1740, 1696, 1496, 1432, 1260, 1166 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₆NO₃ [M+H]⁺ 234.1125, found 234.1124.

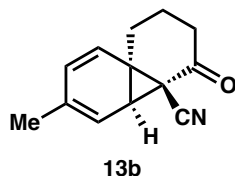
⁵ Choi, M. K-W.; Yu, Y-W.; Che, C-M.; *Org. Lett.* **2005**, 7, 1081.

4-Oxo-1,2,3,4,4a,4b-hexahydrocyclopropa[1,2:1,3]dibenzene-4a-carbonitrile (**13a**)



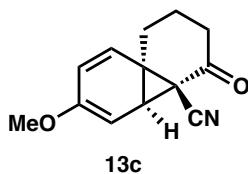
The reaction was run with 23.0 mg (0.108 mmol) of α -diazo- β -keto nitrile **12a**, and the crude material was purified by chromatography using Florisil as the stationary phase (6:4 Hexanes:EtOAc) to afford 14.0 mg (70% yield) of **13a** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.45 (m, 1H), 6.39 (ddd, J = 9.1, 6.5, 1.0 Hz, 1H), 6.22 (ddq, J = 8.9, 6.0, 0.9 Hz, 1H), 6.07 (dd, J = 9.2, 1.0 Hz, 1H), 3.54 (d, J = 6.1 Hz, 1H), 2.54 (dddd, J = 18.7, 6.6, 4.4, 0.7 Hz, 1H), 2.45 (ddd, J = 18.7, 10.1, 7.2 Hz, 1H), 2.33 (ddd, J = 14.3, 11.4, 4.9 Hz, 1H), 2.19 (dt, J = 14.3, 4.8 Hz, 1H), 1.90 (m, 1H), 1.75 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 200.40, 127.50, 126.52, 126.27, 122.18, 112.63, 43.74 (broad), 35.49, 27.83, 17.63; FTIR (NaCl, thin film) 3047, 2949, 2858, 2239, 1689, 1427, 1326, 1276, 1174 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{10}\text{NO}$ $[\text{M}-\text{H}]^-$ 184.0768, found 184.0776.

4-Methyl norcaradiene (**13b**)



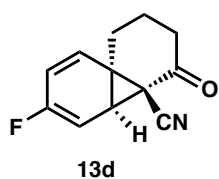
The reaction was run with 18.0 mg (0.0800 mmol) of α -diazo- β -keto nitrile **12b**, and the crude material was purified by chromatography using Florisil as the stationary phase (6:4 Hexanes:EtOAc) to afford 12.5 mg (80% yield) of **13b** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.24 (dd, J = 9.5, 1.3 Hz, 1H), 6.03 (d, J = 9.4 Hz, 1H), 5.90 (d, J = 5.9 Hz, 1H), 3.41 (d, J = 5.9 Hz, 0H), 2.50 (m, 1H), 2.40 (ddd, J = 18.7, 10.3, 7.2 Hz, 1H), 2.29 (ddd, J = 14.1, 11.6, 4.9 Hz, 1H), 2.15 (dt, J = 14.2, 4.6 Hz, 1H), 1.97 (d, J = 1.5 Hz, 3H), 1.87 (m, 1H), 1.73 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 200.38, 136.39, 129.92, 126.78, 117.04, 112.89, 40.87 (broad), 35.41, 27.47, 21.44, 17.53; FTIR (NaCl, thin film) 3034, 2917, 2859, 2239, 1787, 1450, 1326, 1289, 1166 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{12}\text{NO}$ $[\text{M}-\text{H}]^-$ 198.0924, found 198.0934.

4-Methoxy norcaradiene (**13c**)



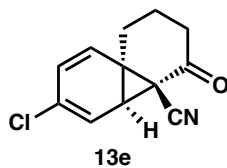
The reaction was run with 31.0 mg (0.127 mmol) of α -diazo- β -keto nitrile **12c**, and the crude material was purified by chromatography using Florisil as the stationary phase (1:1 Hexanes:EtOAc) to afford 24.7 mg (90% yield) of **13c** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.19 (dd, J = 9.9, 2.1 Hz, 1H), 6.08 (d, J = 9.8, 1H), 5.12 (d, J = 6.4 Hz, 1H), 3.64 (s, 3H), 3.49 (d, J = 5.6 Hz, 1H), 2.49 (ddd, J = 19.1, 6.5, 4.1 Hz, 1H), 2.38 (ddd, J = 19.1, 10.5, 7.2 Hz, 1H), 2.26 (ddd, J = 14.2, 11.7, 4.9 Hz, 1H), 2.16 (dt, J = 14.2, 4.5 Hz, 1H), 1.88 (m, 1H), 1.73 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 200.08, 157.12, 129.05, 125.64, 113.06, 90.34, 55.08, 45.00 (broad), 40.39 (broad), 35.40, 27.27, 17.54; FTIR (NaCl, thin film) 3011, 2945, 2853, 2238, 1683, 1650, 1584, 1447, 1422, 1242, 1177 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 216.1019, found 216.1015.

4-Fluoro norcaradiene (13d)



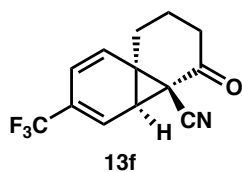
The reaction was run with 17.0 mg (0.0736 mmol) of α -diazo- β -keto nitrile **12d**, and the crude material was purified by silica gel chromatography (1:1 Hexanes:EtOAc) to afford 10.0 mg (67% yield) of **13d** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.34 (td, $J = 9.5, 2.1$ Hz, 1H), 6.19 (dd, $J = 9.7, 5.2$ Hz, 1H), 5.83 (dddd, $J = 9.0, 7.0, 2.0$ Hz, 1H), 3.76 (m, 1H), 2.52 (m, 2H), 2.36 (ddd, $J = 15.1, 10.8, 4.7$ Hz, 1H), 2.19 (dt, $J = 14.5, 5.0$ Hz, 1H), 1.96 (m, 1H), 1.77 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 199.46, 160.05 (d, $J_{\text{C-F}} = 252.4$ Hz), 129.52 (d, $J_{\text{C-F}} = 9.9$ Hz), 120.74 (d, $J_{\text{C-F}} = 32.9$ Hz), 102.79 (d, $J_{\text{C-F}} = 24.7$ Hz), 49.91 (broad), 35.46, 27.72, 18.04; FTIR (NaCl, thin film) 3076, 2952, 2863, 2240, 1690, 1660, 1427, 1327, 1207, 1170 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_9\text{FNO}$ $[\text{M-H}]^-$ 202.0674, found 202.0666.

4-Chloro norcaradiene (13e)



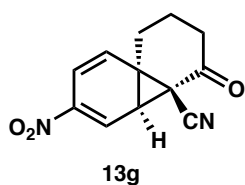
The reaction was run with 21.5 mg (0.0870 mmol) of α -diazo- β -keto nitrile **12e**, and the crude material was purified by silica gel chromatography (1:1 Hexanes:EtOAc) to afford 12.0 mg (63% yield) of **13e** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.39 (dd, $J = 9.5, 1.7$ Hz, 1H), 6.25 (m, 1H), 6.13 (d, $J = 9.5$ Hz, 1H), 3.59 (d, $J = 6.6$ Hz, 1H), 2.55 (ddd, $J = 18.7, 6.7, 4.5$ Hz, 1H), 2.47 (ddd, $J = 18.7, 9.9, 7.2$ Hz, 1H), 2.33 (ddd, $J = 14.4, 11.2, 4.8$ Hz, 1H), 2.19 (dt, $J = 14.4, 4.8$ Hz, 1H), 1.94 (m, 1H), 1.74 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 199.02, 133.06, 128.84, 128.52, 119.08, 112.33, 46.17 (broad), 35.46, 35.46, 27.47, 17.74; FTIR (NaCl, thin film) 3066, 2951, 2858, 2240, 1691, 1411, 1325, 1179 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_9\text{ClNO}$ $[\text{M-H}]^-$ 218.0378, found 218.0377.

4-Trifluoromethyl norcaradiene (13f)



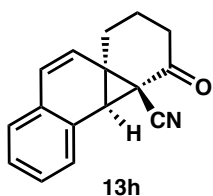
The reaction was run with 28.0 mg (0.100 mmol) of α -diazo- β -keto nitrile **12f**, and the crude material was purified by silica gel chromatography (1:1 Hexanes:EtOAc) to afford 9.0 mg (36% yield) of **13f** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.69 (m, 1H), 6.52 (dd, $J = 9.6, 1.4$ Hz, 1H), 6.27 (dd, $J = 9.6, 1.1$ Hz, 1H), 3.52 (d, $J = 6.3$ Hz, 1H), 2.58 (ddd, $J = 18.8, 6.5, 4.4$ Hz, 1H), 2.49 (ddd, $J = 18.8, 10.2, 7.1$ Hz, 1H), 2.38 (ddd, $J = 14.4, 11.3, 4.9$ Hz, 1H), 2.22 (dt, $J = 14.4, 4.7$ Hz, 1H), 1.95 (m, 1H), 1.75 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 198.59, 130.38 (q, $J = 32.3$ Hz), 128.70, 122.60 (q, $J = 5.3$ Hz), 122.55 (q, $J = 272.2$ Hz), 121.68 (q, $J = 2.5$ Hz), 111.44, 40.94 (broad), 35.52, 27.41, 25.12, 17.55; FTIR (NaCl, thin film) 3057, 2952, 2928, 2242, 1701, 1374, 1308, 1181 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_9\text{F}_3\text{NO}$ $[\text{M-H}]^-$ 252.0642, found 252.0635.

4-Nitro norcaradiene (13g)



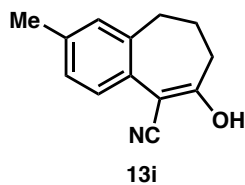
The reaction was run with 22.0 mg (0.0850 mmol) of α -diazo- β -keto nitrile **12g**, and the crude material was purified by silica gel chromatography (1:1 Hexanes:EtOAc) to afford 4.2 mg (20% yield) of **13g** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.43 (m, 1H), 7.37 (dd, $J = 9.4, 1.8$ Hz, 1H), 6.40 (d, $J = 9.5$ Hz, 1H), 4.06 (d, $J = 7.5$ Hz, 1H), 2.64 (m, 2H), 2.51 (ddd, $J = 14.8, 10.3, 4.6$ Hz, 1H), 2.27 (ddd, $J = 14.7, 6.2, 4.4$ Hz, 1H), 2.05 (m, 1H), 1.85 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.74, 148.22, 128.21, 123.68, 122.26, 111.66, 69.01 (broad), 56.12 (broad), 35.61, 30.68, 28.18, 18.31; FTIR (NaCl, thin film) 3083, 2925, 2853, 2242, 1699, 1521, 1344, 1181 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_9\text{N}_2\text{O}_3$ $[\text{M}-\text{H}]^-$ 229.0619, found 229.0623.

5-Oxo-4b,4c,5,6,7,8-hexahydrobenzo[2,3]cyclopropa[1,2-*a*]naphthalene-4c-carbonitrile (13h)



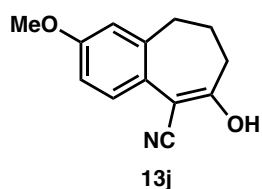
The reaction was run with 25.0 mg (0.0950 mmol) of α -diazo- β -keto nitrile **12h**, and the crude material was purified by chromatography using Florisil as the stationary phase (6:4 Hexanes:EtOAc) to afford 6.9 mg (31% yield) of **13h** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.43 (m, 1H), 7.33 (m, 3H), 6.79 (d, $J = 9.6$ Hz, 1H), 6.08 (dd, $J = 9.6, 1.3$ Hz, 1H), 3.82 (s, 1H), 2.62 (ddd, $J = 18.8, 6.2, 3.5$ Hz, 1H), 2.42 (ddd, $J = 18.7, 11.0, 7.4$ Hz, 1H), 2.29 (m, 2H), 1.92 (m, 1H), 1.84 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 199.72, 131.76, 129.63, 129.44, 128.93, 128.65, 128.47, 127.12, 124.89, 113.06, 42.18, 38.26, 35.50, 27.84, 27.06, 17.28; FTIR (NaCl, thin film) 3042, 2947, 2888, 2239, 1686, 1455, 1326, 1284, 1172, 1120 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{16}\text{H}_{13}\text{NO}$ $[\text{M}-\text{H}]^-$ 234.0924, found 234.0922.

8-Hydroxy-3-methyl-6,7-dihydro-5H-benzo[7]annulene-9-carbonitrile (13i)



The reaction was run with 38.0 mg (0.167 mmol) of α -diazo- β -keto nitrile **12i**, and the crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to afford 31.1 mg (93% yield) of **13i** as a white solid. ^1H NMR (CD_3CN , 500 MHz, compound exists as a 1.5:1 mixture of enol : keto tautomers, only major enol peaks are reported) δ 8.17 (br s, 1H), 7.22 (m, 1H), 7.09 (s, 1H), 7.05 (m, 1H), 2.63 (t, $J = 6.9$ Hz, 3H), 2.28 (m, 2H), 2.17 (m, 5H); ^{13}C NMR (CD_3CN , 126 MHz, compound exists as a 1.5:1 mixture of enol : keto tautomers, only major enol peaks are reported) δ 172.39, 140.77, 137.84, 131.89, 131.01, 128.43, 128.20, 118.66, 87.13, 32.56, 32.38, 31.92, 21.08; FTIR (NaCl, thin film, keto and enol stretches reported) 3139, 2937, 2863, 2216, 1629, 1495, 1392, 1243 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{12}\text{NO}$ $[\text{M}-\text{H}]^-$ 198.0924, found 198.0923.

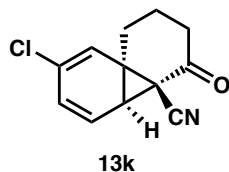
8-Hydroxy-3-methoxy-6,7-dihydro-5H-benzo[7]annulene-9-carbonitrile (**13j**)



The reaction was run with 20.0 mg (0.0823 mmol) of α -diazo- β -keto nitrile **12j**, and the crude material was purified by silica gel chromatography (4:6 Hexanes:EtOAc) to afford 14.4 mg (81% yield) of **13j** as a white solid. ^1H NMR (CD_3CN , 500 MHz, compound exists as a 1.5:1 mixture of enol : keto tautomers, only major enol peaks are reported) δ

7.98 (s, 1H), 7.25 (d, $J = 8.3$ Hz, 1H), 6.85 (s, 1H), 6.81 (m, 1H), 3.78 (s, 3H), 2.64 (t, $J = 6.8$ Hz, 2H), 2.28 (m, 2H), 2.17 (m, 2H); ^{13}C NMR (CD_3CN , 126 MHz, compound exists as a 1.5:1 mixture of enol : keto tautomers, only major enol peaks are reported) δ 171.75, 159.51, 142.47, 129.69, 126.46, 118.74, 115.88, 112.69, 86.69, 55.87, 32.76, 32.23, 31.73; FTIR (NaCl, thin film, keto and enol stretches reported) 3206, 2938, 2868, 2210, 1725, 1631, 1608, 1497, 1376, 1259 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{12}\text{NO}_2$ $[\text{M}-\text{H}]^-$ 214.0874, found 214.0883.

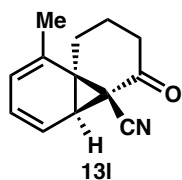
3-Chloro norcaradiene (**13k**)



The reaction was run with 25.0 mg (0.101 mmol) of α -diazo- β -keto nitrile **12k**, and the crude material was purified by chromatography using Florisil as the stationary phase (1:1 Hexanes:EtOAc) to afford 14.6 mg (66% yield) of **13k** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.47 (dd, $J = 9.3, 1.5$ Hz, 1H), 6.29 (dd, $J = 9.3, 6.2$ Hz, 1H), 6.13 (s, 1H),

3.58 (d, $J = 6.1$ Hz, 1H), 2.50 (m, 2H), 2.33 (ddd, $J = 14.4, 11.1, 4.8$ Hz, 1H), 2.22 (dt, $J = 14.4, 4.9$ Hz, 1H), 1.94 (m, 1H), 1.76 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 199.18, 132.13, 129.93, 124.66, 123.05, 112.39, 45.98 (broad), 35.47, 27.73, 17.81; FTIR (NaCl, thin film) 3063, 2945, 2888, 2242, 1684, 1628, 1409, 1321, 1271, 1173 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{12}\text{H}_{10}\text{ClNO}$ $[\text{M}^\bullet]^+$ 219.0451, found 219.0449.

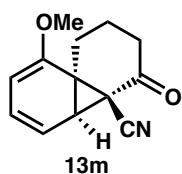
2-Methyl norcaradiene (**13l**)



The reaction was run with 23.0 mg (0.101 mmol) of α -diazo- β -keto nitrile **12l**, and the crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to afford 16.3 mg (81% yield) of **13l** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.35 (dd, $J = 9.3, 6.2$ Hz, 1H), 6.17 (m, 1H), 6.07 (ddd, $J = 9.3, 5.7, 0.9$ Hz, 1H), 3.48 (d, $J = 5.7$ Hz, 1H), 2.56 (ddd, $J =$

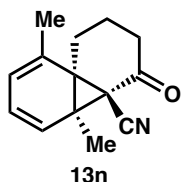
19.3, 6.9, 2.6 Hz, 1H), 2.38 (m, 2H), 2.15 (dt, $J = 14.2, 3.9$ Hz, 1H), 2.06 (s, 3H), 1.88 (m, 1H), 1.69 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 200.79, 134.35, 127.86, 123.43, 119.26, 112.52, 46.87, 38.58, 35.05, 24.76, 24.72, 20.55, 16.57; FTIR (NaCl, thin film) 3057, 2959, 2897, 2235, 1678, 1445, 1325, 1299, 1191 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{12}\text{NO}$ $[\text{M}-\text{H}]^-$ 198.0924, found 198.0928.

2-Methoxy norcaradiene (13m)



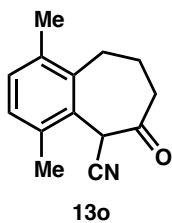
The reaction was run with 19 mg (0.078 mmol) of α -diazo- β -keto nitrile **12m**, and the crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to afford 8.0 mg (47% yield) of **13m** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.39 (ddd, $J = 9.2, 7.0, 0.8$ Hz, 1H), 5.77 (dd, $J = 9.2, 5.5$ Hz, 1H), 5.43 (d, $J = 7.0$ Hz, 1H), 3.71 (s, 3H), 3.44 (d, $J = 5.5$ Hz, 1H), 2.56 (m, 1H), 2.50 (dddd, $J = 19.0, 6.5, 3.4, 0.7$ Hz, 1H), 2.37 (ddd, $J = 19.0, 10.9, 7.4$ Hz, 1H), 2.07 (dt, $J = 14.5, 4.2$ Hz, 1H), 1.86 (m, 1H), 1.65 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 200.33, 155.44, 128.63, 112.61, 112.53, 96.10, 55.79, 44.44, 39.02, 35.41, 23.98, 22.62, 16.94; FTIR (NaCl, thin film) 2954, 2928, 2888, 2236, 1685, 1560, 1389, 1267, 1234, 1185 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 216.1019, found 216.1020.

2,6-Dimethyl norcaradiene (13n)



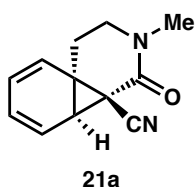
The reaction was run according to a variation of general procedure 7. $\text{Rh}_2(\text{pfb})_4$ was used in place of $\text{Rh}_2(\text{esp})_2$, and the reaction was run at rt instead of -40°C in the glovebox. 100 mg (0.415 mmol) of α -diazo- β -keto nitrile **12n**, and the crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) followed by recrystallization from ethyl acetate/hexanes to afford 21.2 mg (24% yield) of **13n** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.58 (d, $J = 10.1$ Hz, 1H), 6.52 (dd, $J = 10.2, 6.7$ Hz, 1H), 6.10 (d, $J = 6.7$ Hz, 1H), 2.75 (dddd, $J = 18.6, 8.7, 5.4, 0.8$ Hz, 1H), 2.61 (m, 2H), 2.36 (ddd, $J = 16.1, 8.3, 3.7$ Hz, 1H), 2.04 (m, 1H), 2.00 (s, 3H), 1.92 (m, 1H), 1.81 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 202.49, 132.01, 128.11, 125.96, 115.73, 39.98, 26.35, 21.20, 20.22, 19.86; FTIR (NaCl, thin film) 3012, 2951, 2873, 2233, 1723, 1692, 1448, 1323, 1269, 1215 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{16}\text{NO}$ $[\text{M}+\text{H}]^+$ 214.1226, found 214.1235.

1,4-Dimethyl-6-oxo-6,7,8,9-tetrahydro-5H-benzo[7]annulene-5-carbonitrile (13o)



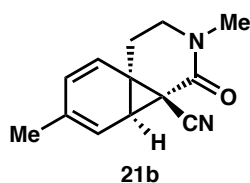
The reaction was run with 31.5 mg (0.130 mmol) of α -diazo- β -keto nitrile **12o**, and the crude material was purified by silica gel chromatography (2% MeOH/DCM) to afford 14.3 mg (50% yield) of **13o** as a white solid. ^1H NMR (CDCl_3 , 500 MHz, compound exists as a 1:1 mixture of enol : keto tautomers, only major keto peaks are reported) δ 7.13 (d, $J = 7.8$ Hz, 1H), 6.99 (d, $J = 7.8$ Hz, 1H), 4.75 (s, 1H), 3.11 (ddd, $J = 15.0, 4.5, 3.3$ Hz, 1H), 2.84 (td, $J = 14.6, 4.7$ Hz, 1H), 2.60 (m, 2H), 2.38 (s, 6H), 2.21 (m, 1H), 1.86 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1:1 mixture of enol : keto tautomers) δ 201.81, 172.70, 137.84, 137.53, 134.57, 134.44, 134.24, 133.15, 131.52, 130.85, 129.78, 129.15, 128.40, 128.17, 116.59, 115.62, 84.13, 46.47, 38.44, 31.08, 29.24, 26.70, 26.33, 25.09, 20.23, 20.21, 20.06, 19.70; FTIR (NaCl, thin film) 3167, 2969, 2864, 2211, 1628, 1588, 1449, 1368, 1331, 1265, 1156 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{14}\text{NO}$ $[\text{M}-\text{H}]^-$ 212.1081, found 212.1073.

Amido norcaradiene (21a)



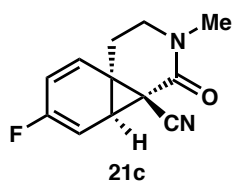
The reaction was run with 25.0 mg (0.109 mmol) of α -diazo- β -amido nitrile **20a**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 15.3 mg (70% yield) of **21a** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.54 (m, 2H), 6.28 (t, J = 7.5 Hz, 1H), 6.11 (d, J = 8.0 Hz, 1H), 4.06 (d, J = 7.1 Hz, 1H), 3.33 (m, 2H), 3.07 (s, 3H), 2.62 (ddd, J = 15.2, 10.1, 5.6 Hz, 1H), 2.37 (dt, J = 14.4, 4.4 Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 164.70, 127.91, 127.51, 124.54, 123.59, 113.55, 63.49 (broad), 45.37, 36.05, 27.43, 25.75 (broad); FTIR (NaCl, thin film) 3044, 2932, 2878, 2240, 1651, 1504, 1442, 1402, 1344 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{11}\text{N}_2\text{O}$ $[\text{M}-\text{H}]^-$ 199.0877, found 199.0881.

4-Methyl amido norcaradiene (21b)



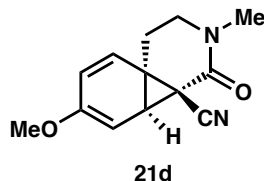
The reaction was run with 22 mg (0.091 mmol) of α -diazo- β -amido nitrile **20b**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 8.0 mg (42% yield) of **21b** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.28 (d, J = 9.0 Hz, 1H), 6.01 (d, J = 9.0 Hz, 1H), 5.94 (d, J = 6.5 Hz, 1H), 3.61 (d, J = 6.5 Hz, 1H), 3.26 (m, 2H), 3.03 (s, 3H), 2.54 (ddd, J = 14.2, 10.5, 6.8 Hz, 1H), 2.24 (dt, J = 14.2, 3.8 Hz, 1H), 1.99 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 164.94, 136.38, 129.61, 124.81, 119.11, 113.60, 51.55 (broad), 44.84, 35.93, 26.47, 21.86; FTIR (NaCl, thin film) 3030, 2937, 2883, 2240, 1646, 1501, 1451, 1344 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 215.1179, found 215.1174.

4-Fluoro amido norcaradiene (21c)



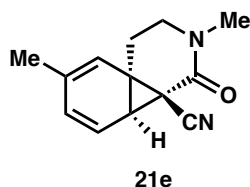
The reaction was run with 33.0 mg (0.134 mmol) of α -diazo- β -amido nitrile **20c**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 17.8 mg (61% yield) of **21c** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.41 (ddd, J = 12.6, 8.6, 2.1 Hz, 1H), 6.20 (dd, J = 8.5, 5.5 Hz, 1H), 6.10 (td, J = 8.3, 2.1 Hz, 1H), 4.65 (m, 1H), 3.47 (ddd, J = 13.0, 6.4, 4.5 Hz, 1H), 3.32 (ddd, J = 13.0, 8.5, 4.4 Hz, 1H), 3.09 (s, 3H), 2.67 (m, 1H), 2.44 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 163.85, 161.31, 159.31, 124.99 (d, J = 10.1 Hz), 116.41 (d, J = 30.0 Hz), 113.96, 112.01 (broad), 83.34 (broad), 46.31, 36.30, 33.02 (broad), 28.59; FTIR (NaCl, thin film) 3071, 2947, 2888, 2241, 1651, 1501, 1454, 1404, 1342, 1151 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{11}\text{FN}_2\text{O}$ $[\text{M}+\text{H}]^+$ 219.0928, found 219.0918.

4-Methoxy amido norcaradiene (**21d**)



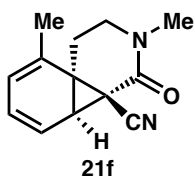
The reaction was run with 25.5 mg (0.100 mmol) of α -diazo- β -amido nitrile **20d**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 19.1 mg (83% yield) of **21d** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.15 (dd, J = 9.5, 2.1 Hz, 1H), 6.06 (d, J = 9.5 Hz, 1H), 5.28 (br d, J = 7.3 Hz, 1H), 3.68 (br s, 1H), 3.65 (s, 3H), 3.28 (m, 2H), 3.03 (s, 3H), 2.51 (m, 1H), 2.24 (dt, J = 14.1, 3.8 Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 164.76, 156.75, 126.67, 122.44 (broad), 113.70, 95.14 (broad), 54.97, 44.73, 35.80, 26.08, 22.13 (broad); FTIR (NaCl, thin film) 3050, 2936, 2240, 1650, 1501, 1446, 1402, 1240 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}_2$ $[\text{M}+\text{H}]^+$ 231.1128, found 231.1121.

3-Methyl amido norcaradiene (**21e**)



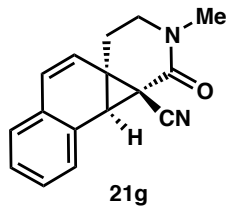
The reaction was run with 32.0 mg (0.132 mmol) of α -diazo- β -amido nitrile **20e**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 16.0 mg (57% yield) of **21e** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.30 (d, J = 9.0 Hz, 1H), 6.17 (dd, J = 8.5, 6.6 Hz, 1H), 5.76 (s, 1H), 3.55 (d, J = 6.3 Hz, 1H), 3.25 (m, 2H), 3.02 (s, 3H), 2.51 (ddd, J = 14.2, 11.1, 6.5 Hz, 1H), 2.23 (dt, J = 14.2, 3.2 Hz, 1H), 1.98 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 165.00, 135.66, 130.15, 122.65, 121.25, 113.58, 57.00 (broad), 49.30 (broad), 44.78, 35.91, 26.57, 21.89; FTIR (NaCl, thin film) 3030, 2937, 2883, 2240, 1646, 1501, 1443, 1342, 1240 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 215.1179, found 215.1175.

2-Methyl amido norcaradiene (**21f**)



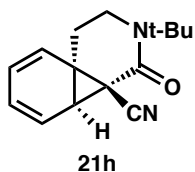
The reaction was run with 20 mg (0.083 mmol) of α -diazo- β -amido nitrile **20f**, and the crude material was purified by silica gel chromatography (7:3 EtOAc:hexanes) followed by preparative HPLC (85:15 EtOAc:Hexanes, SiO_2 column, 5 mL/min) to afford 3.6 mg (20% yield) of **21f** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.30 (dd, J = 9.2, 6.3 Hz, 1H), 6.15 (m, 1H), 6.04 (ddd, J = 9.2, 5.8, 0.8 Hz, 1H), 3.29 (d, J = 5.8 Hz, 1H), 3.23 (m, 1H), 3.18 (ddd, J = 13.5, 6.4, 2.1 Hz, 1H), 3.01 (s, 3H), 2.53 (td, J = 13.2, 6.3 Hz, 1H), 2.17 (ddd, J = 13.9, 4.1, 2.0 Hz, 1H), 2.03 (s, 3H); ^{13}C NMR (CD_2Cl_2 , 126 MHz) δ 165.38, 132.52, 127.24, 123.67, 119.26, 112.81, 45.23, 43.97, 38.33, 35.81, 23.72, 20.56, 16.55; FTIR (NaCl, thin film) 3049, 2932, 2884, 2241, 1648, 1502, 1447, 1403, 1344, 1271 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 215.1179, found 215.1169.

Benzo amido norcaradiene (**21g**)



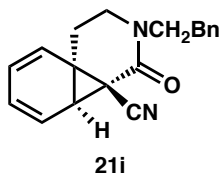
The reaction was run with 21.5 mg (0.77 mmol) of α -diazo- β -amido nitrile **20g**, and the crude material was purified by silica gel chromatography (8:2 EtOAc:hexanes) to afford 9.3 mg (48% yield) of **21g** as a yellow solid. ^1H NMR (CD_2Cl_2 , 500 MHz) δ 7.47 (m, 1H), 7.35 (m, 3H), 6.79 (d, J = 9.7 Hz, 1H), 6.08 (dd, J = 9.6, 1.3 Hz, 1H), 3.68 (s, 1H), 3.36 (td, J = 13.3, 4.5 Hz, 1H), 3.22 (ddd, J = 13.7, 6.2, 1.7 Hz, 1H), 3.02 (s, 3H), 2.48 (td, J = 13.7, 6.2 Hz, 1H), 2.25 (ddd, J = 13.9, 4.4, 1.7 Hz, 1H); ^{13}C NMR (CD_2Cl_2 , 126 MHz) δ 164.60, 132.25, 130.23, 129.73, 129.20, 129.12, 128.72, 128.04, 124.53, 114.30, 44.64, 39.55, 36.28, 36.12, 25.82, 19.89; FTIR (NaCl, thin film) 3016, 2918, 2888, 2238, 1644, 1504, 1443, 1342, 1269 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{16}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 251.1179, found 251.1169.

Amido norcaradiene (**21h**)



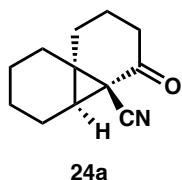
The reaction was run with 26.5 mg (0.100 mmol) of α -diazo- β -amido nitrile **20h**, and the crude material was purified by silica gel chromatography (6:4 EtOAc:hexanes) to afford 19.4 mg (80% yield) of **21h** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 6.61 (m, 2H), 6.33 (t, J = 7.5 Hz, 1H), 6.15 (m, 1H), 4.58 (d, J = 7.9 Hz, 1H), 3.55 (ddd, J = 13.0, 6.0, 4.4 Hz, 1H), 3.27 (ddd, J = 13.2, 9.4, 4.0 Hz, 1H), 2.61 (ddd, J = 13.8, 9.2, 4.3 Hz, 1H), 2.41 (m, 1H), 1.48 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 165.39, 128.71, 128.39, 125.08, 123.69, 114.31, 82.20 (broad), 58.76, 41.29, 35.16 (broad), 30.52, 28.02; FTIR (NaCl, thin film) 2977, 2918, 2885, 2243, 1633, 1447, 1358, 1225 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{15}\text{H}_{19}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 243.1492, found 243.1480.

Amido norcaradiene (**21i**)



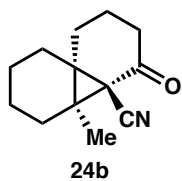
The reaction was run with 27.0 mg (0.0850 mmol) of α -diazo- β -amido nitrile **20i**, and the crude material was purified by silica gel chromatography (6:4 EtOAc:hexanes) to afford 24.2 mg (93% yield) of **21i** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.32 (m, 2H), 7.24 (m, 3H), 6.51 (m, 2H), 6.23 (t, J = 7.3 Hz, 1H), 6.06 (d, J = 8.0 Hz, 1H), 3.80 (m, 2H), 3.61 (ddd, J = 13.5, 7.6, 6.1 Hz, 1H), 3.07 (ddd, J = 13.1, 5.4, 4.2 Hz, 1H), 2.96 (m, 3H), 2.42 (m, 1H), 2.19 (td, J = 14.3, 4.2 Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 164.64, 128.86, 128.63, 127.95, 127.56, 126.66, 124.49, 123.67, 113.51, 64.02 (broad), 50.72, 44.70, 33.66, 27.65, 26.13 (broad); FTIR (NaCl, thin film) 3025, 2929, 2859, 2241, 1646, 1495, 1454 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{19}\text{H}_{19}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 291.1492, found 291.1482.

4-Oxodecahydrocyclopropa[1,2:1,3]dibenzene-4a-carbonitrile (**24a**)



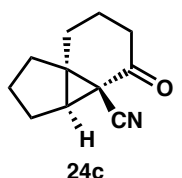
The reaction was run with 20.2 mg (0.0931 mmol) of α -diazo- β -keto nitrile **23a**, and the crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to afford 14.4 mg (82% yield) of **24a** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 2.42 (dddd, J = 19.1, 6.2, 2.4, 0.9 Hz, 1H), 2.33 (dd, J = 8.1, 1.9 Hz, 1H), 2.08 (m, 4H), 1.90 (m, 3H), 1.76 (m, 1H), 1.63 (m, 3H), 1.37 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 199.77, 116.51, 36.68, 35.30, 34.89, 29.49, 28.33, 28.29, 20.37, 20.34, 20.32, 16.63; FTIR (NaCl, thin film) 2942, 2916, 2848, 2228, 1682, 1557, 1455 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{14}\text{NO}$ $[\text{M}-\text{H}]^-$ 188.1081, found 188.1080.

4b-Methyl-4-oxodecahydrocyclopropa[1,2:1,3]dibenzene-4a-carbonitrile (**24b**)



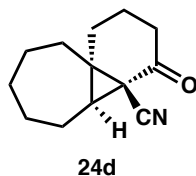
The reaction was run with 29.0 mg (0.125 mmol) of α -diazo- β -keto nitrile **23b**, and the crude material was purified by silica gel chromatography (75:25 Hexanes:EtOAc) to afford 19.4 mg (76% yield) of **24b** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 2.45 (m, 1H), 2.18 (ddd, J = 14.8, 6.8, 5.1 Hz, 1H), 2.06 (m, 2H), 1.86 (m, 6H), 1.62 (m, 2H), 1.37 (m, 2H), 1.24 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 201.36, 118.06, 38.71, 38.67, 38.62, 35.07, 31.41, 31.33, 29.08, 22.63, 20.86, 20.55, 20.43; FTIR (NaCl, thin film) 2942, 2878, 2227, 1696, 1448, 1322, 1266 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{NO}$ $[\text{M}-\text{H}]^-$ 202.1237, found 202.1245.

4-Oxo-octahydro-1H-cyclopenta[1,3]cyclopropa[1,2]benzene-3b-carbonitrile (**24c**)



The reaction was run with 50 mg (0.25 mmol) of α -diazo- β -keto nitrile **23c**, and the crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to afford 40 mg (93% yield) of **24c** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 2.40 (m, 2H), 2.23 (m, 3H), 2.06 (m, 4H), 1.87 (m, 3H), 1.67 (m, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 198.67, 116.14, 47.77, 38.34, 35.99, 35.76, 33.18, 27.29, 25.16, 22.34, 19.40; FTIR (NaCl, thin film) 2936, 2866, 2233, 1698, 1466, 1326, 1303, 1179, 1080 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+$ 176.1070, found 176.1076.

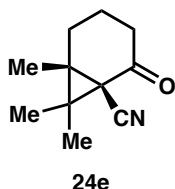
4-Oxodecahydro-1H-benzo[1,3]cyclopropa[1,2][7]annulene-4a-carbonitrile (**24d**)



The reaction was run with 61 mg (0.26 mmol) of α -diazo- β -keto nitrile **23d**, and the crude material was purified by silica gel chromatography (75:25 Hexanes:EtOAc) to afford 50 mg (92% yield) of **24d** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 2.40 (m, 1H), 2.22 (m, 4H), 2.05 (ddd, J = 14.7, 6.7, 1.3 Hz, 1H), 1.78 (m, 7H), 1.48 (m, 2H), 1.32 (m, 2H); ^{13}C

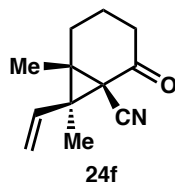
NMR (CDCl₃, 126 MHz) δ 199.30, 116.15, 40.46, 40.22, 35.38, 33.88, 33.62, 31.45, 27.58, 27.39, 27.34, 25.59, 17.22; FTIR (NaCl, thin film) 2925, 2852, 2234, 1694, 1465, 1325, 1291, 1138 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₈NO [M+H]⁺ 204.1383, found 204.1391.

6,7,7-Trimethyl-2-oxobicyclo[4.1.0]heptane-1-carbonitrile (**24e**)



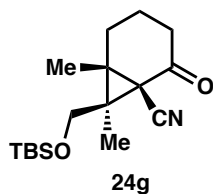
The reaction was run with 35.0 mg (0.171 mmol) of α -diazo- β -keto nitrile **23e**, and the crude material was purified by silica gel chromatography (1:1 Hexanes:EtOAc) to afford 27.2 mg (90% yield) of **24e** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 2.51 (m, 1H), 2.03 (m, 1H), 1.86 (m, 4H), 1.46 (s, 3H), 1.41 (s, 3H), 1.27 (s, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 201.26, 117.34, 39.55, 39.43, 38.79, 35.70, 27.05, 22.81, 21.18, 20.30, 19.46; FTIR (NaCl, thin film) 3005, 2953, 2878, 2848, 2231, 1698, 1455, 1323, 1279, 1093 cm⁻¹; HRMS (MM) calc'd for C₁₁H₁₆NO [M+H]⁺ 178.1226, found 178.1218.

Vinylcyclopropyl ketone (**24f**)



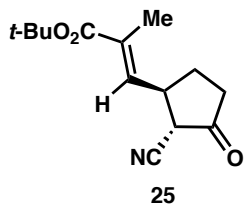
The reaction was run with 31.0 mg (0.143 mmol) of α -diazo- β -keto nitrile **23f**, and the crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to afford 21.4 mg (79% yield) of **24f** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 5.97 (dd, J = 17.2, 10.9 Hz, 1H), 5.41 (dd, J = 10.9, 0.7 Hz, 1H), 5.37 (dd, J = 17.2, 0.7 Hz, 1H), 2.55 (m, 1H), 2.09 (m, 1H), 1.89 (m, 4H), 1.48 (s, 3H), 1.36 (s, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 200.21, 136.16, 119.05, 116.81, 42.82, 39.31, 38.81, 36.59, 27.16, 22.55, 21.12, 16.01; FTIR (NaCl, thin film) 3091, 2992, 2952, 2878, 2232, 1703, 1455, 1323, 1274, 1162 cm⁻¹; HRMS (FAB+) calc'd for C₁₂H₁₆NO [M+H]⁺ 190.1232, found 190.1252.

Cyclopropyl ketone (**24g**)



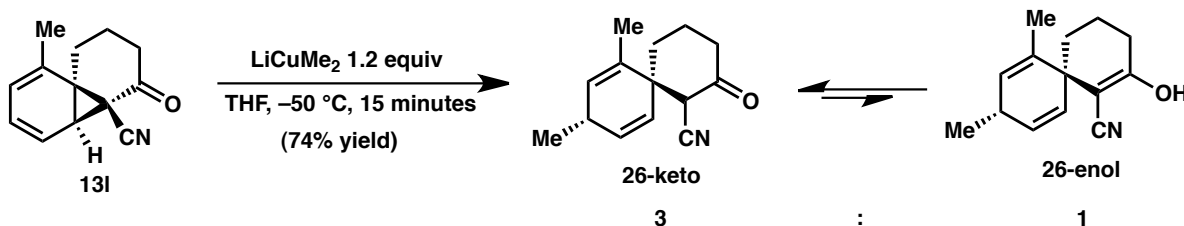
The reaction was run with 35.0 mg (0.104 mmol) of α -diazo- β -keto nitrile **23g**, and the crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to afford 29.7 mg (93% yield) of **24g** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 3.79 (d, J = 10.7 Hz, 1H), 3.72 (d, J = 10.7 Hz, 1H), 2.49 (m, 1H), 2.04 (m, 1H), 1.85 (m, 4H), 1.49 (s, 3H), 1.29 (m, 3H), 0.89 (s, 9H), 0.08 (s, 3H), 0.06 (s, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 200.59, 116.70, 65.67, 42.54, 38.87, 38.71, 34.04, 27.42, 25.73, 22.88, 19.84, 18.17, 14.93, -5.51, -5.55; FTIR (NaCl, thin film) 2953, 2929, 2884, 2856, 2232, 1701, 1472, 1257, 1095 cm⁻¹; HRMS (MM) calc'd for C₁₇H₂₉NO₂Si [M-H]⁻ 306.1895, found 306.1907.

Cyclopentanone (**25**)



The reaction was run with 44 mg (0.16 mmol) of α -diazo- β -keto nitrile **23h**, and the crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to afford 16 mg (40% yield) of **25** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, exists as an 85:15 equilibrating mixture of *trans* : *cis* diastereomers, only major *trans* peaks are reported) δ 6.48 (dq, J = 9.6, 1.5 Hz, 1H), 3.39 (tdd, J = 12.0, 9.6, 6.3 Hz, 1H), 3.07 (d, J = 12.0 Hz, 1H), 2.58 (m, 1H), 2.43 (ddd, J = 19.3, 11.9, 8.8 Hz, 1H), 2.28 (dddd, J = 13.3, 8.8, 6.2, 1.4 Hz, 1H), 1.94 (d, J = 1.5 Hz, 3H), 1.80 (dtd, J = 13.3, 12.0, 8.7 Hz, 1H), 1.50 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 204.74, 166.31, 136.76, 133.69, 115.54, 81.06, 45.70, 41.57, 36.63, 28.01, 27.54, 13.10; FTIR (NaCl, thin film) 3275, 2978, 2933, 2247, 1762, 1706, 1368, 1293, 1253, 1153 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{14}\text{H}_{20}\text{NO}_3$ $[\text{M}+\text{H}]^+$ 250.1443, found 250.1439.

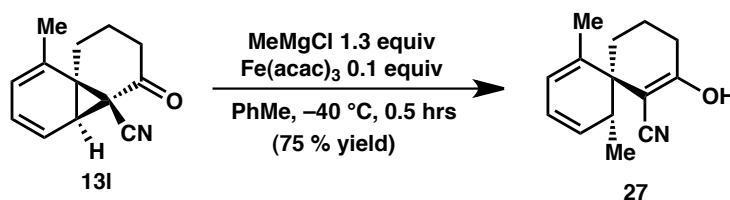
Preparation of 7,9-dimethyl-2-oxospiro[5.5]undeca-7,10-diene-1-carbonitrile (**26**)



To an oven-dried 25 mL flask was added cuprous iodide (74 mg, 0.39 mmol). The flask was sealed, flushed with nitrogen, and charged with THF (6 mL). The CuI/THF slurry was cooled to $-10\text{ }^\circ\text{C}$ and methyllithium (1.2 M Et_2O , 550 μL , 0.66 mmol) was added fast dropwise to the rapidly stirred mixture. Within 30 seconds the CuI dissolved, affording a pale yellow solution. In a separate flask norcaradiene **13I** (55 mg, 0.28 mmol) was dissolved in THF (5 mL) and cooled to $-78\text{ }^\circ\text{C}$. The $\text{Me}_2\text{CuLi/THF}$ solution was cannula transferred dropwise to the norcaradiene at $-78\text{ }^\circ\text{C}$. The initially bright yellow reaction transformed into a murky orange mixture upon the completion of the cuprate addition. After stirring for an additional 15 minutes, TLC analysis indicated consumption of the starting material and the reaction was quenched with excess aqueous NH_4Cl . The reaction was warmed to $22\text{ }^\circ\text{C}$ and 2 drops of aqueous NH_4OH were added. The mixture was extracted twice with ethyl acetate, and the combined organics washed with brine and dried over Na_2SO_4 . The solvent was removed by rotary evaporation under reduced pressure, and the crude residue was purified by flash chromatography (0 \rightarrow 15 \rightarrow 40% EtOAc/hexanes), yielding diene **26** (44 mg, 74% yield) as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as a 3:1 mixture of ketone : enol tautomers, keto tautomer designated by *, enol tautomer denoted by s) δ 5.99 (br s, 1H^s), 5.94 (m, 1H^*), 5.70 (m, 1H^s), 5.66 (m, 1H^*), 5.60 (m, 2H^s), 5.49 (dd, J = 10.2, 1.9 Hz, 1H^*), 3.82 (s, 1H^*), 2.89 (m, 1H^*), 2.82 (m, 1H^s), 2.60 (m, 1H^*), 2.37 (m, 1H^*), 2.26 (m, 3H^s), 2.20 (m, 1H^*),

2.04 (m, 2H^{*}), 1.84 (m, 3H^{*}), 1.82 (m, 2H[§]), 1.70 (s, 3H[§]), 1.67 (m, 1H^{*}), 1.52 (m, 1H[§]), 1.05 (d, $J = 7.4$ Hz, 3H^{*}), 1.03 (d, $J = 7.3$ Hz, 1H[§]); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 3:1 mixture of ketone : enol tautomers, keto tautomer designated by *, enol tautomer denoted by §) δ 200.12^{*}, 166.83[§], 135.22^{*}, 133.00[§], 131.66^{*}, 130.92^{*}, 130.26[§], 130.05[§], 129.34[§], 122.75^{*}, 117.08[§], 114.67^{*}, 90.87[§], 52.43^{*}, 47.63^{*}, 40.70[§], 40.19^{*}, 35.09^{*}, 33.55[§], 31.36^{*}, 31.17[§], 27.66[§], 22.02[§], 21.50^{*}, 21.17^{*}, 19.12[§], 18.18^{*}, 17.85[§]; FTIR (NaCl, thin film) 3330, 3022, 2958, 2925, 2871, 2248, 2203, 1725, 1448, 1340, 1203, 1171 cm⁻¹; HRMS (MM) calc'd for C₁₄H₁₆NO [M-H]⁻ 214.1237, found 214.1228.

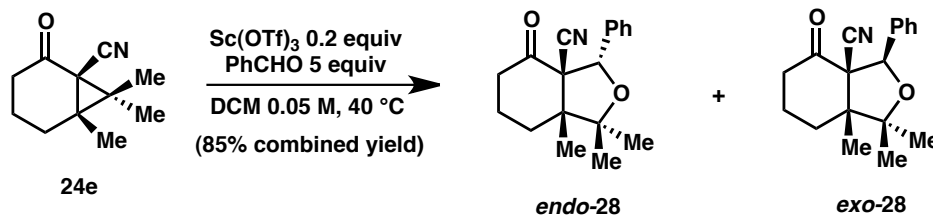
Preparation of 2-hydroxy-7,11-dimethylspiro[5.5]undeca-1,7,9-triene-1-carbonitrile (**27**)



Procedure adapted from the work of Furstner et al.⁶ To an oven-dried 25 mL flask was norcaradiene **13I** (44 mg, 0.24 mmol) and Fe(acac)₃ (8.3 mg, 0.024 mmol). The flask was sealed, flushed with nitrogen, and charged with toluene (6 mL). Dissolution of the highly crystalline norcaradiene **13I** was achieved by vigorous stirring of the mixture for 10 minutes at 22 °C. The clear red solution was cooled to - 50 °C, and methylmagnesium chloride (3.0M THF, 102 μ L, 0.31 mmol) was added dropwise. The brown solution was stirred for 0.5 hours at that temperature, after which TLC analysis indicated consumption of the starting material. The reaction was quenched with 2 equivalents of acetic acid in THF and warmed to 22 °C. The mixture was extracted twice with ethyl acetate, and the combined organics washed with water, brine and dried over Na₂SO₄. The solvent was removed by rotary evaporation under reduced pressure, and the crude residue was purified by flash chromatography (0→20% EtOAc/hexanes), yielding diene **27** (36 mg, 75% yield) as a white solid. ¹H NMR (CDCl₃, 600 MHz, compound exists as a >10:1 mixture of enol : ketone tautomers, only major enol peaks are reported) δ 6.00 (s, 1H), 5.83 (m, 1H), 5.79 (m, 1H), 5.48 (d, $J = 9.2$ Hz, 1H), 2.86 (m, 1H), 2.25 (t, $J = 6.5$ Hz, 2H), 1.81 (s, 3H), 1.71 (m, 3H), 1.57 (m, 1H), 1.02 (d, $J = 7.5$ Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a >10:1 mixture of enol : ketone tautomers, only major enol peaks are reported) δ 168.74, 141.93, 130.38, 124.08, 121.54, 117.12, 89.51, 43.58, 38.17, 27.89, 24.10, 21.79, 18.57, 15.06; FTIR (NaCl, thin film) 3350, 3038, 2963, 2234, 2203, 1728, 1447, 1381, 1309, 1208, 1154 cm⁻¹; HRMS (MM) calc'd for C₁₄H₁₆NO [M-H]⁻ 214.1237, found 214.1241.

⁶ Sherry, B. D.; Furstner, A. *Chem. Commun.* **2009**, 7116.

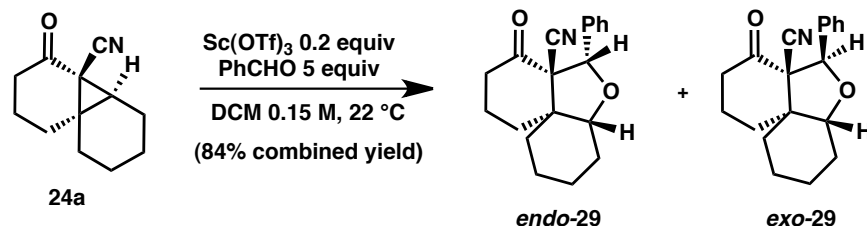
Preparation of 1,1,7a-trimethyl-4-oxo-3-phenyloctahydroisobenzofuran-3a-carbonitrile (28) and diastereomer



Procedure adapted from the work of Johnson et al.⁷ To an oven-dried 1 dram vial under nitrogen was added scandium(III) triflate (28 mg, 0.058 mmol) followed by DCM (1 mL). In a separate flask cyclopropane **24e** (51 mg, 0.29 mmol) and benzaldehyde (147 μ L, 1.5 mmol) were dissolved in DCM (5 mL), and this solution was added in one portion to the $\text{Sc}(\text{OTf})_3$ at 22 $^\circ\text{C}$ (6 mL DCM total, 0.05 M). The murky reaction was heated to 40 $^\circ\text{C}$, at which time the catalyst dissolved and a clear yellow solution resulted. After stirring for 10 minutes at that temperature, TLC analysis indicated consumption of the starting material. The reaction was cooled to 22 $^\circ\text{C}$, directly transferred onto a silica plug, and eluted with excess diethyl ether. The solvent was removed by rotary evaporation under reduced pressure, and ^1H NMR analysis of the crude indicated a 1 : 3.3 ratio of *endo* : *exo* products. The crude residue was purified by flash chromatography (0 \rightarrow 15 \rightarrow 30% EtOAc/hexanes), yielding *endo*-ketone **28** (18 mg, 20% yield) and *exo*-ketone **28** (53 mg, 65% yield) both as white solids. **Endo diastereomer 28**: ^1H NMR (CDCl_3 , 500 MHz) δ 7.34 (m, 5H), 5.64 (s, 1H), 2.10 (m, 1H), 2.00 (m, 1H), 1.88 (m, 1H), 1.65 (m, 2H), 1.58 (m, 4H), 1.42 (s, 3H), 1.32 (s, 3H), 1.14 (ddd, $J = 15.9, 12.8, 6.3$ Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 201.91, 135.96, 128.56, 128.43, 126.26, 120.68, 87.10, 84.24, 67.25, 54.78, 40.35, 32.19, 22.70, 22.64, 20.18, 18.79; FTIR (NaCl, thin film) 2961, 2883, 2238, 1713, 1451, 1424, 1392, 1213, 1109 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{18}\text{H}_{21}\text{NO}_2$ $[\text{M}-\text{H}]^-$ 282.1500, found 282.1508. **Exo diastereomer 28**: ^1H NMR (CDCl_3 , 500 MHz) δ 7.33 (m, 5H), 5.60 (s, 1H), 2.71 (m, 2H), 2.13 (m, 2H), 2.02 (m, 1H), 1.77 (m, 1H), 1.57 (s, 3H), 1.36 (s, 3H), 1.33 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 201.20, 136.96, 128.69, 128.41, 125.98, 116.52, 87.28, 80.85, 69.02, 55.88, 37.85, 31.12, 26.46, 24.35, 21.63, 19.62; FTIR (NaCl, thin film) 2999, 2961, 2882, 2238, 1710, 1451, 1424, 1393, 1242, 1110 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{18}\text{H}_{21}\text{NO}_2$ $[\text{M}-\text{H}]^-$ 282.1500, found 282.1504.

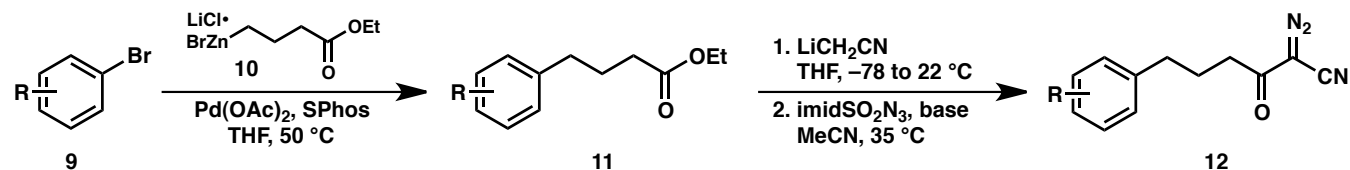
⁷ Parsons, A. T.; Johnson, J. S. *J. Am. Chem. Soc.* **2009**, *131*, 3122.

Preparation of 7-oxo-6-phenyldecahydro-1*H*-dibenzo[*b,c*]furan-6 α -carbonitrile (**29**) and diastereomer



Procedure adapted from the work of Johnson et al.¹⁵ To an oven-dried 1 dram vial under nitrogen was added scandium(III) triflate (7.8 mg, 0.015 mmol). In a separate flask cyclopropane **24a** (15 mg, 0.080 mmol) and benzaldehyde (42 μL , 0.40 mmol) were dissolved in DCM (530 μL , 0.15 M), and this solution was added in one portion to the Sc(OTf)_3 at 22 $^\circ\text{C}$. The clear yellow solution was stirred at 22 $^\circ\text{C}$ for 24 hours, at which time TLC analysis indicated consumption of the starting material. The reaction directly transferred onto a silica plug, and eluted with excess diethyl ether. The solvent was removed by rotary evaporation under reduced pressure, and ^1H NMR analysis of the crude indicated a 1 : 3.5 ratio of *endo* : *exo* products. The crude residue was purified by flash chromatography (0 \rightarrow 15 \rightarrow 30% EtOAc/hexanes), yielding *endo*-ketone **29** (5 mg, 21% yield) and *exo*-ketone **29** (15 mg, 63% yield) both as white solids. **Endo diastereomer 29**: ^1H NMR (CDCl_3 , 500 MHz) δ 7.34 (m, 5H), 5.55 (s, 1H), 3.72 (dd, J = 12.1, 3.9 Hz, 1H), 2.08 (m, 2H), 2.02 (m, 1H), 1.93 (m, 2H), 1.79 (m, 3H), 1.69 (m, 1H), 1.64 (ddd, J = 14.0, 3.0, 1.8 Hz, 1H), 1.50 (m, 3H), 0.91 (ddd, J = 15.7, 13.9, 6.4 Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 202.01, 136.01, 128.62, 128.55, 126.00, 118.96, 87.20, 85.21, 68.11, 53.51, 40.36, 28.74, 24.42, 23.13, 22.75, 20.53, 20.02; FTIR (NaCl, thin film) 2944, 2870, 2239, 1710, 1452, 1345, 1234, 1155, 1070 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{19}\text{H}_{20}\text{NO}_2$ $[\text{M}-\text{H}]^-$ 294.1500, found 294.1507. **Exo diastereomer 29**: ^1H NMR (CDCl_3 , 500 MHz) δ 7.36 (m, 3H), 7.21 (m, 2H), 5.58 (s, 1H), 4.00 (dd, J = 12.0, 4.0 Hz, 1H), 2.79 (m, 1H), 2.66 (m, 1H), 2.12 (m, 3H), 1.89 (m, 4H), 1.75 (m, 1H), 1.67 (m, 2H), 1.50 (qt, J = 13.4, 4.4 Hz, 1H), 1.39 (qt, J = 13.4, 4.4 Hz, 1H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 201.21, 137.46, 128.65, 128.63, 125.40, 114.92, 86.44, 82.73, 70.81, 55.65, 37.70, 28.69, 24.80, 23.06, 22.57, 21.35, 20.35; FTIR (NaCl, thin film) 2944, 2870, 2245, 1713, 1452, 1318, 1240, 1152, 1072 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{19}\text{H}_{20}\text{NO}_2$ $[\text{M}-\text{H}]^-$ 294.1500, found 294.1500.

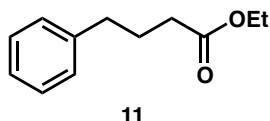
General procedure for the synthesis of α -diazo- β -ketonitriles



General procedure 4 for the cross coupling of aryl halides and 4-Ethoxy-4-oxobutylzinc bromide (10).

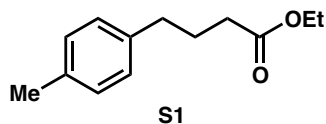
Adapted from the work of Knochel et al.⁸ A dry and argon flushed 20 mL Schlenk-tube is charged with the aryl bromide (**9**, 2.50 mmol, 1 equiv), Pd(OAc)₂ (0.25 mmol, 0.01 equiv), S-Phos (0.50 mmol, 0.02 equiv) and THF (2.5 mL). After stirring the reaction mixture for 5 min, 4-Ethoxy-4-oxobutylzinc bromide (**10**, 3 mmol, 1.2 equiv, 0.40 M in THF) is added (mildly exothermic), affording a light yellow solution. The reaction mixture was heated to 50 °C for 2 hours, during which time the color had progressed to dark brown/black. Then, the reaction mixture was cooled to room temperature and quenched with a saturated aqueous NH₄Cl solution, and extracted with 1:1 v/v hexanes/ethyl acetate. The organic layer was washed with brine, dried over sodium sulfate, and the solvent was removed by rotary evaporation under reduced pressure. The crude residue was purified by silica gel chromatography to afford the aryl-butanoate products.

Ethyl 4-phenylbutanoate (**11**)



The reaction was run on 3.75 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 560 mg (78% yield) of **11** as a colorless oil. The spectral data is consistent with that reported in the literature.⁹

Ethyl 4-(*p*-tolyl)butanoate (**S1**)

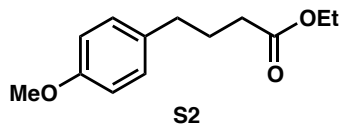


The reaction was run on 3.75 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 470 mg (60% yield) of **S1** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 7.08 (m, 4H), 4.12 (q, J = 7.1 Hz, 2H), 2.61 (t, J = 7.6 Hz, 2H), 2.31 (s, 3H), 2.30 (t, J = 7.6 Hz, 2H), 1.93 (m, 2H), 1.25 (t, J = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 173.48, 138.27, 135.31, 128.98, 128.30, 60.17, 34.63, 33.61, 26.61, 20.94, 14.20; FTIR (NaCl, thin film) 2977, 2924, 2858, 1733, 1515, 1373, 1243, 1145 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₉O₂ [M+H]⁺ 207.1380, found 207.1389.

⁸ Manolikakes, G.; Hernandez, C. M.; Schade, M. A.; Metzger, A.; Knochel, P. *J. Org. Chem.* **2008**, *73*, 8422.

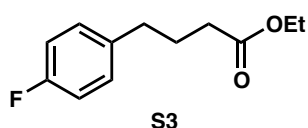
⁹ Everson, D. A.; Shrestha, R.; Weix, D. J. *J. Am. Chem. Soc.* **2010**, *132*, 920.

Ethyl 4-(4-methoxyphenyl)butanoate (S2)



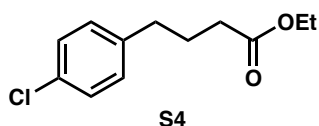
The reaction was run on 3.25 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 600 mg (85% yield) of **S2** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.09 (m, 2H), 6.83 (m, 2H), 4.12 (q, $J = 7.1$ Hz, 2H), 3.79 (s, 3H), 2.59 (t, $J = 7.6$ Hz, 2H), 2.30 (t, $J = 7.6$ Hz, 2H), 1.92 (m, 2H), 1.25 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.53, 157.81, 133.46, 129.34, 113.73, 60.20, 55.20, 34.19, 33.59, 26.76, 14.22.; FTIR (NaCl, thin film) 2980, 2936, 2860, 2835, 1732, 1612, 1583, 1513, 1464, 1373, 1300, 1246 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{19}\text{O}_3$ $[\text{M}+\text{H}]^+$ 223.1329, found 223.1339.

Ethyl 4-(4-fluorophenyl)butanoate (S3)



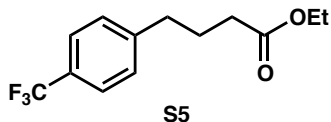
The reaction was run on 3.25 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 590 mg (84% yield) of **S3** as a pale yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.13 (m, 2H), 6.96 (t, $J = 8.7$ Hz, 2H), 4.12 (q, $J = 7.1$ Hz, 2H), 2.62 ($J = 7.5$ Hz, 2H), 2.30 (t, $J = 7.5$ Hz, 2H), 1.93 (m, 2H), 1.25 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.37, 161.33 (d, $J_{\text{C-F}} = 243.5$ Hz), 137.00 (d, $J_{\text{C-F}} = 3.3$ Hz), 129.77 (d, $J_{\text{C-F}} = 7.9$ Hz), 115.07 (d, $J_{\text{C-F}} = 21.1$ Hz), 60.29, 34.27, 33.51, 26.63, 26.62, 14.22; FTIR (NaCl, thin film) 3039, 2981, 2937, 2868, 1732, 1600, 1510, 1374, 1221 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{12}\text{H}_{15}\text{FO}_2$ $[\text{M}\cdot]^+$ 210.1056, found 210.1049.

Ethyl 4-(4-chlorophenyl)butanoate (S4)



The reaction was run on 3.25 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 586 mg (78% yield) of **S4** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.24 (m, 2H), 7.11 (m, 2H), 4.12 (q, $J = 7.1$ Hz, 2H), 2.62 (t, $J = 7.5$ Hz, 2H), 2.30 (t, $J = 7.5$ Hz, 2H), 1.92 (m, 2H), 1.25 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.28, 139.82, 131.65, 129.78, 128.42, 60.29, 34.41, 33.46, 26.38, 14.21; FTIR (NaCl, thin film) 3022, 2979, 2933, 2866, 1730, 1491, 1374, 1176 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{12}\text{H}_{15}\text{ClO}_2$ $[\text{M}\cdot]^+$ 226.0761, found 226.0718.

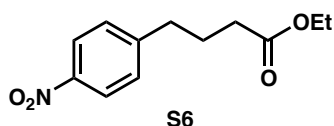
Ethyl 4-(4-(trifluoromethyl)phenyl)butanoate (S5)



The reaction was run on 3.25 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 560 mg (66% yield) of **S5** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.54 (d, $J = 7.9$ Hz, 1H), 7.29 (d, $J = 7.9$ Hz, 2H), 4.13 (q, $J = 7.1$ Hz, 2H), 2.71 (t, $J = 7.7$ Hz, 2H), 2.32 (t, $J = 7.3$ Hz, 2H), 1.97 (m, 2H), 1.26 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.18, 145.53 (q, $J_{\text{C-F}} = 1.4$ Hz), 128.76, 128.35 (q, $J_{\text{C-F}} =$

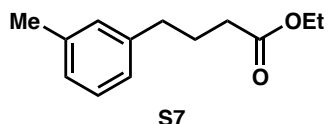
32.3 Hz), 125.28 (q, $J_{\text{C-F}} = 3.7$ Hz), 124.30 (q, $J_{\text{C-F}} = 271.7$ Hz), 60.36, 34.90, 33.46, 26.19, 14.20; FTIR (NaCl, thin film) 3044, 2982, 2940, 2871, 1735, 1618, 1418, 1375, 1326, 1163 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{13}\text{H}_{15}\text{F}_3\text{O}_2$ $[\text{M}^\bullet]^+$ 260.1024, found 260.1035.

Ethyl 4-(4-nitrophenyl)butanoate (S6)



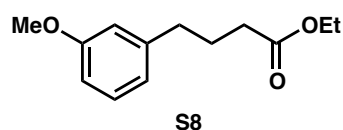
The reaction was run on 3.75 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 633 mg (70% yield) of **S6** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 8.15 (m, 2H), 7.34 (m, 2H), 4.14 (q, $J = 7.1$ Hz, 2H), 2.76 (t, $J = 7.5$ Hz, 2H), 2.34 (t, $J = 7.5$ Hz, 2H), 1.99 (m, 2H), 1.26 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 172.95, 149.29, 146.43, 129.23, 123.66, 60.43, 34.91, 33.36, 25.98, 14.20; FTIR (NaCl, thin film) 2980, 2939, 2869, 1733, 1604, 1517, 1345, 1247, 1180 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{14}\text{NO}_4$ $[\text{M-H}]^-$ 236.0928, found 236.0941.

Ethyl 4-(*m*-tolyl)butanoate (S7)



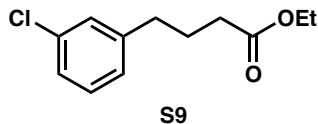
The reaction was run on 5.85 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 1080 mg (90% yield) of **S7** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.17 (m, 1H), 7.00 (m, 3H), 4.13 (q, $J = 7.1$ Hz, 2H), 2.61 (t, $J = 7.7$ Hz, 2H), 2.32 (m, 5H), 1.95 (m, 2H), 1.26 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.47, 141.31, 137.82, 129.24, 128.19, 126.62, 125.42, 60.17, 35.01, 33.64, 26.52, 21.33, 14.19; FTIR (NaCl, thin film) 2979, 2929, 2863, 1733, 1608, 1456, 1373, 1240, 1178 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{19}\text{O}_2$ $[\text{M+H}]^+$ 207.1380, found 207.1390.

Ethyl 4-(3-methoxyphenyl)butanoate (S8)



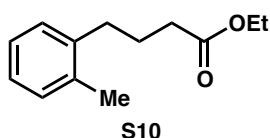
The reaction was run on 3.75 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 717 mg (85% yield) of **S8** as a yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.20 (m, 1H), 6.76 (m, 3H), 4.13 (q, $J = 7.1$ Hz, 2H), 3.80 (s, 3H), 2.63 (t, $J = 7.5$ Hz, 2H), 2.32 (t, $J = 7.5$ Hz, 2H), 1.95 (m, 2H), 1.25 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.40, 159.57, 143.00, 129.25, 120.82, 114.14, 111.19, 60.18, 55.03, 35.10, 33.57, 26.37, 14.19; FTIR (NaCl, thin film) 2977, 2937, 2868, 2835, 1734, 1601, 1583, 1489, 1456, 1373, 1258, 1151 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{19}\text{O}_3$ $[\text{M+H}]^+$ 223.1329, found 223.1327.

Ethyl 4-(3-methoxyphenyl)butanoate (S9)



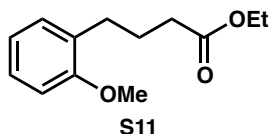
The reaction was run on 3.63 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 655 mg (80% yield) of **S9** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.19 (m, 3H), 7.06 (m, 1H), 4.13 (q, $J = 7.1$ Hz, 2H), 2.63 (t, $J = 7.7$ Hz, 2H), 2.31 (t, $J = 7.4$ Hz, 2H), 1.95 (m, 2H), 1.26 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.10, 143.38, 134.01, 129.52, 128.49, 126.58, 126.06, 60.21, 34.66, 33.38, 26.16, 14.15; FTIR (NaCl, thin film) 3057, 2980, 2933, 2863, 1732, 1598, 1573, 1477, 1374, 1203 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{16}\text{O}_2\text{Cl}$ $[\text{M}+\text{H}]^+$ 227.0839, found 227.0830.

Ethyl 4-(*o*-tolyl)butanoate (S10)



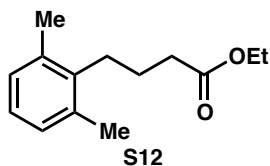
The reaction was run on 8.20 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 1.40 g (83% yield) of **S10** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.14 (m, 4H), 4.15 (q, $J = 7.1$ Hz, 2H), 2.65 (m, 2H), 2.38 (t, $J = 7.4$ Hz, 2H), 2.33 (s, 3H), 1.92 (m, 2H), 1.28 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.45, 139.62, 135.90, 130.17, 128.92, 126.05, 125.88, 60.24, 33.93, 32.52, 25.31, 19.19, 14.22; FTIR (NaCl, thin film) 2977, 2939, 2870, 1733, 1494, 1463, 1372, 1246, 1183 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{13}\text{H}_{19}\text{O}_2$ $[\text{M}+\text{H}]^+$ 207.1380, found 207.1386.

Ethyl 4-(2-methoxyphenyl)butanoate (S11)



The reaction was run on 3.75 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 742 mg (75% yield) of **S11** as a yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.18 (td, $J = 8.1, 1.8$ Hz, 1H), 7.12 (dd, $J = 7.5, 1.6$ Hz, 1H), 6.88 (td, $J = 7.4, 1.1$ Hz, 1H), 6.84 (dd, $J = 8.2, 1.1$ Hz, 1H), 4.12 (q, $J = 7.1$ Hz, 2H), 3.81 (s, 3H), 2.65 (t, $J = 7.5$ Hz, 2H), 2.32 (t, $J = 7.5$ Hz, 2H), 1.92 (m, 2H), 1.25 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.68, 157.40, 129.94, 129.75, 127.14, 120.27, 110.12, 60.10, 55.11, 33.88, 29.47, 24.99, 14.21; FTIR (NaCl, thin film) 3064, 2977, 2938, 2835, 1732, 1601, 1587, 1494, 1464, 1373, 1242 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{19}\text{O}_3$ $[\text{M}+\text{H}]^+$ 223.1329, found 223.1331.

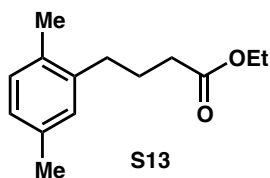
Ethyl 4-(2,6-dimethylphenyl)butanoate (S12)



The reaction was run on 6.23 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 800 mg (58% yield) of **S12** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.00 (m, 4H), 4.16 (q, $J = 7.1$ Hz, 2H), 2.65 (m, 2H), 2.42 (t, $J = 7.2$ Hz, 2H), 2.33 (s, 6H), 1.79 (m, 2H), 1.27 (t, $J = 7.1$ Hz, 3H);

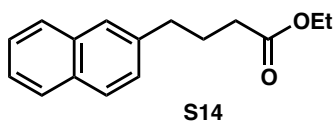
^{13}C NMR (CDCl_3 , 126 MHz) δ 173.31, 138.34, 136.00, 128.05, 125.70, 60.23, 34.40, 29.06, 24.15, 19.67, 14.20; FTIR (NaCl, thin film) 3066, 2957, 1732, 1586, 1467, 1373, 1245, 1192 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{21}\text{O}_2$ $[\text{M}+\text{H}]^+$ 221.1536, found 221.1527.

Ethyl 4-(2,5-dimethylphenyl)butanoate (S13)



The reaction was run on 5.85 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9.5:0.5 Hexanes:EtOAc) to give 1440 mg (70% yield) of **S13** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.03 (d, J = 7.6 Hz, 1H), 6.94 (m, 2H), 4.15 (q, J = 7.1 Hz, 2H), 2.61 (m, 2H), 2.37 (t, J = 7.4 Hz, 2H), 2.30 (s, 3H), 2.27 (s, 3H), 1.90 (m, 2H), 1.27 (t, J = 7.1 Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.51, 139.46, 135.25, 132.70, 130.09, 129.75, 126.71, 60.25, 34.00, 32.54, 25.42, 20.92, 18.72, 14.24; FTIR (NaCl, thin film) 3041, 2978, 2938, 2868, 1732, 1503, 1458, 1373, 1194 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{20}\text{O}_2$ $[\text{M}\cdot]^+$ 220.1463, found 220.1469.

Ethyl 4-(naphthalen-2-yl)butanoate (S14)

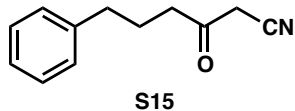


The reaction was run on 3.33 mmol scale for 2 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 800 mg (90% yield) of **S14** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.79 (m, 3H), 7.62 (s, 1H), 7.44 (m, 2H), 7.33 (dd, J = 8.4, 1.7 Hz, 1H), 4.13 (q, J = 7.2 Hz, 2H), 2.82 (m, 2H), 2.35 (t, J = 7.5 Hz, 2H), 2.05 (m, 2H), 1.25 (t, J = 7.1 Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.43, 138.86, 133.51, 132.00, 127.91, 127.54, 127.36, 127.18, 126.54, 125.87, 125.15, 60.22, 35.21, 33.59, 26.34, 14.20; FTIR (NaCl, thin film) 3047, 2977, 2933, 2863, 1730, 1699, 1505, 1369, 1179 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{16}\text{H}_{18}\text{O}_2$ $[\text{M}\cdot]^+$ 242.1307, found 242.1300.

General procedure 5 for the synthesis of keto nitriles.

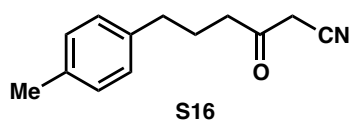
In a glovebox a flame-dried 50 mL flask was charged with solid LHMDS (5.25 mmol, 2.20 equiv). This flask was sealed on the benchtop under N_2 . THF (10 mL) was charged, dissolving the LHMDS. After cooling to -78°C , acetonitrile (6.21 mmol, 2.6 equiv) was added in one portion. The hazy light yellow solution was stirred for 0.5 hours at this temperature. After this time a solution of the ester (**11**, 2.39 mmol, 1.0 equiv) in 15 mL of THF was added fast drop-wise via cannula to the lithio-acetonitrile solution at -78°C . The reaction became orange during the addition of the ester. After completion of the transfer, the reaction was slowly warmed to 0°C over 1 hour. At this point TLC analysis indicated complete consumption of starting material, and was quenched with a saturated aqueous NH_4Cl solution, and extracted with ethyl acetate. The organic layer was washed with brine, dried over sodium sulfate, and the solvent was removed by rotary evaporation under reduced pressure. The crude residue was purified by silica gel chromatography to afford the keto nitriles products.

3-Oxo-6-phenylhexanenitrile (S15)



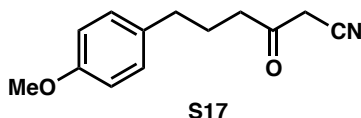
The reaction was run on 2.58 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 429 mg (89% yield) of **S15** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 7.30 (m, 2H), 7.22 (m, 1H), 7.16 (m, 2H), 3.39 (s, 2H), 2.66 (t, *J* = 7.5 Hz, 2H), 2.61 (t, *J* = 7.2 Hz, 2H), 1.98 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.28, 140.74, 128.44, 128.36, 126.14, 113.71, 41.11, 34.50, 31.92, 24.58; FTIR (NaCl, thin film) 3026, 2943, 2863, 2260, 1729, 1497, 1453, 1403, 1373, 1308 cm⁻¹; HRMS (ESI-) calc'd for C₁₂H₁₂NO [M-H]⁻ 186.0924, found 186.0921.

3-Oxo-6-(*p*-tolyl)hexanenitrile (S16)



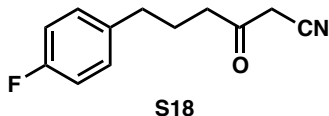
The reaction was run on 1.00 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 158 mg (79% yield) of **S16** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 7.11 (m, 2H), 7.05 (m, 2H), 3.38 (s, 2H), 2.60 (m, 4H), 2.32 (s, 3H), 1.96 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.26, 137.61, 135.73, 129.18, 128.30, 113.67, 41.17, 34.11, 31.95, 24.73, 20.97; FTIR (NaCl, thin film) 3019, 2943, 2921, 2863, 2260, 1729, 1514, 1457, 1403, 1373, 1308 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₄NO [M-H]⁻ 200.1081, found 200.1085.

6-(4-Methoxyphenyl)-3-oxohexanenitrile (S17)



The reaction was run on 2.16 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 280 mg (60% yield) of **S17** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 7.07 (m, 2H), 6.84 (m, 2H), 3.79 (s, 3H), 3.38 (s, 2H), 2.59 (m, 4H), 1.95 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.33, 157.94, 132.74, 129.29, 113.84, 113.72, 55.19, 41.10, 33.61, 31.91, 24.85; FTIR (NaCl, thin film) 3036, 3010, 2952, 2922, 2835, 2258, 1716, 1615, 1585, 1515, 1372, 1347, 1300, 1251 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₄NO₂ [M-H]⁻ 216.1030, found 216.1038.

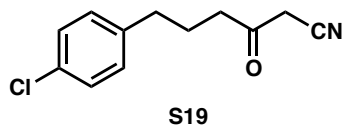
6-(4-Fluorophenyl)-3-oxohexanenitrile (S18)



The reaction was run on 2.38 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 380 mg (78% yield) of **S18** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 7.11 (m, 2H), 6.98 (m, 2H), 3.41 (s, 2H), 2.62 (m, 4H), 1.95 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.32, 161.38 (d, *J*_{C-F} = 243.5 Hz), 136.47 (d, *J*_{C-F} = 3.8 Hz), 129.64 (d, *J*_{C-F} = 7.7 Hz), 115.04 (d, *J*_{C-F} = 20.8 Hz), 113.77, 40.96, 33.61, 31.90, 24.64,

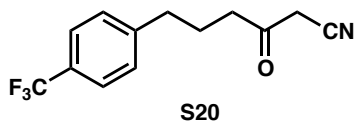
24.63; FTIR (NaCl, thin film) 3040, 2946, 2867, 2261, 1731, 1600, 1510, 1454, 1403, 1307, 1219 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{11}\text{FNO}$ $[\text{M}-\text{H}]^-$ 204.0830, found 204.0830.

6-(4-Chlorophenyl)-3-oxohexanenitrile (S19)



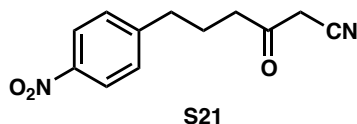
The reaction was run on 1.97 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 250 mg (57% yield) of **S19** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.26 (m, 2H), 7.09 (m, 2H), 3.41 (s, 2H), 2.62 (m, 4H), 1.94 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.09, 139.24, 131.83, 129.69, 128.53, 113.67, 41.00, 33.84, 31.98, 24.46; FTIR (NaCl, thin film) 3027, 2946, 2866, 2260, 1729, 1696, 1492, 1455, 1406, 1373, 1306, 1090 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{11}\text{ClNO}$ $[\text{M}-\text{H}]^-$ 220.0535, found 220.0549.

3-Oxo-6-(4-(trifluoromethyl)phenyl)hexanenitrile (S20)



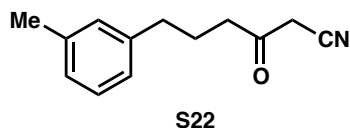
The reaction was run on 1.61 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 250 mg (61% yield) of **S20** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.56 (d, J = 8.0 Hz, 2H), 7.28 (d, J = 8.0 Hz, 2H), 3.42 (s, 2H), 2.71 (t, J = 7.6 Hz, 2H), 2.64 (t, J = 7.2 Hz, 2H), 1.99 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.05, 145.02 (q, $J_{\text{C-F}}$ = 1.5 Hz), 128.66, 128.41 (q, $J_{\text{C-F}}$ = 32.2 Hz), 125.34 (q, $J_{\text{C-F}}$ = 3.8 Hz), 124.23 (q, $J_{\text{C-F}}$ = 272.0 Hz), 113.69, 40.98, 34.31, 31.99, 24.27; FTIR (NaCl, thin film) 3044, 2940, 2872, 2261, 1727, 1617, 1459, 1407, 1340, 1248, 1114 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{11}\text{F}_3\text{NO}$ $[\text{M}-\text{H}]^-$ 254.0798, found 254.0813.

6-(4-Nitrophenyl)-3-oxohexanenitrile (S21)



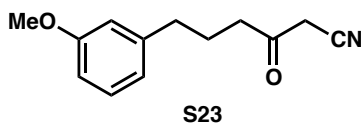
The reaction was run on 1.00 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (6:4 Hexanes:EtOAc) to give 124 mg (54% yield) of **S21** as a yellow solid. ^1H NMR (CDCl_3 , 500 MHz) δ 8.14 (m, 2H), 7.33 (m, 2H), 3.47 (s, 2H), 2.75 (t, J = 7.7 Hz, 2H), 2.66 (t, J = 7.1 Hz, 2H), 1.99 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 196.80, 148.75, 146.51, 129.17, 123.75, 113.60, 40.94, 34.43, 32.05, 24.11; FTIR (NaCl, thin film) 2952, 2920, 2870, 2258, 1728, 1597, 1507, 1347 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{11}\text{N}_2\text{O}_3$ $[\text{M}-\text{H}]^-$ 231.0775, found 231.0785.

3-Oxo-6-(*m*-tolyl)hexanenitrile (S22)



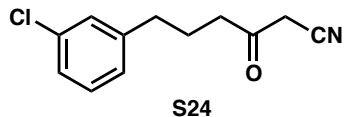
The reaction was run on 2.04 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 329 mg (80% yield) of **S22** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.18 (t, J = 7.5 Hz, 1H), 7.03 (m, 1H), 6.97 (m, 2H), 3.39 (s, 2H), 2.61 (m, 4H), 2.33 (s, 3H), 1.97 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.29, 140.67, 138.09, 129.20, 128.36, 126.91, 125.39, 113.70, 41.18, 34.45, 31.93, 24.62, 21.35; FTIR (NaCl, thin film) 3017, 2944, 2920, 2863, 2260, 1731, 1607, 1588, 1487, 1455, 1403, 1306 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{NO}$ $[\text{M}+\text{H}]^+$ 202.1226, found 202.1225.

6-(3-Methoxyphenyl)-3-oxohexanenitrile (S23)



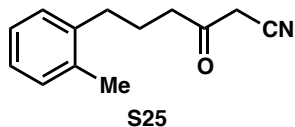
The reaction was run on 1.00 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 175 mg (81% yield) of **S23** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.21 (t, J = 7.8 Hz, 1H), 6.75 (m, 2H), 6.70 (m, 1H), 3.80 (s, 3H), 3.40 (s, 2H), 2.63 (t, J = 7.5 Hz, 2H), 2.59 (t, J = 7.2 Hz, 2H), 1.97 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.21, 159.69, 142.36, 129.48, 120.77, 114.21, 113.67, 111.38, 55.12, 41.12, 34.55, 31.96, 24.48; FTIR (NaCl, thin film) 3002, 2943, 2836, 2260, 1729, 1601, 1583, 1487, 1455, 1312, 1260 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 218.1176, found 218.1182.

6-(3-chlorophenyl)-3-oxohexanenitrile (S24)



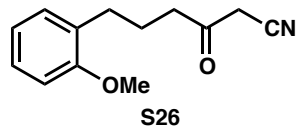
The reaction was run on 1.68 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 310 mg (84% yield) of **S24** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.18 (m, 3H), 7.04 (m, 1H), 3.44 (s, 2H), 2.61 (m, 4H), 1.94 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.04, 142.85, 134.15, 129.74, 128.42, 126.57, 126.34, 113.66, 41.00, 34.17, 31.99, 24.32; FTIR (NaCl, thin film) 3060, 2946, 2867, 2260, 1731, 1697, 1572, 1475, 1403, 1305 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{12}\text{H}_{12}\text{NClO}$ $[\text{M}\cdot]^+$ 221.0607, found 221.0608.

3-Oxo-6-(*o*-tolyl)hexanenitrile (S25)



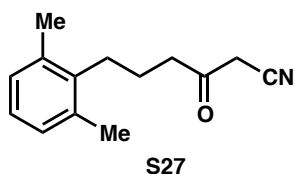
The reaction was run on 2.09 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 311 mg (75% yield) of **S25** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.14 (m, 4H), 3.42 (s, 2H), 2.64 (m, 4H), 2.33 (s, 3H), 1.93 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.30, 138.98, 135.88, 130.24, 128.77, 126.20, 125.87, 113.77, 41.33, 31.94, 31.85, 23.28, 19.09; FTIR (NaCl, thin film) 3017, 2946, 2920, 2260, 1732, 1603, 1493, 1462, 1403, 1372, 1306 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{13}\text{H}_{15}\text{NO}$ $[\text{M}\cdot]^+$ 201.1154, found 201.1149.

6-(2-Methoxyphenyl)-3-oxohexanenitrile (S26)



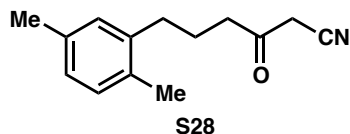
The reaction was run on 1.00 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 165 mg (76% yield) of **S26** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.20 (td, $J = 7.8, 1.7$ Hz, 1H), 7.09 (dd, $J = 7.4, 1.8$ Hz, 1H), 6.89 (td, $J = 7.4, 1.1$ Hz, 1H), 6.85 (dd, $J = 8.2, 1.0$ Hz, 1H), 3.82 (s, 3H), 3.39 (s, 2H), 2.65 (t, $J = 7.3$ Hz, 2H), 2.58 (t, $J = 7.2$ Hz, 2H), 1.94 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.46, 157.40, 130.04, 129.14, 127.53, 120.49, 113.79, 110.36, 55.23, 41.37, 31.80, 28.99, 23.41; FTIR (NaCl, thin film) 3002, 2941, 2837, 2260, 1729, 1599, 1586, 1493, 1464, 1290, 1243 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{16}\text{NO}_2$ [$\text{M}+\text{H}$] $^+$ 218.1176, found 218.1178.

6-(2,6-Dimethylphenyl)-3-oxohexanenitrile (S27)



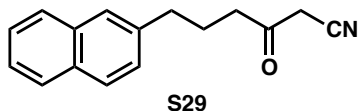
The reaction was run on 3.18 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 600 mg (88% yield) of **S27** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.02 (m, 3H), 3.45 (s, 2H), 2.73 (t, $J = 7.0$ Hz, 2H), 2.65 (m, 2H), 2.34 (s, 6H), 1.82 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.14, 137.83, 136.04, 128.18, 125.96, 113.75, 41.91, 31.97, 28.65, 22.44, 19.75; FTIR (NaCl, thin film) 3019, 2953, 2941, 2260, 1732, 1585, 1470, 1403, 1306, 1092 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{16}\text{NO}$ [$\text{M}-\text{H}$] $^-$ 214.1237, found 214.1243.

6-(2,5-Dimethylphenyl)-3-oxohexanenitrile (S28)



The reaction was run on 2.02 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 341 mg (78% yield) of **S28** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.04 (d, $J = 7.6$ Hz, 1H), 6.95 (m, 1H), 6.93 (s, 1H), 3.40 (s, 2H), 2.65 (t, $J = 7.1$ Hz, 2H), 2.61 (m, 2H), 2.30 (s, 3H), 2.27 (s, 3H), 1.92 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.23, 138.80, 135.37, 132.74, 130.25, 129.68, 126.97, 113.71, 41.48, 32.03, 31.92, 23.49, 20.88, 18.71; FTIR (NaCl, thin film) 2944, 2868, 2260, 1732, 1504, 1462, 1403, 1306, 1082 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{14}\text{H}_{17}\text{NO}$ [$\text{M}\cdot$] $^+$ 215.1310, found 215.1339.

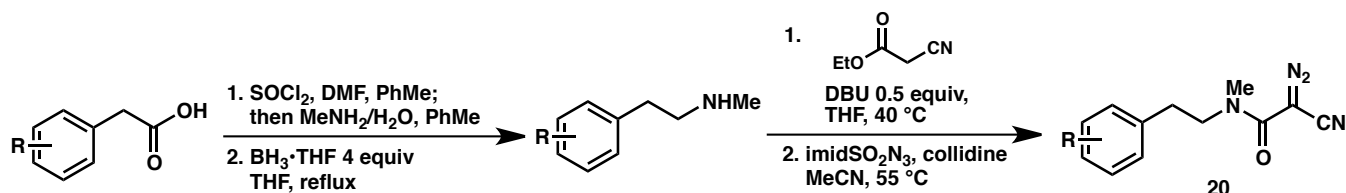
6-(naphthalen-2-yl)-3-oxohexanenitrile (S29)



The reaction was run on 1.53 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 295 mg (82% yield) of **S29** as a wispy white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.81 (m, 3H), 7.60 (m, 1H), 7.47 (m, 2H), 7.31 (dd, $J = 8.4, 1.7$ Hz, 1H), 3.34 (s, 2H), 2.81 (t, $J = 7.3$ Hz, 2H), 2.57 (t,

$J = 7.2$ Hz, 2H), 2.04 (m, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.22, 138.25, 133.42, 132.00, 128.10, 127.55, 127.33, 126.95, 126.53, 126.03, 125.33, 113.68, 41.04, 34.59, 31.87, 24.37; FTIR (NaCl, thin film) 3052, 2944, 2848, 2260, 1731, 1633, 1597, 1456, 1399, 1245, 1085 cm^{-1} ; HRMS (FAB+) calc'd for $\text{C}_{16}\text{H}_{15}\text{NO}$ [M^+] 237.1154, found 237.1157.

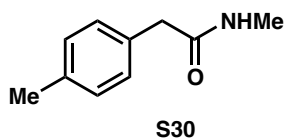
General procedure for the synthesis of α -diazo- β -amidonitriles



General procedure 6 for the synthesis of 2-arylacetamides.

Adapted from the procedure of Haney et al.¹⁰ To a 100 mL round bottom flask was charged (2-methylphenyl) acetic acid (3.47 mmol, 1.00 equiv) followed by anhydrous toluene (10 mL). DMF (0.31 mL, 1.15 equiv) and thionyl chloride (0.30 mL, 1.2 equiv) were added successively, resulting in a clear yellow solution, which was heated to 40 °C for 30 minutes. The resulting acid chloride solution was transferred to an addition funnel, and added in a rapid dropwise fashion to a vigorously stirred, pre-cooled (0 °C) 40% wt methylamine/water solution. A heterogeneous biphasic mixture resulted, and upon completion of the acid chloride addition was warmed to 22 °C for 30 minutes. LC/MS analysis indicated complete consumption of the starting 2-arylacetic acid. The reaction was quenched with water, and extracted with ethyl acetate (3 X 50 mL). The combined organic layers were washed with saturated aqueous sodium bicarbonate, brine, and subsequently dried over sodium sulfate. The solvent was removed by rotary evaporation under reduced pressure to yield a crude residue of sufficient purity for the ensuing reduction step. Recrystallization from hexanes/ethyl acetate was in certain cases employed to improve product purity.

N-Methyl-2-(*p*-tolyl)acetamide (**S30**)

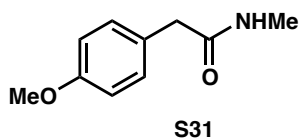


The reaction was run on 3.47 mmol scale to afford 450 mg (80% yield) of **S30** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.16 (m, 2H), 7.13 (m, 2H), 5.32 (br s, 1H), 3.54 (s, 2H), 2.75 (d, $J = 4.9$ Hz, 3H), 2.35 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.83, 136.90, 131.77, 129.59, 129.30, 43.17, 26.36, 20.98. FTIR (NaCl, thin film)

¹⁰ Ulysse, G. L.; Yang, Q.; McLaws, M. D.; Keefe, D. K.; Guzzo, P. R.; Haney, B. P.; *Organic Process Research & Development* **2010** 14 (1), 225.

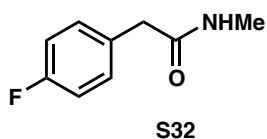
3251, 3083, 2962, 2915, 2837, 1653, 1631, 1575, 1512, 1408, 1219, 1166 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{10}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 180.1019, found 180.1011.

2-(4-Methoxyphenyl)-*N*-methylacetamide (S31)



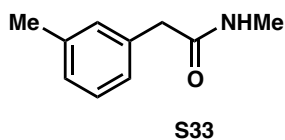
The reaction was run on 27.5 mmol scale to afford, after recrystallization from hexanes/EtOAc, 2.9 g (60% yield) of **S31** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.14 (m, 2H), 6.86 (m, 2H), 5.58 (br s, 1H), 3.78 (s, 3H), 3.48 (s, 2H), 2.72 (d, J = 4.8 Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.98, 158.74, 130.49, 126.82, 114.30, 55.23, 42.67, 26.36; FTIR (NaCl, thin film) 3251, 3083, 2962, 2915, 2837, 1653, 1631, 1575, 1512, 1408, 1219, 1166 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{10}\text{H}_{14}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 180.1019, found 180.1011.

2-(4-Fluorophenyl)-*N*-methylacetamide (S32)



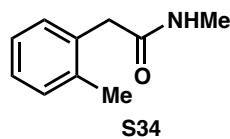
The reaction was run on 15.5 mmol scale to afford 2.1 g (80% yield) of **S32** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.19 (m, 2H), 6.99 (m, 2H), 5.86 (br s, 1H), 3.49 (s, 2H), 2.73 (d, J = 4.8 Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.41, 162.02 (d, $J_{\text{C-F}}$ = 245.6 Hz), 130.85 (d, $J_{\text{C-F}}$ = 7.7 Hz), 130.67 (d, $J_{\text{C-F}}$ = 3.4 Hz), 115.63 (d, $J_{\text{C-F}}$ = 21.6 Hz), 42.54, 26.39; FTIR (NaCl, thin film) 3291, 3092, 2943, 2907, 1648, 1564, 1505, 1410, 1219, 1162 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_9\text{H}_{11}\text{FNO}$ $[\text{M}+\text{H}]^+$ 168.0819, found 168.0827.

N-Methyl-2-(*m*-tolyl)acetamide (S33)



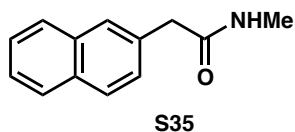
The reaction was run on 22.2 mmol scale to afford 2.5 g (70% yield) of **S33** as a pale yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.22 (t, J = 7.5 Hz, 1H), 7.06 (m, 3H), 5.61 (br s, 1H), 3.52 (s, 2H), 2.74 (d, J = 4.8 Hz, 3H), 2.33 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.73, 138.64, 134.75, 130.17, 128.80, 127.99, 126.40, 43.54, 26.39, 21.28; FTIR (NaCl, thin film) 3291, 3083, 2942, 1647, 1559, 1490, 1409, 1339 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{10}\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+$ 164.1070, found 164.1077.

N-methyl-2-(*o*-tolyl)acetamide (S34)



The reaction was run on 21.3 mmol scale to afford 2.9 g (83% yield) of **S34** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.19 (m, 4H), 5.35 (br s, 1H), 3.57 (s, 2H), 2.73 (d, J = 4.9 Hz, 3H), 2.27 (s, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.29, 137.21, 133.33, 130.74, 130.49, 127.76, 126.56, 41.66, 26.40, 19.41; FTIR (NaCl, thin film) 3270, 3077, 2914, 1643, 1556, 1406, 1348, 1254 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{10}\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+$ 164.1070, found 164.1065.

***N*-methyl-2-(naphthalen-2-yl)acetamide (S35)**



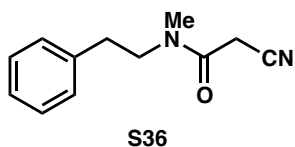
The reaction was run on 15.0 mmol scale to afford 2.9 g (quantitative yield) of **S35** as a white solid. ^1H NMR (CDCl_3 , 500 MHz) δ 7.81 (m, 3H), 7.69 (s, 1H), 7.48 (m, 2H), 7.35 (dd, $J = 8.4, 1.8$ Hz, 1H), 5.68 (br s, 1H), 3.71 (s, 2H), 2.73 (d, $J = 4.8$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 171.53, 133.43, 132.39, 132.34, 128.68, 128.19, 127.62, 127.51, 127.30, 126.35, 125.96, 43.70, 26.41; FTIR (NaCl, thin film) 3262, 3081, 3052, 2931, 1643, 1567, 1430, 1409, 1333, 1269, 1165 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{14}\text{NO}$ $[\text{M}+\text{H}]^+$ 200.1070, found 200.1078.

General procedure 7 for the synthesis of 2-cyanoacetamides.

Adapted from the procedure of Priestley et al.¹¹ To a 100 mL round bottom flask fitted with a condenser and flushed with nitrogen was charged *N*-methyl-2-phenylacetamide (2.53 mmol, 1.00 equiv) followed by anhydrous THF (10 mL). Borane–tetrahydrofuran (10.12 mmol, 1M THF, 4 equiv) was added via syringe to the amide at room temperature. Upon completion of the addition the clear, colorless reaction was heated to reflux for 4 hours. After this time the reaction was cooled in an ice bath, and methanol (3.5 mL) was added cautiously (gas evolution!). 6 M HCl (5 mL) was added fast dropwise, and the mixture was heated to reflux for 30 minutes. The volatiles were then concentrated *in vacuo*, and the resulting mixture was cooled in an ice bath and 50% aqueous NaOH (5 mL) was added (pH > 10). The mixture was then diluted with water and extracted with diethyl ether (3 X 50 mL). The combined organic phases were washed with brine, dried over MgSO_4 , filtered and concentrated, affording a colorless oil. The crude secondary amine was used directly in the subsequent step.

Adapted from the procedure of Price et al.¹² To a 25 mL round bottom flask containing the *N*-methyl-2-phenethylamine (2.60 mmol, 1.00 equiv) was added DBU (1.30 mmol, 0.5 equiv) and THF (5 mL). Ethyl cyanoacetate (3.88 mmol, 1.5 equiv) was added in one portion, and the clear, deep yellow reaction was stirred at room temperature overnight. After TLC analysis indicated complete consumption of the starting material, the volatiles were concentrated *in vacuo* and the crude residue was purified by column chromatography to afford the 2-cyanoacetamide products.

2-Cyano-*N*-methyl-*N*-phenethylacetamide (S36)



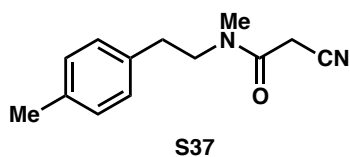
The reaction was run on 9.10 mmol scale and the crude material was purified by silica gel chromatography (3:7 hexanes:EtOAc) to afford 1.34 g (72% yield, 2 steps) of **S36** as a pale yellow oil. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.1:1 mixture

¹¹ Priestley, E. Scott; Cheney, Daniel L.; Wurtz, Nicholas R.; Glunz, Peter W.; PCT Int. Appl. (2007) WO 076431 A1.

¹² Price, K. E.; Larrivée-Aboussafy, C.; Lillie, B. M.; McLaughlin, R. W.; Mustakis, J.; Hettenbach, K. W.; Hawkins, J. M.; Vaidyanathan, R.; *Org. Lett.* **2009** 11 (9), 2003.

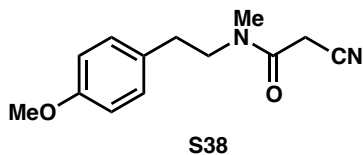
of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.28 (m, 4H*, 4H§), 7.14 (m, 1H*, 1H§), 3.62 (m, 2H§), 3.50 (t, J = 6.6 Hz, 2H*), 3.44 (s, 2H§), 3.03 (s, 3H§), 2.91 (s, 3H*), 2.88 (m, 4H*, 2H§); ^{13}C NMR (CDCl_3 , 126 MHz; compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.66§, 161.33*, 138.25*, 137.46§, 128.98*, 128.62*§, 128.49§, 127.15*, 126.44§, 114.05§, 113.92*, 52.19§, 50.47*, 36.48*, 34.02§, 33.80§, 33.27*, 25.20§, 24.03*; FTIR (NaCl, thin film) 3027, 2928, 2860, 2259, 1657, 1453, 1401, 1175 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{15}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 203.1179, found 203.1177.

2-Cyano-*N*-methyl-*N*-(4-methylphenethyl)acetamide (S37)



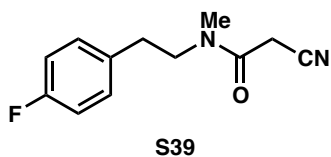
The reaction was run on 2.53 mmol scale and the crude material was purified by silica gel chromatography (3:7 hexanes:EtOAc) to afford 347 mg (63% yield, 2 steps) of **S37** as a pale yellow oil. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.2:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.15 (m, 2H*), 7.11 (m, 4H§), 7.03 (m, 2H*), 3.60 (m, 2H§), 3.48 (t, J = 6.5 Hz, 2H*), 3.44 (s, 2H§), 3.02 (s, 3H*), 2.91 (s, 3H§), 2.87 (s, 2H*), 2.84 (m, 2H*, 2H§), 2.34 (s, 3H*), 2.32 (s, 3H§); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1.2:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.67*, 161.34§, 136.59*, 135.75§, 135.05§, 134.26*, 129.45§, 129.02*, 128.41*, 128.35§, 114.10*, 114.02§, 52.08*, 50.35§, 36.25§, 33.61*, 33.41*, 32.68§, 25.06*, 23.94§, 20.75*§; FTIR (NaCl, thin film) 3027, 2923, 2861, 2259, 1657, 1515, 1452, 1401, 1172 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{17}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 217.1335, found 217.1330.

2-Cyano-*N*-(4-methoxyphenethyl)-*N*-methylacetamide (S38)



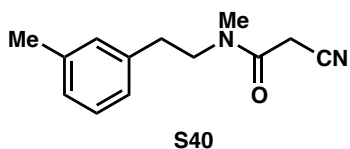
The reaction was run on 11.4 mmol scale to afford, after chromatography (3:7 hexanes:EtOAc) and recrystallization from hexanes/EtOAc, 1.26 g (47% yield, 2 steps) of **S38** as a white solid. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.12 (m, 2H§), 7.05 (m, 2H*), 6.87 (m, 2H*), 6.85 (m, 2H§), 3.80 (s, 3H*), 3.79 (s, 3H§), 3.58 (m, 2H§), 3.47 (t, J = 6.5 Hz, 2H*), 3.44 (s, 2H§), 3.02 (s, 3H*), 2.90 (s, 3H§), 2.90 (s, 2H*), 2.82 (m, 2H*, 2H§); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.47*§, 158.41*§, 130.23§, 129.63*§, 129.30*, 114.39*, 114.09§, 113.91*§, 55.19*, 55.13§, 52.43*, 50.67§, 36.54§, 33.81*, 33.13*, 32.40§, 25.21§, 24.10*; FTIR (NaCl, thin film) 3030, 2935, 2836, 2259, 1660, 1611, 1513, 1464, 1401, 1247, 1178 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{17}\text{N}_2\text{O}_2$ $[\text{M}+\text{H}]^+$ 233.1285, found 233.1289.

2-Cyano-*N*-(4-fluorophenethyl)-*N*-methylacetamide (S39)



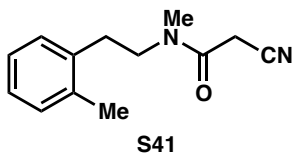
The reaction was run on 8.8 mmol scale and the crude material was purified by silica gel chromatography (3:7 hexanes:EtOAc) to afford 1.00 g (52% yield, 2 steps) of **S39** as a white solid. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.5:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.15 (m, 2H*, 2H §), 7.02 (m, 2H*, 2H §), 3.59 (m, 2H*), 3.49 (t, J = 6.8 Hz, 2H §), 3.44 (s, 2H*), 3.03 (s, 2H §), 3.02 (s, 3H §), 2.93 (s, 3H*), 2.89 (t, J = 6.8 Hz, 2H §), 2.85 (t, J = 7.4 Hz, 2H*); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1.5:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.85 § (d, $J_{\text{C-F}}$ = 246.4 Hz), 161.59* (d, $J_{\text{C-F}}$ = 244.0 Hz), 161.51 § , 161.37*, 133.93* (d, $J_{\text{C-F}}$ = 3.4 Hz), 133.12 § (d, $J_{\text{C-F}}$ = 3.4 Hz), 130.21 § (d, $J_{\text{C-F}}$ = 8.1 Hz), 130.12* (d, $J_{\text{C-F}}$ = 8.0 Hz), 115.93 § (d, $J_{\text{C-F}}$ = 21.4 Hz), 115.39* (d, $J_{\text{C-F}}$ = 21.1 Hz), 113.95 § , 113.82*, 52.27 § (d, $J_{\text{C-F}}$ = 1.7 Hz), 50.53* (d, $J_{\text{C-F}}$ = 1.4 Hz), 36.57*, 33.91 § , 33.36 § , 32.51*, 25.25*, 24.28 § ; FTIR (NaCl, thin film) 3040, 2932, 2866, 2260, 1660, 1600, 1510, 1402, 1220 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{14}\text{FN}_2\text{O}$ $[\text{M}+\text{H}]^+$ 221.1085, found 221.1090.

2-Cyano-*N*-methyl-*N*-(3-methylphenethyl)acetamide (S40)



The reaction was run on 11.4 mmol scale and the crude material was purified by silica gel chromatography (4:6 hexanes:EtOAc) to afford 1.35 g (65% yield, 2 steps) of **S40** as a white solid. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.20 (m, 1H*, 1H §), 7.10 (d, J = 7.5, 1H*), 7.03 (m, 1H*, 2H §), 6.94 (m, 1H*, 1H §), 3.59 (m, 2H §), 3.48 (t, J = 6.6 Hz, 2H*), 3.45 (s, 2H §), 3.02 (s, 3H*), 2.92 (s, 3H §), 2.91 (s, 2H*), 2.83 (m, 2H*, 2H §), 2.34 (s, 3H*), 2.33 (s, 3H §); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.67*, 161.22 § , 138.89*, 138.26 § , 138.21 § , 137.42*, 129.54 § , 129.47*, 129.01 § , 128.49 § , 128.02*, 127.30*, 125.67* § , 114.02*, 113.78 § , 52.41*, 50.73 § , 36.68 § , 34.12*, 33.93*, 33.33 § , 25.28 § , 24.11*, 21.31* § ; FTIR (NaCl, thin film) 3017, 2923, 2858, 2259, 1660, 1486, 1457, 1402, 1169 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{17}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 217.1335, found 217.1347.

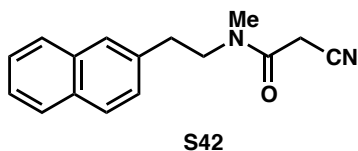
2-Cyano-*N*-methyl-*N*-(2-methylphenethyl)acetamide (S41)



The reaction was run on 11.5 mmol scale and the crude material was purified by silica gel chromatography (3:7 hexanes:EtOAc) to afford, after recrystallization from hexanes/EtOAc, 1.00 g (40% yield, 2 steps) of **S41** as a white solid. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.16 (m, 4H*, 3H §), 7.05 (m, 1H §), 3.56 (m, 2H*), 3.48 (t, J = 6.7 Hz, 2H §), 3.47 (s, 2H*), 3.04 (s, 3H §), 2.96 (s, 3H*), 2.91 (t, J = 6.7 Hz, 2H §), 2.89 (m, 2H*, 2H §), 2.38 (s, 3H*),

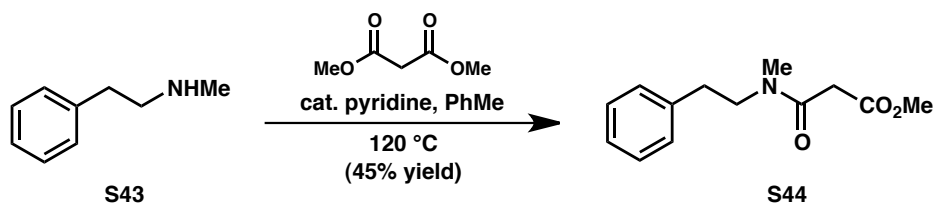
2.34 (s, 3H[§]); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.57[§], 161.31*, 136.33[§], 136.22*, 135.66*, 135.65[§], 130.79[§], 130.37*, 129.61[§], 129.35*, 127.45[§], 126.72*, 126.65[§], 126.10*, 114.03[§], 113.85*, 51.03[§], 49.43*, 36.49*, 34.11[§], 31.37[§], 30.76*, 25.25*, 23.86[§], 19.17[§], 19.10*; FTIR (NaCl, thin film) 3015, 2946, 2858, 2259, 1654, 1490, 1458, 1400, 1172 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₇N₂O [M+H]⁺ 217.1335, found 217.1343.

2-Cyano-*N*-methyl-*N*-(2-(naphthalen-2-yl)ethyl)acetamide (S42)



The reaction was run on 13.0 mmol scale and the crude material was purified by silica gel chromatography (3:7 hexanes:EtOAc) to afford 2.00 g (61% yield, 2 steps) of **S42** as a white solid. ¹H NMR (CDCl₃, 500 MHz; compound exists as a 1.2:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.82 (m, 3H*, 3H[§]), 7.66 (s, 1H*), 7.61 (s, 1H[§]), 7.48 (m, 2H*, 2H[§]), 7.36 (dd, *J* = 8.4, 1.8 Hz, 1H*), 7.28 (dd, *J* = 8.4, 1.8 Hz, 1H[§]), 3.71 (m, 2H*), 3.61 (t, *J* = 6.8 Hz, 1H[§]), 3.45 (s, 2H*), 3.06 (m, 2H*, 5H[§]), 2.96 (s, 2H[§]), 2.91 (s, 3H*); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 1.2:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 161.52[§], 161.37*, 135.79*, 134.76[§], 133.42*, 133.36[§], 132.19[§], 132.10*, 128.76[§], 128.20*, 128.20[§], 127.63*, 127.54*, 127.39*[§], 127.37[§], 127.31*, 127.08[§], 127.01[§], 126.53[§], 126.48*, 126.06*, 125.94[§], 125.47*[§], 113.99[§], 113.89*, 52.12[§], 50.45*, 36.58*, 34.33[§], 33.94[§], 33.49*, 25.21*, 24.22[§]; FTIR (NaCl, thin film) 3015, 3019, 2939, 2861, 2259, 1659, 1483, 1401, 1176 cm⁻¹; HRMS (MM) calc'd for C₁₆H₁₇N₂O [M+H]⁺ 253.1335, found 253.1345.

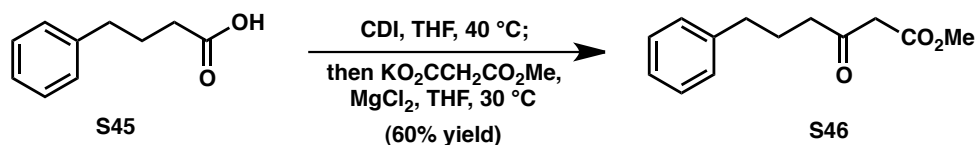
Preparation of methyl 3-(methyl(phenethyl)amino)-3-oxopropanoate (S44)



To a 10 mL schlenk tube under an atmosphere of nitrogen was added commercially available *N*-methyl-phenethylamine **S43** (400 mg, 2.96 mmol), dimethyl malonate (510 μL, 4.44 mmol), and toluene (6 mL). Pyridine (12 μL, 0.148 mmol) was charged and the tube was sealed and heated to 120 °C for 48 hours. The initially murky mixture clarified to a light yellow solution upon achieving reflux. After cooling the reaction was loaded directly onto a silica gel column and purified by flash chromatography (0→60% EtOAc/hexanes) to afford **S44** (0.31 g, 45% yield) as a pale yellow oil. ¹H NMR (CDCl₃, 300 MHz; compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 7.29 (m, 2H*, 2H[§]), 7.19 (m, 3H*, 3H[§]), 3.76 (s, 3H*), 3.71 (s, 3H[§]), 3.61 (m, 2H*), 3.51 (t, *J* = 7.2 Hz, 2H[§]), 3.44 (s, 2H*), 3.15 (s, 2H[§]), 2.99 (s,

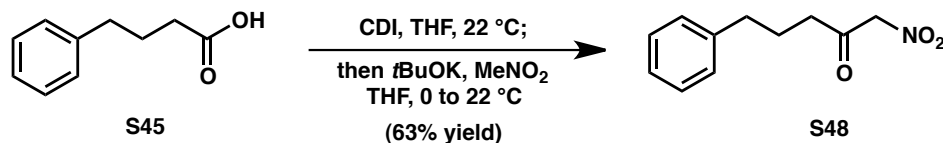
3H[§]), 2.87 (m, 5H*, 2H[§]); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 1.1:1 mixture of rotamers, major rotamer is designated by *, minor rotamer denoted by §) δ 168.02[§], 167.97*, 165.79[§], 165.70*, 138.86*, 137.77[§], 128.83[§], 128.77*, 128.66[§], 128.45*, 126.86[§], 126.32*, 52.38*, 52.34[§], 52.31[§], 50.23*, 41.40*, 40.42[§], 36.66*, 34.59[§], 33.61[§], 33.49*; FTIR (NaCl, thin film) 3026, 2949, 1743, 1653, 1490, 1437, 1325, 1257, 1155 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₈NO₃ [M+H]⁺ 236.1281, found 236.1284.

Preparation of methyl 3-oxo-6-phenylhexanoate (S46)



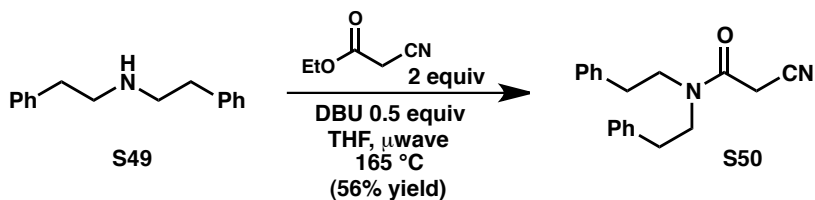
A flame-dried 100 mL round-bottom flask equipped with stir bar and reflux condenser was charged with potassium monomethyl malonate (1.59 g, 10.1 mmol) and MgCl₂ (0.64 g, 6.77 mmol). This flask was evacuated and backfilled with nitrogen 3 times. THF (10 mL) was added and the suspension was heated to 65 °C for 3 hr, followed by 30 °C for 2 h. A separate 50 mL flame-dried round-bottom flask was charged with commercially available 4-phenylbutyric acid **S45** (1.11 g, 6.77 mmol) and carbonyl diimidazole (1.15 g, 7.11 mmol). The flask was fitted with a reflux condenser and THF (10 mL) was added, and the solution was heated at 40 °C for 1 hour. The resulting acyl imidazole solution was added dropwise via cannula to the magnesium malonate suspension at 30 °C (NOTE: a white precipitate forms rapidly, and vigorous stirring is necessary to avoid clumping). After 12 hr the white suspension was cooled to 0 °C and quenched by the addition of 1M HCl (5 mL). The reaction was extracted into EtOAc (3 x 50 mL), washed successively with water, brine, and dried over sodium sulfate. Concentration under reduced pressure yielded a crude oil, which was purified by flash chromatography (0→20% EtOAc/hexanes), yielding β-ketoester **S46** (0.90 g, 60% yield) as a pale yellow oil. ¹H NMR (CDCl₃, 500 MHz, compound exists as a 10:1 mixture of ketone : enol tautomers, only major ketone peaks are reported) δ 7.29 (m, 2H), 7.17 (m, 3H), 3.73 (s, 3H), 3.43 (s, 2H), 2.63 (t, *J* = 7.6 Hz, 2H), 2.55 (t, *J* = 7.3 Hz, 2H), 1.94 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 10:1 mixture of ketone : enol tautomers, only major ketone peaks are reported) δ 202.37, 167.52, 141.24, 128.37, 128.33, 125.94, 52.26, 48.95, 42.06, 34.70, 24.76; FTIR (NaCl, thin film) 3026, 2951, 2860, 1748, 1715, 1628, 1496, 1453, 1407, 1319, 1258 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₅O₃ [M-H]⁻ 219.1027, found 219.1027.

Preparation of 1-nitro-5-phenylpentan-2-one (S48)



A 250 mL flame-dried round-bottom flask was charged with commercially available 4-phenylbutyric acid **S45** (1.42 g, 8.66 mmol) and carbonyl diimidazole (1.15 mg, 7.11 mmol). THF (45 mL) was introduced, and the clear, colorless solution was stirred at 22 °C for 5 hrs. In a separate 100 mL round-bottom flask potassium *tert*-butoxide (1.12 g, 9.96 mmol) was dissolved in THF (30 mL) and cooled to 0 °C. Nitromethane (4.67 mL, 86.6 mmol) was added dropwise, resulting in a thick white slurry. After warming to room temperature, the slurry was poured directly into the acyl imidazole flask pre-cooled to 0 °C, and the headspace with re-swept with nitrogen. After stirring overnight at room temperature, the orange slurry was quenched with 1M HCl. The volatiles were concentrated and the aqueous was extracted twice with EtOAc. The organic phase was washed with brine, dried over sodium sulfate, and concentrated under reduced pressure. The crude residue was purified by flash chromatography (0→40% EtOAc/hexanes), yielding α -nitroketone **S48** (1.14 g, 63% yield) as a white solid, after recrystallization from EtOAc/hexanes. ¹H NMR (CDCl₃, 500 MHz) δ 7.30 (m, 2H), 7.22 (m, 1H), 7.16 (m, 2H), 5.20 (s, 2H), 2.67 (t, *J* = 7.4 Hz, 2H), 2.53 (t, *J* = 7.2 Hz, 2H), 2.02 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 195.93, 140.61, 128.49, 128.37, 126.20, 83.10, 39.40, 34.45, 24.34; FTIR (NaCl, thin film) 3063, 3019, 2954, 2868, 1727, 1655, 1454, 1397, 1341, 1312, 1198 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₃N₂O₃ [M-H]⁻ 206.0823, found 206.0814.

Preparation of 2-cyano-*N,N*-diphenethylacetamide (S50)

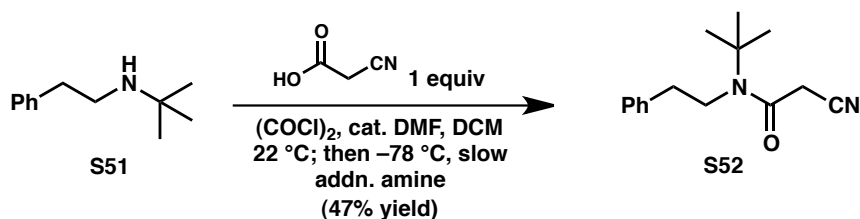


To a 5 mL microwave vessel was added *N,N*-diphenethylamine **S49**¹³ (1.2 g, 5.33 mmol) and a stirbar, and was sealed with a crimped cap under nitrogen. 1,8-Diazabicyclo[5.4.0]undec-7-ene (0.40 mL, 2.67 mmol), THF (3 mL) and ethylcyanoacetate (1.13 mL, 10.66 mmol) were added successively via syringe, and the clear orange solution was heated in a microwave to 165 °C for 45 minutes. After cooling the reaction was extracted

¹³ Synthesized from *N*-phenethyl-2-phenylacetamide (coupling product of 2-phenethylamine and phenylacetic acid), followed by borane reduction according to general procedure 7.

with EtOAc, washed with 1M HCl, brine, and dried over sodium sulfate. The solvent was removed by rotary evaporation under reduced pressure, and the crude residue was purified by flash chromatography (0→33% EtOAc/hexanes), yielding acetamide **S50** (1.0 g, 56% yield) as a yellow oil. ^1H NMR (CDCl_3 , 500 MHz; compound exists as a 1:1 mixture of rotamers) δ 7.31 (m, 4H), 7.23 (m, 4H), 7.09 (m, 2H), 3.61 (m, 2H), 3.29 (t, J = 6.7 Hz, 2H), 2.92 (m, 2H), 2.87 (s, 2H), 2.80 (t, J = 6.7 Hz, 2H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 1:1 mixture of rotamers) δ 161.59, 138.46, 137.38, 129.03, 128.72, 128.69, 128.58, 127.22, 126.52, 113.96, 50.73, 48.37, 34.53, 33.49, 24.34; FTIR (NaCl, thin film) 3061, 3027, 2926, 2860, 2256, 1660, 1496, 1454, 1428, 1368, 1183 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{19}\text{H}_{21}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 293.1648, found 293.1660.

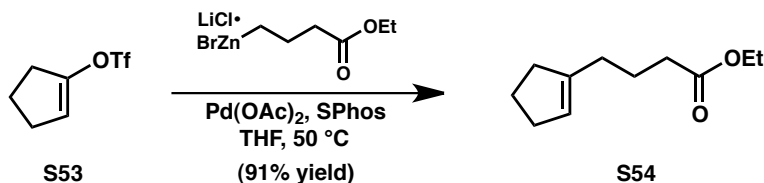
Preparation of *N*-(*t*-butyl)-2-cyano-*N*-phenethylacetamide (**S52**)



To a 25 mL round bottom flask containing cyanoacetic acid (64 mg, 0.75 mmol) was added DCM (5 mL) and one drop of DMF. Oxalyl chloride (70 μL , 0.83 mmol) was added in one portion, and gas evolution resulted. After 20 minutes the bubbling ceased, and the reaction was cooled to -78 °C, and a solution of amine **S72**¹⁴ (0.40 g, 2.3 mmol) in DCM (7 mL) was added dropwise to the acid chloride via cannula. The reaction immediately turned yellow upon addition of the amine and progressed to a clear dark orange solution during the addition. The reaction was warmed to 22 °C and stirred for 10 minutes, at which point TLC analysis indicated formation of a new species. The volatiles were concentrated *in vacuo* and the crude residue was purified by column chromatography (0→10→30% EtOAc/hexanes), cyanoamide **S73** (86 mg, 47% yield, unoptimized) as a pale yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 7.33 (m, 3H), 7.17 (m, 2H), 3.48 (m, 2H), 3.25 (s, 2H), 2.87 (t, J = 7.6 Hz, 2H), 1.54 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 161.98, 137.45, 129.02, 128.40, 127.14, 114.54, 58.57, 47.70, 37.93, 28.68, 27.46; FTIR (NaCl, thin film) 2973, 2918, 2255, 1653, 1453, 1413, 1394, 1362, 1175 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{15}\text{H}_{21}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$ 245.1648, found 245.1661.

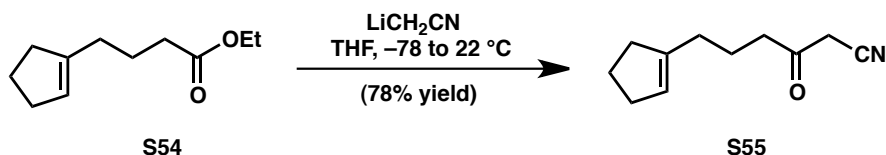
¹⁴ Padwa, A.; Austin, D. J.; Price, A. T.; Semones, M. A.; Doyle, M. P.; Protopopova, M. N.; Winchester, W. R.; Tran, A.; *J. Am. Chem. Soc.* **1993**, *115*, 8669.

Preparation of ethyl 4-(cyclopent-1-en-1-yl)butanoate (S54)



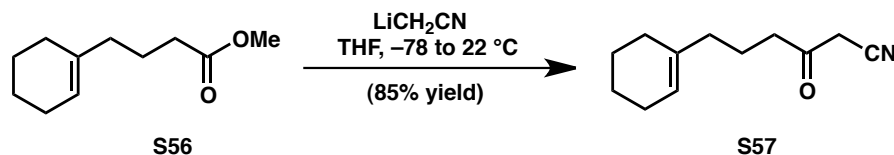
Compound **S54** was synthesized according to general procedure 4. The reaction was run on 5.10 mmol scale for 0.5 hr. The crude material was purified by silica gel chromatography (95:5 Hexanes:Et₂O) to give 850 mg (91% yield) of **S54** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 5.33 (m, 1H), 4.11 (q, *J* = 7.1 Hz, 2H), 2.27 (m, 4H), 2.21 (m, 2H), 2.09 (m, 2H), 1.84 (m, 2H), 1.77 (m, 2H), 1.24 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 173.70, 143.58, 124.06, 60.14, 34.86, 33.96, 32.40, 30.47, 23.38, 23.01, 14.22; FTIR (NaCl, thin film) 2947, 2844, 1737, 1446, 1372, 1242, 1178 cm⁻¹; HRMS (MM) calc'd for C₁₁H₁₉O₂ [M+H]⁺ 183.1380, found 183.1371.

Preparation of 6-(cyclopent-1-en-1-yl)-3-oxohexanenitrile (S55)



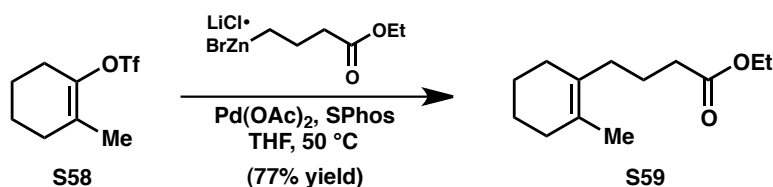
Compound **S55** was synthesized according to general procedure 5. The reaction was run on 4.17 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 572 mg (78% yield) of **S55** as a white solid. ¹H NMR (CDCl₃, 500 MHz) δ 5.34 (m, 1H), 3.45 (s, 2H), 2.58 (t, *J* = 7.3 Hz, 2H), 2.28 (m, 2H), 2.19 (m, 2H), 2.09 (m, 2H), 1.84 (m, 2H), 1.78 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.45, 143.13, 124.64, 113.77, 41.56, 34.70, 32.35, 32.00, 30.03, 23.32, 21.22; FTIR (NaCl, thin film) 2947, 2844, 2260, 1729, 1444, 1403, 1306, 1085 cm⁻¹; HRMS (MM) calc'd for C₁₁H₁₄NO [M-H]⁻ 176.1081, found 176.1073.

Preparation of 6-(cyclohex-1-en-1-yl)-3-oxohexanenitrile (S57)



Compound **S57** was synthesized according to general procedure 5 from known compound **S56**.¹⁵ The reaction was run on 1.78 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 290 mg (85% yield) of **S57** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 5.38 (m, 1H), 3.45 (s, 2H), 2.55 (t, *J* = 7.2 Hz, 2H), 1.95 (m, 4H), 1.87 (m, 2H), 1.73 (p, *J* = 7.2 Hz, 2H), 1.59 (m, 2H), 1.53 (m, 2H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.52, 136.33, 122.29, 113.79, 41.38, 36.92, 32.01, 27.85, 25.14, 22.80, 22.35, 21.09; FTIR (NaCl, thin film) 2926, 2934, 2260, 1728, 1438, 1403, 1306, 1091 cm⁻¹; HRMS (MM) calc'd for C₁₂H₁₆NO [M-H]⁻ 190.1237, found 190.1233.

Preparation of ethyl 4-(2-methylcyclohex-1-en-1-yl)butanoate (S59)

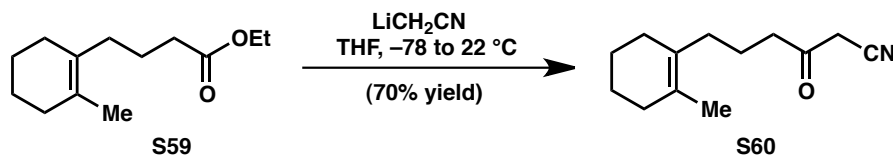


Compound **S59** was synthesized according to general procedure 4. Enol triflate **S58** was synthesized according to Isamir et al¹⁶ and obtained as a 9:1 mixture of **S59** to the enol triflate derived from the thermodynamic enolization of 2-Me cyclohexanone. The reaction was run on 2.95 mmol scale for 3 hr. The crude material was purified by silica gel chromatography (95:5 Hexanes:EtOAc) to give 600 mg (77% yield) of **S59** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz, compound exists as a 5:1 mixture of alkene isomers, only major **S59** peaks are reported) δ 4.12 (q, *J* = 7.1 Hz, 2H), 2.27 (t, *J* = 7.5 Hz, 2H), 2.01 (m, 2H), 1.91 (m, 4H), 1.69 (m, 2H), 1.59 (s, 3H), 1.56 (m, 4H), 1.26 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as a 5:1 mixture of alkene isomers, only major **S59** peaks are reported) δ 173.84, 128.94, 126.94, 60.15, 34.02, 32.62, 31.82, 29.34, 23.42, 23.37, 23.33, 19.02, 14.25; FTIR (NaCl, thin film) 2927, 2858, 1737, 1447, 1372, 1245, 1155 cm⁻¹; HRMS (MM) calc'd for C₁₃H₂₃O₂ [M+H]⁺ 211.1693, found 211.1697.

¹⁵ Snider, B. B.; *J. Org. Chem.* **1974**, *39*, 255.

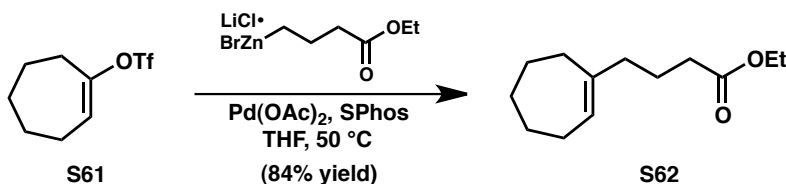
¹⁶ Martínez, I; Alford, P. E.; Ovaska, T. V.; *Org. Lett.* **2005** *7*, 1133

Preparation of 6-(2-methylcyclohex-1-en-1-yl)-3-oxohexanenitrile (S60)



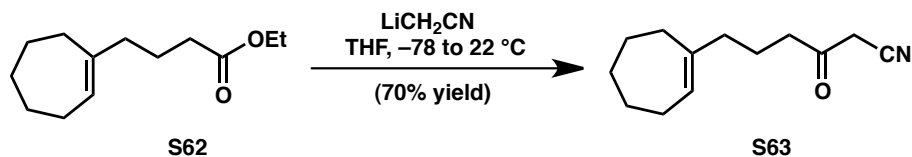
Compound **S60** was synthesized according to general procedure 5. The reaction was run on 1.66 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc), and followed by recrystallization from 99:1 Hexanes:EtOAc, afforded 230 mg (70% yield) of **S60** as a wispy white solid. ^1H NMR (CDCl_3 , 500 MHz, compound exists as a 93:7 mixture of alkene isomers, only major **S60** peaks are reported) δ 3.44 (s, 2H), 2.58 (t, J = 7.3 Hz, 2H), 2.02 (t, J = 7.7 Hz, 2H), 1.91 (m, 4H), 1.71 (m, 2H), 1.59 (s, 3H), 1.56 (m, 4H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as a 93:7 mixture of alkene isomers, only major **S60** peaks are reported) δ 197.53, 128.51, 127.49, 113.79, 41.67, 32.14, 31.93, 31.76, 29.24, 23.31, 23.22, 21.71, 19.09; FTIR (NaCl, thin film) 2924, 2858, 2260, 1730, 1448, 1403, 1371, 1306, 1077 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{18}\text{NO}$ $[\text{M}-\text{H}]^-$ 204.1394, found 204.1387.

Preparation of ethyl 4-(cyclohept-1-en-1-yl)butanoate (S62)



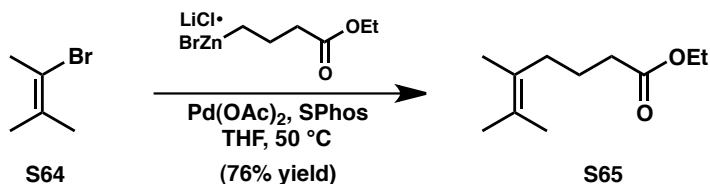
Compound **S62** was synthesized according to general procedure 4. The reaction was run on 5.10 mmol scale for 0.5 hr. The crude material was purified by silica gel chromatography (95:5 Hexanes: Et_2O) to give 900 mg (84% yield) of **S62** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 5.53 (tt, J = 6.5, 1.3 Hz, 1H), 4.11 (q, J = 7.1 Hz, 2H), 2.26 (m, 2H), 2.05 (m, 4H), 1.98 (m, 2H), 1.70 (m, 4H), 1.44 (m, 4H), 1.24 (t, J = 7.1 Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.80, 143.50, 126.80, 60.10, 39.50, 33.74, 32.61, 32.52, 28.27, 27.30, 26.81, 23.11, 14.22; FTIR (NaCl, thin film) 2919, 2847, 1737, 1446, 1372, 1244, 1169 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{13}\text{H}_{23}\text{O}_2$ $[\text{M}+\text{H}]^+$ 211.1693, found 211.1691.

Preparation of 6-(cyclohept-1-en-1-yl)-3-oxohexanenitrile (S63)



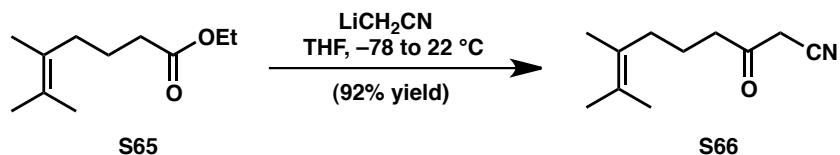
Compound **S63** was synthesized according to general procedure 5. The reaction was run on 3.57 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (8:2 Hexanes:EtOAc) to give 510 mg (70% yield) of **S63** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 5.52 (tt, *J* = 6.4, 1.2 Hz, 1H), 3.45 (s, 2H), 2.57 (t, *J* = 7.2 Hz, 2H), 2.05 (m, 4H), 1.97 (m, 2H), 1.71 (m, 4H), 1.44 (m, 4H); ¹³C NMR (CDCl₃, 126 MHz) δ 197.54, 143.11, 127.37, 113.78, 41.34, 39.02, 32.50, 32.34, 32.04, 28.21, 27.23, 26.74, 21.29; FTIR (NaCl, thin film) 2919, 2846, 2260, 1729, 1446, 1403, 1306, 1091 cm⁻¹; HRMS (MM) calc'd for C₁₃H₁₈NO [M-H]⁻ 204.1394, found 204.1397.

Preparation of ethyl 5,6-dimethylhept-5-enoate (S65)



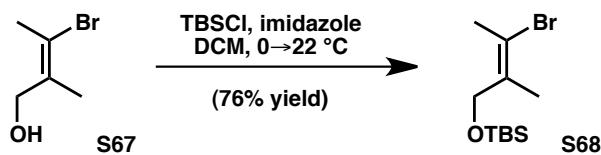
Compound **S65** was synthesized according to general procedure 4. The reaction was run on 3.63 mmol scale for 2.5 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 510 mg (76% yield) of **S65** as a colorless oil. ¹H NMR (CDCl₃, 500 MHz) δ 4.11 (q, *J* = 7.1 Hz, 2H), 2.25 (t, *J* = 7.5 Hz, 2H), 2.05 (m, 2H), 1.68 (m, 2H), 1.62 (m, 9H), 1.25 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz) δ 173.81, 126.65, 124.91, 60.14, 33.91, 33.60, 23.35, 20.54, 20.11, 18.16, 14.23; FTIR (NaCl, thin film) 2981, 2917, 2862, 1737, 1457, 1372, 1243, 1173 cm⁻¹; HRMS (MM) calc'd for C₁₁H₂₁O₂ [M+H]⁺ 185.1536, found 185.1540.

Preparation of 7,8-dimethyl-3-oxonon-7-enenitrile (S66)



Compound **S66** was synthesized according to general procedure 5. The reaction was run on 1.47 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 253 mg (92% yield) of **S66** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 3.45 (s, 2H), 2.56 (t, J = 7.2 Hz, 2H), 2.04 (t, J = 7.6 Hz, 2H), 1.70 (m, 2H), 1.63 (br s, 6H), 1.60 (m, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 197.55, 126.21, 125.46, 113.80, 41.54, 33.07, 31.92, 21.67, 20.52, 20.18, 18.06; FTIR (NaCl, thin film) 2987, 2918, 2862, 2260, 1730, 1451, 1372, 1306, 1084 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{16}\text{NO}$ $[\text{M}+\text{H}]^+$ 178.1237, found 178.1248.

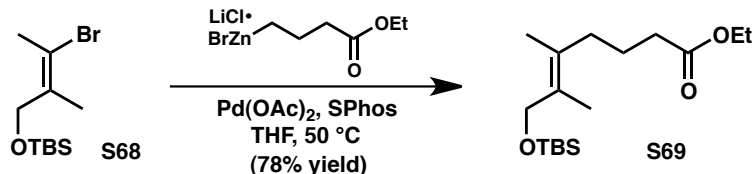
Preparation of bromo alkene (S68)



To a 250 mL round bottom flask was added allylic alcohol **S67**¹⁷ (2.40 g, 14.5 mmol), dichloromethane (100 mL), and imidazole (1.20 g, 1.75 mmol). The clear colorless solution was cooled to 0 $^\circ\text{C}$ in an ice bath and *tert*-butyldimethylsilyl chloride (2.40 g, 16.0 mmol) was added in one portion. A mild exotherm occurred and a white solid rapidly precipitated. The reaction was warmed to room temperature and stirred for 16 hr. The reaction was quenched with water and the organic phase was separated and washed successively with 1M HCl, saturated aqueous NaHCO_3 , and brine. The organic layer was dried over sodium sulfate and concentrated under reduced pressure. The crude residue was purified by flash chromatography (100% hexanes), yielding bromo alkene **S68** (3.50 g, 10:1 *E:Z* ratio, 63% yield) as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 4.16 (s, 2H), 2.34 (m, 3H), 1.89 (q, J = 1.5 Hz, 3H), 0.90 (s, 9H), 0.07 (s, 6H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 133.92, 119.61, 62.70, 25.85, 24.94, 20.86, 18.32, -5.32; FTIR (NaCl, thin film) 2954, 2928, 2856, 2884, 1471, 1372, 1254, 1086, 1056 cm^{-1} ; HRMS (EI+) calc'd for $\text{C}_{11}\text{H}_{22}\text{OSi}^{81}\text{Br}$ $[\text{M}+\text{H}]^+ - \text{H}_2$ 279.0603, found 279.0598.

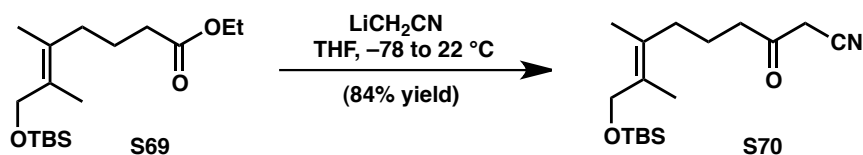
¹⁷ Curran, D. P.; Kuo, S. C.; *Tetrahedron* **1987**, *43*, 5653.

Preparation of ethyl ester (S69)



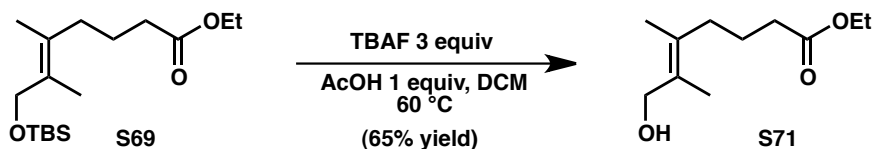
Compound **S69** was synthesized according to general procedure 4. The reaction was run on 3.25 mmol scale for 4 hr. The crude material was purified by silica gel chromatography (9.5:0.5 Hexanes:EtOAc) to give 800 mg (78% yield) of **S69** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 4.13 (m, 4H), 2.28 (t, $J = 7.5$ Hz, 2H), 2.06 (m, 2H), 1.68 (m, 8H), 1.26 (t, $J = 7.1$ Hz, 3H), 0.90 (s, 9H), 0.06 (s, 6H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 173.71, 129.42, 129.03, 63.87, 60.20, 34.05, 33.96, 25.97, 22.99, 18.42, 17.73, 15.41, 14.24, -5.21; FTIR (NaCl, thin film) 2955, 2929, 2856, 1737, 1471, 1372, 1251, 1163 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{19}\text{O}_2$ $[\text{M}-\text{OTBS}]^+$ 183.1380, found 183.1384.

Preparation of β -ketonitrile (S70)



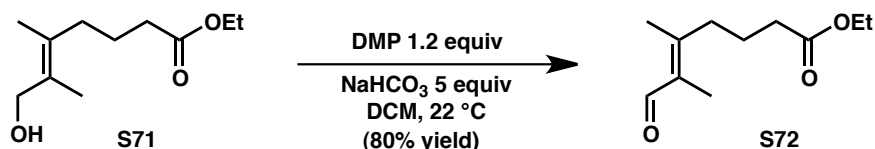
Compound **S70** was synthesized according to general procedure 5. The reaction was run on 2.39 mmol scale for 3 hr. The crude material was purified by silica gel chromatography (9:1 Hexanes:EtOAc) to give 622 mg (84% yield) of **S70** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 4.13 (s, 2H), 3.44 (s, 2H), 2.59 (t, $J = 7.1$ Hz, 2H), 2.07 (m, 2H), 1.74 (m, 2H), 1.68 (m, 3H), 1.66 (m, 3H), 0.90 (s, 9H), 0.06 (s, 6H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 197.39, 129.55, 129.00, 113.76, 63.79, 41.46, 33.49, 31.98, 25.96, 21.24, 18.41, 17.59, 15.60, -5.24; FTIR (NaCl, thin film) 2953, 2928, 2856, 2260, 1732, 1462, 1371, 1254, 1067 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{16}\text{NO}$ $[\text{M}-\text{OTBS}]^+$ 178.1226, found 178.1234.

Preparation of (*E*)-ethyl 7-hydroxy-5,6-dimethylhept-5-enoate (**S71**)



To the ester (**S69**, 1.25 g, 3.98 mmol) in a 100 mL round bottom flask was added in succession DCM (15 mL), acetic acid (0.24 mL, 3.98 mmol) and tetra-*n*-butylammonium fluoride (12 mL, 1M THF solution, 11.9 mmol). The clear, colorless reaction was heated to 60 °C for 18 hours open to air, at which point TLC analysis indicated full consumption of the starting material. The volatiles were concentrated *in vacuo*, and the residue was purified by flash chromatography (0→25→40% EtOAc/hexanes), yielding allylic alcohol **S71** (520 mg, 65% yield) as a colorless oil. ¹H NMR (CDCl₃, 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 4.12 (m, 4H), 2.28 (t, *J* = 7.4 Hz, 2H), 2.07 (m, 2H), 1.73 (m, 8H), 1.25 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 173.63, 132.06, 128.66, 63.98, 60.26, 33.93, 33.92, 22.93, 17.72, 16.21, 14.23; FTIR (NaCl, thin film) 3420, 2977, 2935, 2863, 1734, 1447, 1373, 1160 cm⁻¹; HRMS (MM) calc'd for C₁₁H₁₉O₂ [M-OH]⁺ 183.1380, found 183.1382.

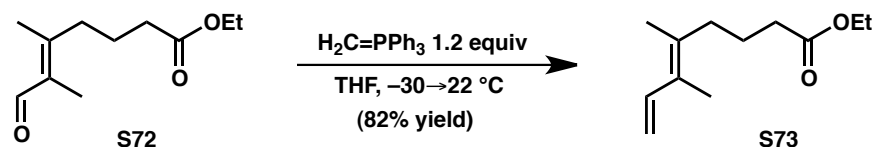
Preparation of (*E*)-ethyl 5,6-dimethyl-7-oxohept-5-enoate (**S72**)



To a 25 mL round bottom flask was added the allylic alcohol (**S71**, 170 mg, 0.865 mmol) followed by DCM (15 mL) and sodium bicarbonate (363 mg, 4.33 mmol). Dess-Martin periodinane (440 mg, 1.04 mmol) was charged and the slurry was stirred vigorously at 22 °C open to air. After 15 minutes TLC analysis indicated full consumption of the starting material. The reaction was diluted with hexanes (10 mL), filtered, and the filtrate was concentrated *in vacuo*. The white solid residue was purified by flash chromatography (0→15% EtOAc/hexanes), yielding enal **S72** (135 mg, 80% yield) as a colorless oil. ¹H NMR (CDCl₃, 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 10.13 (s, 1H), 4.13 (q, *J* = 7.2 Hz, 2H), 2.34 (t, *J* = 7.2 Hz, 2H), 2.30 (m, 2H), 2.18 (q, *J* = 1.4 Hz, 3H), 1.79 (m, 2H), 1.74 (q, *J* = 1.4 Hz, 3H), 1.25 (t, *J* = 7.1 Hz, 3H); ¹³C NMR (CDCl₃, 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of

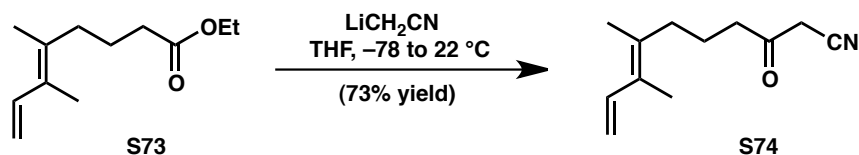
alkene isomers, only major peaks are reported) δ 191.47, 172.97, 156.84, 132.61, 60.43, 36.25, 33.78, 22.30, 17.16, 14.19, 10.55; FTIR (NaCl, thin film) 2980, 2936, 2872, 1732, 1667, 1447, 1373, 1172 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{11}\text{H}_{18}\text{O}_3$ $[\text{M}-\text{OH}]^+$ 199.1329, found 199.1328.

Preparation of (*E*)-ethyl 5,6-dimethylocta-5,7-dienoate (**S73**)



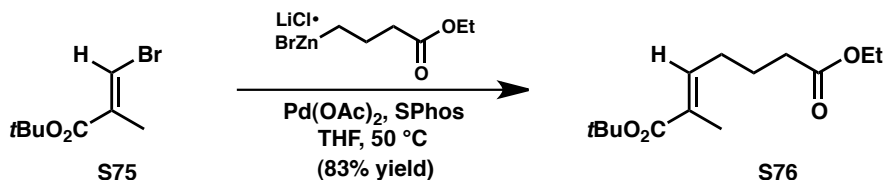
To an oven-dried 25 mL round bottom flask was added MePPh_3Br (353 mg, 0.990 mmol), and the headspace was purged with N_2 . The solid was slurried in THF (5 mL) and the mixture was cooled to $-30\text{ }^\circ\text{C}$ in a dry ice/acetone bath. *n*-Butyllithium (400 μL , 2.1M hexanes, 0.850 mmol) was added dropwise, resulting in dissolution of the solids and the formation of a clear bright yellow solution. The flask was warmed briefly to $22\text{ }^\circ\text{C}$ and re-cooled to $-30\text{ }^\circ\text{C}$. In a conical 10 mL round bottom flask a THF (5 mL) solution of enal **S72** (140 mg, 0.707 mmol) was cannula transferred to the phosphorane at $-30\text{ }^\circ\text{C}$. During the addition the yellow color of the Wittig reagent dissipated, and upon completion of the transfer the reaction was warmed to $22\text{ }^\circ\text{C}$ for 10 minutes. After TLC analysis indicated full consumption of the starting material, the reaction was quenched with 200 μL of acetic acid and diluted with hexanes (20 mL). The white slurry was filtered through celite, and the filtrate was concentrated *in vacuo*. The white solid residue was purified by flash chromatography (0 \rightarrow 10% EtOAc/hexanes), yielding diene **S73** (113 mg, 82% yield) as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 6.82 (dd, $J = 17.2, 10.9\text{ Hz}$, 1H), 5.12 (dd, $J = 17.2, 1.6\text{ Hz}$, 1H), 4.99 (dd, $J = 10.9, 1.6\text{ Hz}$, 1H), 4.12 (q, $J = 7.2\text{ Hz}$, 2H), 2.29 (t, $J = 7.4\text{ Hz}$, 2H), 2.25 (m, 2H), 2.18 (m, 2H), 1.81 (q, $J = 1.4\text{ Hz}$, 3H), 1.74 (m, 5H), 1.25 (t, $J = 7.2\text{ Hz}$, 3H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 173.59, 135.89, 134.36, 127.51, 111.63, 60.24, 34.83, 33.94, 23.20, 18.19, 14.24, 13.31; FTIR (NaCl, thin film) 3088, 2980, 2934, 2869, 1736, 1373, 1173 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{21}\text{O}_2$ $[\text{M}+\text{H}]^+$ 197.1536, found 197.1533.

Preparation of (*E*)-7,8-dimethyl-3-oxodeca-7,9-dienenitrile (**S74**)



Compound **S74** was synthesized according to general procedure 5. The reaction was run on 0.58 mmol scale for 1 hr. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 80 mg (73% yield) of **S74** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 6.80 (dd, $J = 17.2, 10.9$ Hz, 1H), 5.14 (dd, $J = 17.2, 1.5$ Hz, 1H), 5.02 (dd, $J = 10.9, 1.5$ Hz, 1H), 3.44 (s, 2H), 2.60 (t, $J = 7.1$ Hz, 2H), 2.18 (m, 2H), 1.80 (q, $J = 1.4$ Hz, 3H), 1.76 (m, 5H); ^{13}C NMR (CDCl_3 , 126 MHz, compound exists as an inseparable 10:1 *E:Z* mixture of alkene isomers, only major peaks are reported) δ 197.24, 135.67, 133.74, 127.89, 113.71, 112.13, 41.50, 34.29, 31.99, 21.49, 18.11, 13.43; FTIR (NaCl, thin film) 3020, 2921, 2871, 2261, 1732, 1446, 1376, 1307 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{12}\text{H}_{16}\text{NO}$ $[\text{M}-\text{H}]^-$ 190.1237, found 190.1235.

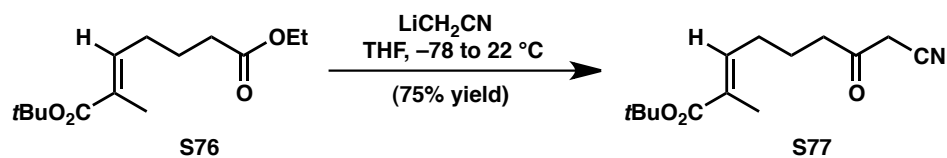
Preparation of (*E*)-1-*tert*-butyl 7-ethyl 2-methylhept-2-enedioate (**S76**)



Compound **S76** was synthesized according to general procedure 4. Bromo ester **S75** was synthesized according to the procedure of Zhang et al.¹⁸ The reaction was run on 11.3 mmol scale for 0.5 hr. The crude material was purified by silica gel chromatography (9.5:0.5 Hexanes:EtOAc) to give 2.60 g (83% yield) of **S76** as a yellow oil. ^1H NMR (CDCl_3 , 500 MHz) δ 6.62 (tq, $J = 7.5, 1.5$ Hz, 1H), 4.13 (q, $J = 7.1$ Hz, 2H), 2.32 (t, $J = 7.4$ Hz, 2H), 2.19 (q, $J = 7.4$ Hz, 2H), 1.78 (m, 5H), 1.48 (s, 9H), 1.26 (t, $J = 7.1$ Hz, 3H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 173.26, 167.36, 139.61, 130.03, 80.01, 60.30, 33.72, 28.08, 27.91, 23.86, 14.21, 12.38; FTIR (NaCl, thin film) 2978, 2933, 2868, 1734, 1700, 1457, 1368, 1251, 1159 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{10}\text{H}_{15}\text{O}_4$ $[\text{M}-t\text{Bu}]^-$ 199.0976, found 199.0975.

¹⁸ Li, X.; Zeng, X.; *Tett. Lett.* **2006**, 47, 6839.

Preparation of (*E*)-*tert*-butyl 8-cyano-2-methyl-7-oxooct-2-enoate (**S77**)



Compound **S77** was synthesized according to general procedure 5. The reaction was run on 1.04 mmol scale for 5 minutes at -78 °C, after which time it was immediately quenched with acetic acid (140 μL , 2.28 mmol), and then subjected to the normal workup of procedure 5. The crude material was purified by silica gel chromatography (7:3 Hexanes:EtOAc) to give 195 mg (75% yield) of **S77** as a colorless oil. ^1H NMR (CDCl_3 , 500 MHz) δ 6.58 (tq, $J = 7.5, 1.5$ Hz, 1H), 3.45 (s, 2H), 2.65 (t, $J = 7.2$ Hz, 2H), 2.19 (m, 2H), 1.78 (m, 5H), 1.49 (s, 9H); ^{13}C NMR (CDCl_3 , 126 MHz) δ 196.98, 167.22, 138.89, 130.52, 113.63, 80.22, 41.36, 31.99, 28.07, 27.43, 22.13, 12.47; FTIR (NaCl, thin film) 2977, 2933, 2259, 1731, 1699, 1457, 1368, 1291, 1159 cm^{-1} ; HRMS (MM) calc'd for $\text{C}_{14}\text{H}_{22}\text{NO}_3$ $[\text{M}+\text{H}]^+$ 252.1594, found 252.1588.