Supporting Information
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Supporting Information

Synthesis of N-pyridyl hydroxylamines via copper-catalyzed cross-coupling

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General

Starting materials, reagents and solvents were purchased from commercial sources and used without further purification. All non-aqueous reactions were carried out under dry conditions using oven dried glassware and an inert atmosphere of Argon, unless otherwise indicated. When indicated, solvents and reagents were degassed by bubbling Argon through the liquids for 1 h. Flash chromatography was performed using Reveleris X2 system (Büchi Labortechnik AG; Flawil, Switzerland). Melting points were recorded on a Thomas Hoover capillary melting point apparatus (Philadelphia, PA) and reported uncorrected. $^1$H and $^{13}$C NMR spectra were recorded with a 400 MHz JEOL NMR spectrometer (JEOL USA, Inc.; Peabody, MA). IR spectra was recorded using a Perking Elmer FT-IR spectrometer (Boston, MA). High resolution mass spectroscopy (HRMS) was measured using a ThermoFinnigan Q-Exactive instrument (Thermo Fisher Scientific; Waltham, MA) with electron spray ionization (ESI) and gas chromatography mass spectrometer chemical ionization time of flight (CI/TOF, Agilent Technologies; Santa Clara, CA).

General Procedure A: Acetylation.$^1$

To a solution of $O$-protected hydroxylamine (18.25 mmol) in anhydrous CH$_2$Cl$_2$ (91 mL), Et$_3$N (5.6 mL, 40.15 mmol) and 4-dimethylaminopyridine (222 mg, 1.82 mmol) were added at 0 °C. Ac$_2$O (1.90 mL, 20.07 mmol) was added drop-wise through an addition funnel. The mixture was warmed to room temperature and stirred overnight. The mixture was washed with NaHCO$_3$, 1 M HCl, H$_2$O and brine. The organic layer was dried over MgSO$_4$, filtered and concentrated under reduced pressure. The crude product was purified by chromatography.

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*N-(Allyloxy)acetamide 2k.* Compound **2k** was synthesized following general procedure A, using *O*-allylhydroxylamine hydrochloride (2.00 g, 18.25 mmol). Compound **2k** was extracted from the aqueous layer using EtOAc, the organic layer was dried over Na₂SO₄, filtered and concentrated under reduced pressure to yield **2k**. The compound was used without further purification.

Colourless oil; yield: 1.41 g (67%).

IR (neat): 3184, 2967, 1659, 1370, 1078, 992, 927, 729 cm⁻¹.

¹H NMR (CDCl₃, 400 MHz): δ = 5.87 – 5.83 (m, 1H), 5.24 – 5.15 (m, 2H), 4.27 (d, *J* = 6.4 Hz, 2H), 1.82 (s, 3H).

¹³C NMR (CDCl₃, 400 MHz): δ = 168.4, 132.3, 120.1, 77.6, 19.8.


*N-((Tert-butyldimethylsilyl)oxy)acetamide 2o.* Compound **2o** was synthesized following general procedure A, using *O-*(tert-butyldimethylsilyl)hydroxylamine (500 mg, 3.39 mmol). The crude product was purified by chromatography (SiO₂, 50 – 100% CH₂Cl₂: Hexanes followed by 0 – 20% EtOAc:CH₂Cl₂ gradient) to afford **2o**.

White solid; yield: 250 mg (39%).

IR (neat): 3157, 2934, 2863, 2304, 1654, 1465, 1390, 1252, 1088, 1040, 984, 829, 785 cm⁻¹.

¹H NMR (CD₃OD, 400 MHz): δ = 1.86 (s, 3H), 0.97 (s, 9H), 0.17 (s, 6H).

¹³C NMR (CD₃OD, 400 MHz): δ = 168.8 (d), 24.9, 18.0, 17.9, −6.8.

HRMS (Cl/TOF): *m/z* [M + H]⁺ calcd for C₈H₂₀NO₂Si : 190.1258; found: 190.1260.
N-(2-(Trimethylsilyl)ethoxy)acetamide 2q. Compound 2q was synthesized following general procedure A, using O-(2-(trimethylsilyl)ethyl)hydroxylamine (1.00 g, 5.89 mmol). The crude product was purified by chromatography (SiO$_2$, 0 – 20% EtOAc: CH$_2$Cl$_2$ gradient) to afford 2q. Colourless oil; yield: 1.01 g (98%).

IR (neat): 3191, 2951, 2854, 2364, 2109, 1655, 1372, 1250, 1080, 988, 833 cm$^{-1}$.

$^1$H NMR (CDCl$_3$, 400 MHz): $\delta = 9.21, 8.64$ (rotamers, br, 1H), 3.94 – 3.89 (m, 2H), 2.07, 1.88 (rotamers, s, 3H), 1.01 – 0.97 (m, 2H), −0.02 (s, 9H).

$^{13}$C NMR (CDCl$_3$, 400 MHz): $\delta = 168.1, 74.1, 19.9, 16.7, -1.4$.

HRMS (CI/TOF): $m/z$ [M + H]$^+$ calcd for C$_7$H$_{18}$NO$_2$Si: 176.1101; found: 176.1104.

**General Procedure B: Carbamate preparation**

To a solution of the alcohol (6.39 mmol) in anhydrous benzene (6.8 mL), carbamylidimidazole (CDI, 80%, 1.30 g, 6.39 mmol) was added. The mixture was stirred at room temperature for 2 h. A solution of O-protected hydroxylamine (6.39 mmol) in anhydrous benzene (1.5 mL) was added and the mixture was stirred for 16 h. The mixture was diluted with benzene and washed with brine. The organic layer was dried over MgSO$_4$, filtered and concentrated under reduced pressure. The crude residue was purified by chromatography using a gradient of 50 – 100% CH$_2$Cl$_2$:Hexanes followed by 0 – 20% EtOAc: CH$_2$Cl$_2$ to yield the product.

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**2-(Trimethylsilyl)ethyl (allyloxy)carbamate 2m.** Compound 2m was synthesized following general procedure B, using O-allylhydroxylamine hydrochloride (700 mg, 6.39 mmol) and 2-(trimethylsilyl)ethan-1-ol (0.91 mL, 6.39 mmol).

Yellow oil; yield: 1.36 g (97%).

IR (neat): 3255, 2955, 1720, 1458, 1249, 1106, 1061, 858, 835, 698 cm⁻¹.

$^1$H NMR (CDCl$_3$, 400 MHz): δ = 7.50 (br, 1H), 5.93 – 5.88 (m, 1H), 5.31 – 5.26 (m, 2 H), 4.31 (d, $J$ = 6.0 Hz, 2H), 4.25 – 4.21 (m, 2H), 1.01 – 0.96 (m, 2H), 0.00 (s, 9H).

$^{13}$C NMR (CDCl$_3$, 400 MHz): δ = 157.9, 132.4, 120.2, 77.6, 64.4, 17.7, -1.4.

HRMS (Cl/TOF): $m/z$ [M + H]$^+$ calcd for C$_9$H$_{20}$NO$_3$Si: 218.1207; found: 218.1203.

![Structure 2m]

**Tert-butyl ((tetrahydro-2H-pyran-2-yl)oxy)carbamate 2h.** Compound 2h was synthesized following general procedure B, using O-(tetrahydro-2H-pyran-2-yl)hydroxylamine (2.00 g, 17.08 mmol) and tBuOH (1.26 g, 17.08 mmol). The crude product was purified by chromatography (SiO$_2$, 0 – 20% EtOAc: CH$_2$Cl$_2$ gradient) to afford 2h.

Colourless oil; yield: 1.18 g (32%).

IR (neat): 3274, 2944, 1720, 1462, 1368, 1248, 1164, 1101, 1037 cm⁻¹.

$^1$H NMR (CDCl$_3$, 400 MHz): δ = 7.58 (br, 1H), 4.89 (br, 1H), 3.92 – 3.89 (m, 1H), 3.60 – 3.57 (m, 1H), 1.75 (m, 3H), 1.57 – 1.54 (m, 3H), 1.45 (s, 9H).

$^{13}$C NMR (CDCl$_3$, 400 MHz): δ = 156.5, 102.4, 81.7, 62.6, 28.2, 25.1, 18.9.

HRMS (ESI): $m/z$ [M+H]$^+$ calcd for C$_{10}$H$_{20}$NO$_4$: 218.1387; found: 218.1385.

![Structure 2h]
**Tert-butyl (allyloxy)carbamate 2l.** Compound 2l was synthesized following general procedure B, using O-allylhydroxylamine hydrochloride (2.00 g, 18.25 mmol) and tBuOH (1.35 g, 18.25 mmol). The crude product was purified by chromatography (SiO₂, 0 – 20% EtOAc: CH₂Cl₂ gradient) to afford 2l.

White solid; Yield: 266 mg (7%).

¹H NMR (400 MHz; CDCl₃): δ = 7.36 (br, 1H), 5.95 – 5.53 (m, 1H), 5.29 – 5.20 (m, 2H), 4.28 (d, J = 6.4 Hz, 2H), 1.42 (s, 9H).

¹³C NMR (400 MHz; CDCl₃): δ 156.9, 132.6, 119.8, 81.6, 77.4, 28.2.

Analytical data is in agreement to the reported in literature.³

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**Benzyl ((tetrahydro-2H-pyran-2-yl)oxy)carbamate 2j.** Compound 2j was synthesized following general procedure B, using O-(tetrahydro-2H-pyran-2-yl)hydroxylamine (2.00 g, 17.08 mmol) and BnOH (1.77 mL, 17.08 mmol). The crude product was purified by chromatography (SiO₂, 0 – 20% EtOAc: CH₂Cl₂ gradient) to afford 2j.

White solid; Yield: 3.08 g (72%); mp 55 – 56 °C.

¹H NMR (400 MHz; CDCl₃): δ = 7.82 (s, 1H), 7.35 – 7.28 (m, 5H), 5.15 (m, 2H), 4.92 (m, 1H), 3.94 – 3.89 (m, 1H), 3.60 – 3.57 (m, 1H), 1.75 (m, 3H), 1.60 – 1.53 (m, 3H).

¹³C NMR (400 MHz; CDCl₃): δ = 157.1, 135.7, 128.7, 128.5, 128.4, 102.7, 67.6, 62.6, 28.2, 25.8, 18.8.


Analytical data is in agreement to the reported in literature.⁴

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N-(Benzyloxy)methanesulfonamide 2e. To a solution of O-benzyl hydroxylamine (2.00 g, 16.19 mmol), in THF (32 mL), MsCl (1.25 mL, 16.19 mmol) was added. The mixture was stirred at room temperature for 20 h. The mixture was diluted in Et₂O and washed with NaHCO₃ saturated aqueous solution. The organic layer was dried over MgSO₄, filtered and concentrated under reduced pressure. The crude residue was purified by chromatography using a gradient of 0 – 20% EtOAc: CH₂Cl₂ to afford the product.
Crystalline solid; yield: 2.28 g (70%); mp 93 – 95 °C.
IR (neat): 3217, 3023, 2896, 1675, 1473, 1458, 1368, 1319, 1155, 1027, 968, 837, 780, 755, 702, 681, 605, 522, 500, 458 cm⁻¹.
¹H NMR (CDCl₃, 400 MHz): δ = 7.40 – 7.38 (m, 5H), 7.12 (s, 1H), 4.98 (s, 2H), 3.00 (s, 3H).
¹³C NMR (CDCl₃, 400 MHz): δ = 135.2, 129.6, 129.0, 128.7, 79.6, 36.9.

Table 1: Copper-catalyzed coupling of 2,6-diiodopyridine with 2 equiv. of hydroxylamine
N,N'-:(Pyridine-2,6-diyl)bis(N-benzzyloxy)acetamide) 3y. Following the general procedure for copper catalyzed coupling, using 2,6-diiodopyridine (200 mg, 0.600 mmol), N-(benzzyloxy)acetamide (200 mg, 1.21 mmol), CuO (17 mg, 0.121 mmol), DMEDA (26 µL, 0.242 mmol) and K2CO3 (334 mg, 2.42 mmol), compound 3y was obtained with 3r as byproduct. The reaction proceeded with an 81% conversion. The crude product was purified by chromatography (SiO2, 50 – 100% Hexanes:CH2Cl2 then 0 – 10% EtOAc:CH2Cl2 gradient) to afford 3y. Yellow oil; yield: 56 mg (23%).

IR (neat): 3082, 3002, 1686, 1585, 1464, 1431, 1367, 1282, 1151, 778, 584 cm⁻¹.

1H NMR (CDCl3, 400 MHz): δ = 7.78 (t, J = 8.2 Hz, 1H), 7.56 (d, J = 7.8 Hz, 2H), 7.41 – 7.39 (m, 4H), 7.34 – 7.32 (m, 6H), 5.03 (s, 4H), 2.31 (s, 6H).

13C NMR (CDCl3, 400 MHz): δ = 170.8, 150.4, 140.0, 134.3, 129.7, 129.1, 128.7, 114.7, 77.8, 23.0.

**N,N’-(Pyridine-2,6-diyl)bis(N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide) 3z.** Following the general procedure for copper catalyzed coupling, using 2,6-diiodopyridine (426 mg, 1.29 mmol), N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide (412 mg, 2.57 mmol), Cu₂O (37 mg, 2.57 mmol), DMEDA (55 µL, 0.514 mmol) and K₂CO₃ (710 mg, 5.14 mmol), compound 3z was obtained with 3u as byproduct. The crude product was purified by chromatography (SiO₂, 0 – 10% Acetone:Hexanes:CH₂Cl₂ gradient) to afford 3z and 3u (188 mg).

Yellow oil; yield: 108 mg (36%).

IR (neat): 2941, 2866, 1688, 1582, 1436, 1364, 1278, 1204, 1033, 897, 873, 804 cm⁻¹.

¹H NMR (CDCl₃, 400 MHz): δ = 7.77 (t, J = 7.8 Hz, 1H), 7.46 (d, J = 8.2 Hz, 2H), 5.03 (m, 2H), 3.81 – 3.79 (m, 2H), 3.39 – 3.37 (m, 2H), 2.34 (s, 6H), 1.84 – 1.80 (m, 6H), 1.54 (s, 6H).

¹³C NMR (CDCl₃, 400 MHz): δ = 171.2, 151.4, 139.6(d), 116.0(d), 104.1(d), 64.0, 28.7(d), 24.9, 23.1, 19.7(d).


**Di-tert-butyl pyridine-2,6-diylbis(((tetrahydro-2H-pyran-2-yl)oxy)carbamate) 3aa.** Following the general procedure for copper catalyzed coupling, using 2,6-diiodopyridine (500 mg, 1.51 mmol), tert-butyl ((tetrahydro-2H-pyran-2-yl)oxy)carbamate (659 mg, 3.03 mmol), Cu₂O (43 mg, 0.303 mmol), DMEDA (66 µL, 0.610 mmol) and K₂CO₃ (838 mg, 6.07 mmol), compound 3aa was obtained. The crude product was purified by chromatography (SiO₂, 50 – 100% Hexanes: CH₂Cl₂ followed by 0 – 20% EtOAc: CH₂Cl₂ gradient) to afford 3aa and traces of the decoupling by product.

Off-white solid; yield: 376 mg (49%); mp 113 – 116°C.

IR (neat): 2982, 2937, 1728, 1585, 1447, 1365, 1300, 1156, 1100, 1020, 964, 908, 874 cm⁻¹.

¹H NMR (CDCl₃, 400 MHz): δ = 7.66 (t, J = 7.8 Hz, 1H), 7.28 (d, J = 7.8 Hz, 2H), 5.10 (m, 2H), 3.91 – 3.87 (m, 2H), 3.40 (m, 2H), 1.92 – 1.53 (m, 12H), 1.49 (s, 18H).

¹³C NMR (CDCl₃, 400 MHz): δ = 154.0(d), 152.6(d), 138.6 (d), 116.6 (d), 102.5(d), 82.6, 62.3(d), 28.3, 25.3, 18.4(d).

NMR Data

$^1$H NMR (400 MHz, CDCl$_3$) of N-(allyloxy)acetamide 2k
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(allyloxy)acetamide 2k
$^1$H NMR (400 MHz, CD$_3$OD) of $N$-((tert-butyldimethylsilyl)oxy)acetamide 2o
$^{13}$C NMR (400 MHz, CD$_3$OD) of $N$-((tert-butyldimethylsilyl)oxy)acetamide 2o
$^1$H NMR (400 MHz, CDCl$_3$) of N-(2-(trimethylsilyl)ethoxy)acetamide 2q
$^{13}$C NMR (400 MHz, CDCl$_3$) of N-(2-(trimethylsilyl)ethoxy)acetamide 2q
$^1$H NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (allyloxy)carbamate 2m
$^{13}$C NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (allyloxy)carbamate 2m

\[
\text{HN-OC} \quad \text{TMS}
\]

X: parts per million / $^{13}$C
$^1$H NMR (400 MHz, CDCl$_3$) of tert-butyl ((tetrahydro-2H-pyran-2-yl)oxy)carbamate 2h
$^{13}$C NMR (400 MHz, CDCl$_3$) (400 MHz, CDCl$_3$) of tert-butyl ((tetrahydro-2H-pyran-2-yl)oxy)carbamate 2h
$^1$H NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)methanesulfonamide 2e
$^{13}$C NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)methanesulfonamide 2e
$^1$H NMR (400 MHz, CD$_3$OD) of $N$-(benzyloxy)-$N$-(pyridin-2-yl)acetamide 3a
$^{13}$C NMR (400 MHz, CD$_3$OD) of N-(benzyloxy)-N-(pyridin-2-yl)acetamide 3a
$^1$H NMR (400 MHz, CDCl$_3$) of $\text{tert}$-butyl (benzyloxy)(pyridin-2-yl)carbamate 3b
$^{13}$C NMR (400 MHz, CDCl$_3$) of tert-butyl (benzoyloxy)(pyridin-2-yl)carbamate 3b
$^1$H NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (benzyloxy)(pyridin-2-yl)carbamate 3c
$^{13}$C NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (benzyloxy)(pyridin-2-yl)carbamate 3c
$^1$H NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)-4-methyl-N-[(pyridin-2-yl)benzenesulfonamide 3d
$^1$H NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)-4-methyl-$N$-(pyridin-2-yl)benzenesulfonamide 3d
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(benzyloxy)-4-methyl-$N$-(pyridin-2-yl)benzenesulfonamide 3d
$^1$H NMR (400 MHz, CDCl$_3$) of $N$-(benzyloxy)-$N$-(pyridin-2-yl)methanesulfonamide 3e
$^{13}$C NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)-N-(pyridin-2-yl)methanesulfonamide 3e
$^1$H NMR (400 MHz, CDCl$_3$) of N-(pyridin-2-yl)-N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3g
$^{13}$C NMR (400 MHz, CDCl$_3$) of N-(pyridin-2-yl)-N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3g
$^1$H NMR (400 MHz, CDCl$_3$) of tert-butyl pyridin-2-yl((tetrahydro-2H-pyran-2-yl)oxy)carbamate 3h
$^{13}$C NMR (400 MHz, CDCl$_3$) of tert-butyl pyridin-2-yl((tetrahydro-2H-pyran-2-yl)oxy)carbamate 3h
$^1$H NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl pyridin-2-yl((tetrahydro-2H-pyran-2-yl)oxy)carbamatecarbamate 3i
$^{13}$C NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl pyridin-2-yl((tetrahydro-2H-pyran-2-yloxy)carbamatecarbamate 3i
$^1$H NMR (400 MHz, CDCl$_3$) of Benzyl pyridin-2-yl( (tetrahydro-2H-pyran-2-yl)oxy) carbamate 3j
$^{13}$C NMR (400 MHz, CDCl$_3$) of Benzyl pyridin-2-yl((tetrahydro-2H-pyran-2-yl)oxy)carbamate 3j
$^1$H NMR (400 MHz, CDCl$_3$) of N-(allyloxy)-N-(pyridin-2-yl)acetamide 3k
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(allyloxy)-$N$-(pyridin-2-yl)acetamide 3k
$^{1}$H NMR (400 MHz, CDCl$_3$) of tert-butyl (allyloxy)(pyridin-2-yl)carbamate 3l
$^{13}$C NMR (400 MHz, CDCl$_3$) of tert-butyl (allyloxy)(pyridin-2-yl)carbamate 3l
$^1$H NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (allyloxy)(pyridin-2-yl)carbamate 3m

![NMR spectrum of 2-(trimethylsilyl)ethyl (allyloxy)(pyridin-2-yl)carbamate 3m]
$^{13}$C NMR (400 MHz, CDCl$_3$) of 2-(trimethylsilyl)ethyl (allyloxy)(pyridin-2-yl)carbamate 3m
$^1$H NMR (400 MHz, CDCl$_3$) of Benzyl (allyloxy)(pyridin-2-yl)carbamate 3n

![NMR Spectrum]

X: parts per million / 1H
$^{13}$C NMR (400 MHz, CDCl$_3$) of Benzyl (allyloxy)(pyridin-2-yl)carbamate 3n
$^1$H NMR (400 MHz, CDCl$_3$) of N-(pyridin-2-yl)-N-(2-(trimethylsilyl)ethoxy)acetamide 3q
$^{13}$C NMR(400 MHz, CDCl$_3$) of $N$-(pyridin-2-yl)$-N$-(2-(trimethylsilyl)ethoxy)acetamide 3q
$^1$H NMR (400 MHz, CDCl$_3$) of N-(benzyloxy)-N-(6-iodopyridin-2-yl)acetamide 3r
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(benzyloxy)-$N$-(6-iodopyridin-2-yl)acetamide 3r
$^1$H NMR (400 MHz, CDCl$_3$) of tert-butyl (benzyloxy)(6-iodopyridin-2-yl)carbamate 3s
$^{13}$C NMR (400 MHz, CDCl$_3$) of tert-butyl (benzyloxy)(6-iodopyridin-2-yl)carbamate 3s
$^1$H NMR (400 MHz, CDCl$_3$) of di-tert-butyl pyridine-2,6-diylbis((benzyloxy)carbamate) 3s2
$^{13}$C NMR (400 MHz, CDCl$_3$) of di-tert-butyl pyridine-2,6-diylbis((benzyloxy)carbamate) 3s2
$^1$H NMR (400 MHz, CDCl$_3$) of $N$-(6-iodopyridin-2-yl)-$N$-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3u
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(6-iodopyridin-2-yl)-$N$-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3u
$^1$H NMR (400 MHz, CDCl$_3$) of (Z)-1-methylpyridin-2(1H)-one O-benzyl oxime 3v
$^{13}$C NMR (400 MHz, CDCl$_3$) of (Z)-1-methylpyridin-2(1H)-one O-benzyl oxime 3v
$^1$H NMR (400 MHz, CDCl$_3$) of (Z)-1-methylpyridin-2(1H)-one O-tetrahydro-2H-pyran-2-yl oxime 3w
$^{13}$C NMR (400 MHz, CDCl$_3$) of (Z)-1-methylpyridin-2(1H)-one O-tetrahydro-2H-pyran-2-yl oxime 3w
$^1$H NMR (400 MHz, CDCl$_3$) of N-(pyrimidin-2-yl)-N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3x
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N$-(pyrimidin-2-yl)-$N$-((tetrahydro-2H-pyran-2-yl)oxy)acetamide 3x
$^1$H NMR (400 MHz, CDCl$_3$) of N,N'-(pyridine-2,6-diyl)bis(N-(benzyloxy)acetamide) 3y
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N,N'$-(pyridine-2,6-diyl)bis($N$-(benzyloxy)acetamide) 3y
$^1$H NMR (400 MHz, CDCl$_3$) of $N,N'$(pyridine-2,6-diyl)bis(N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide) 3z
$^{13}$C NMR (400 MHz, CDCl$_3$) of $N,N'$-(pyridine-2,6-diyl)bis(N-((tetrahydro-2H-pyran-2-yl)oxy)acetamide) 3z
\textsuperscript{1}H NMR (400 MHz, CDCl\textsubscript{3}) of di-\textit{tert}-butyl pyridine-2,6-diylbis(((tetrahydro-2H-pyran-2-yl)oxy)carbamate) 3aa
$^{13}$C NMR (400 MHz, CDCl$_3$) of di-tert-butyl pyridine-2,6-diylbis(((tetrahydro-2H-pyran-2-yl)oxy)carbamate) 3aa