Supporting Information for:

Regioselectivity in Pd-Catalyzed C-H Activation/Oxygenation Reactions

Dipannita Kalyani and Melanie S. Sanford*

*University of Michigan, Department of Chemistry, 930 N. University Ave., Ann Arbor,
MI 48109*

General Procedures: NMR spectra were obtained on a Varian Inova 500 (499.90 MHz for ^1H ; 125.70 MHz for ^{13}C) or a Varian Inova 400 (399.96 MHz for ^1H ; 100.57 MHz for ^{13}C ; 376.34 MHz for ^{19}F) spectrometer. ^1H NMR chemical shifts are reported in parts per million (ppm) relative to TMS, with the residual solvent peak used as an internal reference. Multiplicities are reported as follows: singlet (s), doublet (d), doublet of doublets (dd), doublet of doublets of doublets (ddd), doublet of triplets (dt), triplet (t), quartet (q), quintet (quin), multiplet (m), and broad resonance (br). IR spectra were obtained on a Perkin-Elmer "Spectrum BX" FT-IR spectrometer.

Materials and Methods: Pyridine substrate **8** was prepared by Suzuki cross-coupling of 3-methoxyphenyl boronic acid with 2-bromopyridine according to a literature procedure.ⁱ Pyridine substrates **2-7**, **13-16** and **18** were prepared by Stille cross-coupling of 2-tributylpyridyltin with the corresponding aryl bromides.ⁱⁱ Amide substrates **9-12** were prepared by palladium-catalyzed arylation of the corresponding lactam.ⁱⁱⁱ Substrate **17** was prepared by coupling 2-lithiopyridine with NNN'N' tetraethylisophthalamide according to a literature procedure.^{iv} The authentic compounds were prepared by Stille cross-coupling.^v Cyclopalladated complex **19** was prepared according to a literature procedure.^{vi} $\text{Pd}(\text{OAc})_2$ was obtained from Pressure Chemical and used as received, and $\text{PhI}(\text{OAc})_2$ and $\text{PhI}(\text{TFA})_2$ were obtained from Acros and used as received. Solvents were obtained from Fisher Chemical and used without further

purification. Flash chromatography was performed on EM Science silica gel 60 (0.040–0.063 mm particle size, 230–400 mesh) and thin layer chromatography was performed on Merck TLC plates pre-coated with silica gel 60 F₂₅₄. Control reactions (in the absence of Pd catalyst) were run for each substrate, and generally showed no reaction under our standard conditions. The regioselectivity of acetoxylation was determined based on coupling constant analysis and assignment of each aromatic proton of the products is detailed below. For products **4a**, **7a**, **9a** and **15a** the aromatic signals could not be completely resolved by ¹H NMR spectroscopy; therefore the regioselectivity was based on coupling constant analysis of the hydrolyzed products **4c**, **7c**, **9c** and **15c** respectively. Authentic samples of **2b**, **4a**, **6b**, **8b**, **18a** and **18b** were synthesized to further confirm the regioselectivity in these reactions.

Substrate **2** (132 mg, 0.66 mmol, 1 equiv), PhI(OAc)₂ (637 mg, 2.0 mmol, 3.0 equiv), and Pd(OAc)₂ (7.38 mg, 0.03 mmol, 0.05 equiv) were combined in C₆H₆ (2.2 mL) and Ac₂O (2.2 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 3 h. The solvent was removed under vacuum, and the resulting yellow solid was purified by chromatography on silica gel (*R*_f = 0.24 in 65% hexanes/35% ethyl acetate). The product **2a** was obtained as a pale yellow solid (101 mg, 60% yield); mp = 98–99 °C. ¹H NMR (*d*₆-acetone): δ 8.75–8.73 (m, 1H_a), 8.71 (d, *J* = 2.9 Hz, 1H_e), 8.33 (dd, *J* = 8.9, 2.9 Hz, 1H_f), 7.95–7.91 (m, 1H_c), 7.85–7.82 (m, 1H_d), 7.52 (d, *J* = 8.9 Hz, 1H_g), 7.44–7.41 (m, 1H_b), 2.26 (s, 3H). ¹³C{¹H} NMR (*d*₆-acetone): δ 168.98, 154.01, 153.93, 150.80, 146.74, 137.71, 135.14, 126.86, 126.03, 125.23, 124.56, 124.17, 20.90. IR (thin film): 3098, 1760, 1591, 1531, 1353 cm⁻¹. Anal. Calcd for C₁₃H₁₀N₂O₄: C, 60.47, H, 3.90, N, 10.85; Found: C, 60.34, H, 3.66, N, 10.53. Retention time (GC): 10.1 min. Only one isomer is observed by GC and ¹H NMR.

2-Bromo-6-nitrophenol (506 mg, 2.30 mmol, 1 equiv), Ac₂O (4.6 mL) and pyridine (0.88 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH₂Cl₂ (15 mL) and extracted with H₂O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO₄, filtered and concentrated under vacuum. The product, 1-bromo-2-acetoxy-3-nitrobenzene was obtained as a yellow oil (559 mg, 93% yield).

Under a nitrogen atmosphere, 1-bromo-2-acetoxy-3-nitrobenzene (559 mg, 2.1 mmol, 1 equiv), and Pd(PPh₃)₄ (124 mg, 0.11 mmol, 0.05 equiv) and tributylpyridyltin (870 mg, 2.4 mmol, 1.1 equiv) were combined in toluene (5 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 110 °C for 12 h. The reaction mixture was diluted with ethyl acetate, filtered through a pad of Celite, and washed with copious ethyl acetate. The washings were combined and concentrated under vacuum. The crude product was dissolved in ethyl acetate and extracted with 1M aqueous KF (4 x 30 mL). The combined organic layers were then extracted with brine (1 x 30 mL), dried over MgSO₄, filtered and concentrated. The resulting brown oil was purified by chromatography on silica gel (R_f = 0.25 in 65% hexanes/35% ethyl acetate). The product was obtained as a viscous yellow oil (30.0 mg, 5% yield). ¹H NMR (*d*₆-acetone): δ 8.73-8.71 (m, 1H_a), 8.18 (dd, *J* = 8.1, 1.6 Hz, 1H_g), 8.14 (dd, *J* = 7.8, 1.6 Hz, 1H_e), 7.94 (td, *J* = 7.9, 1.8 Hz, 1H_c), 7.75 (dt, *J* = 7.9, 1.0 Hz, 1H_d), 7.64 (t, *J* = 8.1 Hz, 1H_f), 7.44 (ddd, *J* = 7.6, 4.8, 1.1 Hz, 1H_b), 2.22 (s, 3H). Retention time (GC): 9.42 min.

Substrate **3** (208 mg, 0.93 mmol, 1 equiv), PhI(OAc)₂ (450 mg, 1.40 mmol, 1.5 equiv), and Pd(OAc)₂ (10.4 mg, 0.05 mmol, 0.05 equiv) were combined in C₆H₆ (3 mL) and Ac₂O (3

mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 45 min. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel ($R_f = 0.30$ in 75% hexanes/25% ethyl acetate). The product **3a** was obtained as a pale yellow oil (211 mg, 81% yield). ^1H NMR (d_6 -benzene): δ 8.43 (d, $J = 4.7$ Hz, 1H_a), 8.07 (s, 1H_e), 7.24 (d, $J = 8.4$ Hz, 1H_f), 7.09 (d, $J = 7.9$ Hz, 1H_d), 7.02 (t, $J = 8.0$ Hz, 1H_c), 6.89 (d, $J = 8.4$ Hz, 1H_g), 6.62-6.59 (m, 1H_b), 1.71 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 169.11, 154.36, 151.98, 150.58, 137.46, 134.74, 128.61 (q, $^3J_{\text{C-F}} = 3.8$ Hz), 128.51 (q, $^2J_{\text{C-F}} = 33$ Hz), 127.10 (q, $^3J_{\text{C-F}} = 3.8$ Hz), 125.63, 124.89 (q, $^1J_{\text{C-F}} = 271$ Hz), 124.39, 123.77, 20.74. IR (KBr): 1768, 1597 cm^{-1} . Anal. Calcd for $\text{C}_{14}\text{H}_{10}\text{F}_3\text{NO}_2$: C, 59.79, H, 3.58, N, 4.98; Found: C, 60.14, H, 3.68, N, 5.25. Only one isomer is observed by GC and ^1H NMR.

Substrate **4** (207 mg, 1.20 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (462 mg, 1.4 mmol, 1.2 equiv), and $\text{Pd}(\text{OAc})_2$ (13.4 mg, 0.06 mmol, 0.05 equiv) were combined in C_6H_6 (7.7 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 4 h. ^1H NMR analysis of the crude reaction mixture showed a 6:1 mixture of regioisomers. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel ($R_f = 0.26$ in 70% hexanes/30% ethyl acetate). The product **4a** was obtained as a pale yellow oil (163 mg, 59% yield) as a 6:1 (by NMR) mixture of regioisomers. ^1H NMR (d_6 -acetone) (major isomer): δ 8.70-8.69 (m, 1H), 7.88 (td, $J = 7.6, 1.8$ Hz, 1H), 7.73 (d, $J = 8.0$ Hz, 1H), 7.61-7.58 (m, 1H), 7.38-7.35 (m, 1H), 7.26-7.23 (multiple peaks, 2H), 2.18 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone) (major isomer): δ 169.76, 161.18 (d, $^1J_{\text{CF}} = 241$ Hz), 154.97, 150.66, 145.50, 137.56, 135.79 (d, $^3J_{\text{CF}} = 8.34$ Hz), 126.40 (d, $^3J_{\text{CF}} = 8.4$ Hz), 124.40, 123.80, 117.66 (d, $^2J_{\text{CF}} = 24$ Hz), 116.93 (d, $^2J_{\text{CF}} = 24$ Hz), 20.94. ^{19}F NMR (CDCl_3): -116.27 to -116.32 (m), -128.33 to -128.37 (m). IR (thin film): 1766, 1462 cm^{-1} . Anal. Calcd for $\text{C}_{13}\text{H}_{10}\text{FNO}_2$: C, 67.53, H, 4.36, N, 6.06; Found: C, 67.19, H, 4.16, N, 6.04. The isomers do not separate by GC.

The regioselectivity of this reaction could not be determined definitively from the ^1H NMR spectrum of **4a**. As a result, **4a** was hydrolyzed to the phenol according to the following procedure in order to assess the regioselectivity. Product **4a** (30.0 mg, 0.13 mmol, 1 equiv) and HCl (1ml) were combined in MeOH (1.0 mL) in a 20 mL vial, and the reaction was stirred for 8 h. The reaction mixture was diluted with ethylacetate (15 mL) and extracted with NaHCO_3 (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product was obtained as a brown solid (13.0 mg, 53% yield); mp = 77.3-79 °C. ^1H NMR (d_6 -acetone): δ 8.65 (ddd, J = 5.0, 1.8, 1.0 Hz, 1H_a), 8.20 (dt, J = 8.3, 1.0 Hz, 1H_d), 8.06 (td, J = 7.5, 1.8 Hz, 1H_c), 7.75 (dd, J = 10.3, 3.1 Hz, 1H_e), 7.48 (ddd, J = 7.5, 5.0, 1.0 Hz, 1H_b), 7.10 (ddd, J = 11.0, 9.0, 3.1 Hz, 1H_f), 6.92 (dd, J = 9.0, 5.0 Hz, 1H_g).

2-Bromo-4-fluorophenol (1.00 g, 5.20 mmol, 1 equiv), Ac_2O (10.5 mL) and pyridine (2.0 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (30 mL) and extracted with H_2O (3 x 30 mL) and brine (1 x 30 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product, 1-acetoxy-2-bromo-4-fluorobenzene was obtained as a yellow oil (946 mg, 77% yield).

Under a nitrogen atmosphere, 1-acetoxy-2-bromo-4-fluorobenzene (500 mg, 2.10 mmol, 1 equiv), and $\text{Pd}(\text{PPh}_3)_4$ (248 mg, 0.21 mmol, 0.10 equiv) were combined in toluene (11 mL), and 2-tributylpyridyltin (869 mg, 2.36 mmol, 1.1 equiv) was added. The reaction mixture was refluxed for 12 h, then diluted with ethyl acetate (30 mL), filtered through a pad of silica, and washed with copious ethyl acetate. The washings were combined, concentrated under vacuum, and purified by chromatography on silica gel (R_f = 0.24 in

75% hexanes/25% ethyl acetate). The product (**4a**) was obtained as pale yellow oil (248 mg, 50% yield). ^1H NMR (d_6 -acetone): δ 8.70-8.68 (m, 1H), 7.89 (td, J = 8.0, 1.8 Hz, 1H), 7.74 (d, J = 8.0 Hz, 1H), 7.60-7.57 (m, 1H), 7.39-7.36 (m, 1H), 7.26-7.24 (multiple peaks, 2H), 2.18 (s, 3H).

Substrate **5** (206 mg, 0.88 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (312 mg, 0.97 mmol, 1.1 equiv), and $\text{Pd}(\text{OAc})_2$ (9.85 mg, 0.04 mmol, 0.05 equiv) were combined in C_6H_6 (2.8 mL) and Ac_2O (2.8 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 1.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.25 in 80% hexanes/20% ethyl acetate). The product **5a** was obtained as a pale yellow oil (213 mg, 83% yield). ^1H NMR (d_6 -acetone): δ 8.69 (ddd, J = 4.8, 1.8, 1.0, 1H_a), 7.99 (d, J = 2.5 Hz, 1H_e), 7.89 (td, J = 7.5, 1.8 Hz, 1H_c), 7.73 (dt, J = 8.0, 1.0 Hz, 1H_d), 7.63 (dd, J = 8.6, 2.5 Hz, 1H_f), 7.38 (ddd, J = 7.5, 4.8, 1.1 Hz, 1H_b), 7.19 (d, J = 8.6 Hz, 1H_g), 2.19 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 169.45, 154.65, 150.69, 148.66, 137.58, 136.09, 134.20, 133.21, 126.78, 124.50, 123.83, 119.53, 20.97. IR (KBr): 1764, 1585 cm^{-1} . Anal. Calcd for $\text{C}_{13}\text{H}_{10}\text{BrNO}_2$: C, 53.45, H, 3.45, N, 4.79; Found: C, 53.34, H, 3.51, N, 4.83. Only one isomer is observed by GC and ^1H NMR.

Substrate **6** (214 mg, 1.26 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (448 mg, 1.39 mmol, 1.1 equiv), and $\text{Pd}(\text{OAc})_2$ (14.2 mg, 0.06 mmol, 0.05 equiv) were combined in C_6H_6 (8.2 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 0.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.32 in 70% hexanes/30% ethyl acetate).

The product **6a** was obtained as a yellow oil (219 mg, 77% yield) as a 27:1 (by GC) mixture of regioisomers. ^1H NMR (d_6 -acetone): δ 8.68-8.66 (m, 1H_a), 7.83 (td, J = 7.5, 1.9, 1H_c), 7.65 (dd, J = 7.9, 1.0 Hz, 1H_d), 7.61 (d, J = 2.3 Hz, 1H_e), 7.31 (ddd, J = 7.5, 4.8, 1.1 Hz, 1H_b), 7.25 (dd, J = 8.2, 2.3 Hz, 1H_f), 7.07 (d, J = 8.2 Hz, 1H_g), 2.39 (s, 3H), 2.15 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 169.79, 156.48, 150.43, 147.28, 137.23, 136.47, 133.71, 132.02, 130.90, 124.34, 124.26, 123.14, 21.01, 20.92. IR (thin film): 2922, 1763, 1586 cm^{-1} . Anal. Calcd for $\text{C}_{14}\text{H}_{13}\text{NO}_2$: C, 73.99, H, 5.77, N, 6.16; Found: C, 73.85, H, 6.04, N, 6.01. Retention time (GC): 7.84 min (major) 7.58 min (minor).

2-Bromo-6-methylphenol^{vii} (500 mg, 2.70 mmol, 1 equiv), Ac_2O (5.30 mL) and pyridine (1.11 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product, 1-bromo-2-acetoxy-3-methylbenzene was obtained as a yellow oil (499 mg, 81% yield).

Under a nitrogen atmosphere, 2-acetoxy-1-bromo-3-methylbenzene (500 mg, 2.18 mmol, 1 equiv), and $\text{Pd}(\text{PPh}_3)_4$ (252 mg, 0.22 mmol, 0.10 equiv) were combined in toluene (11 mL), and 2-tributylpyridyltin (883 mg, 2.40 mmol, 1.1 equiv) was then added. The reaction mixture was refluxed for 12 h, then diluted with ethyl acetate (30 mL), filtered through a pad of silica gel and washed with copious ethyl acetate. The washings were combined, concentrated under vacuum, and, purified by column chromatography on silica gel (R_f = 0.20 in 75% hexanes/25% ethyl acetate). The product was obtained as a pale yellow oil (238 mg, 48% yield). ^1H NMR (d_6 -acetone): δ 8.67-8.65 (m, 1H), 7.85 (td, J = 7.5, 1.9 Hz, 1H), 7.63 (dt, J = 7.9, 1.0 Hz, 1H), 7.57 (d, J = 7.6 Hz, 1H), 7.35-7.31 (multiple peaks, 2H), 7.27 (t, J = 7.5 Hz, 1H), 2.22 (s, 3H), 2.17 (s, 3H). Retention time (GC): 7.58 min.

The regioselectivity of this reaction could not be determined definitively from the ^1H NMR spectrum of **6b**. As a result, **6b** was hydrolyzed to the phenol according to the following procedure in order to assess the regioselectivity. Product **6b** (30.4 mg, 0.13 mmol, 1 equiv) and HCl (1ml) were combined in MeOH (1.0 mL) in a 20 mL vial, and the reaction was stirred for 8 h. The reaction mixture was diluted with ethylacetate (15 mL) and extracted with NaHCO_3 (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product was obtained as a yellow oil (16.9 mg, 68% yield). ^1H NMR (d_6 -acetone): δ 8.62 (d, J = 5.0 Hz, 1H_a), 8.16 (d, J = 8.3 Hz, 1H_d), 8.01 (td, J = 7.5, 1.8 Hz, 1H_c), 7.81 (d, J = 8.0 Hz, 1H_g), 7.41 (ddd, J = 7.4, 5.0, 1.0 Hz, 1H_b), 7.19 (d, J = 7.5 Hz, 1H_e), 6.81 (t, J = 7.3 Hz, 1H_f), 2.24 (s, 3H).

Substrate **7** (0.205 mg, 0.95 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (368 mg, 1.14 mmol, 1.2 equiv), and $\text{Pd}(\text{OAc})_2$ (10.7 mg, 0.05 mmol, 0.05 equiv) were combined in C_6H_6 (6.2 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100 $^\circ\text{C}$ for 1.0 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.12 in 75% hexanes/25% ethyl acetate). The product **7a** was obtained as a yellow oil (196 mg, 76% yield). ^1H NMR (d_6 -acetone): δ 8.68-8.67 (m, 1H), 7.84 (td, J = 8.0, 1.8 Hz, 1H), 7.68 (d, J = 8.0 Hz, 1H), 7.50-7.49 (m, 1H), 7.34-7.31 (m, 1H), 7.13-7.12 (multiple peaks, 2H), 5.25 (s, 2H), 3.46 (s, 3H), 2.15 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 169.94, 156.09, 156.02, 150.50, 143.74, 137.32, 134.85, 125.37, 124.32, 123.37, 118.73, 118.16, 95.46, 56.17, 20.97. IR (thin film): 2956, 1763, 1586 cm^{-1} . HRMS electrospray (m/z): $[\text{M}^+ + \text{Na}]$ calcd for $\text{C}_{15}\text{H}_{15}\text{NO}_4$, 296.0899; found, 296.0903. GC

analysis (RESTEK Rtx[®]-5, FID detector): 100% integration. Only one isomer is observed by GC and ¹H NMR.

The regioselectivity of this reaction could not be determined definitively from the ¹H NMR spectrum of **7a**. As a result, **7a** was hydrolyzed to the phenol according to the following procedure in order to assess the regioselectivity. Product **7a** (70.0 mg, 0.26 mmol, 1 equiv) and K₂CO₃ (5.30 mg, 0.04 mmol, 0.15 equiv) were combined in MeOH (1. mL) in a 20 mL vial, and the reaction was stirred for 12 h. The reaction mixture was diluted with ethyl acetate (15 mL) and extracted with H₂O (3 × 15 mL) and brine (1 × 15 mL). The combined organic layers were dried over MgSO₄, filtered and concentrated under vacuum. The product was obtained as a brown oil (24.0 mg, 41% yield). ¹H NMR (C₆D₆): δ 7.88 (ddd, *J* = 5.0, 1.9, 0.9 Hz, 1H_a), 7.53 (d, *J* = 2.9 Hz, 1H_e), 7.28 (dt, *J* = 8.3, 1.0 Hz, 1H_d), 7.21 (d, *J* = 8.9 Hz, 1H_g), 7.07 (dd, *J* = 8.9, 2.9 Hz, 1H_f), 6.89 (td, *J* = 8.3, 1.9 Hz, 1H_c), 6.35 (ddd, *J* = 7.5, 5.0, 1.0 Hz, 1H_b).

Substrate **8** (201 mg, 1.08 mmol, 1 equiv), PhI(OAc)₂ (384 mg, 1.19 mmol, 1.1 equiv), and Pd(OAc)₂ (12.1 mg, 0.05 mmol, 0.05 equiv) were combined in C₆H₆ (7 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 1.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (*R*_f = 0.27 in 60% hexanes/40% ethyl acetate). The product **8a** was obtained as a yellow oil (206 mg, 78% yield) as a 60:1 (by GC) mixture of regioisomers. ¹H NMR (*d*₆-acetone): δ 8.69-8.67 (m, 1H_a), 7.84 (td, *J* = 7.6, 1.9 Hz, 1H_c), 7.68 (d, *J* = 8.0 Hz, 1H_d), 7.36 (d, *J* = 3.1 Hz, 1H_e), 7.31 (ddd, *J* = 7.5, 4.8, 1.1 Hz, 1H_b), 7.12 (d, *J* = 8.8 Hz, 1H_g), 7.01 (dd, *J* = 8.8, 3.1 Hz, 1H_f), 3.85 (s, 3H), 2.15 (s, 3H).

$^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 169.70, 158.11, 155.87, 150.17, 142.57, 136.99, 134.45, 125.07, 124.05, 123.02, 115.69, 115.58, 55.73, 20.67. IR (thin film): 2940, 1760, 1585 cm^{-1} . Anal. Calcd for $\text{C}_{14}\text{H}_{13}\text{NO}_3$: C, 69.12, H, 5.39, N, 5.76; Found: C, 69.33, H, 5.08, N, 5.72. Retention time (GC): 8.85 min (major) 8.56 min (minor).

2-Bromo-6-methoxyphenol^{viii} (500 mg, 2.46 mmol, 1 equiv), Ac_2O (4.7 mL) and pyridine (4.7 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product, 1-bromo-2-acetoxy-3-methoxybenzene was obtained as a yellow oil (542 mg, 90% yield).

Under a nitrogen atmosphere, 1-bromo-2-acetoxy-3-methoxybenzene (542 mg, 2.21 mmol, 1 equiv), and $\text{Pd}(\text{PPh}_3)_4$ (255 mg, 0.22 mmol, 0.10 equiv) were combined in toluene (11 mL), and 2-tributylpyridyltin (895 mg, 2.43 mmol, 1.1 equiv) was added. The reaction mixture was refluxed for 12 h, then diluted with ethyl acetate (30 mL), filtered through a pad of silica, and washed with copious ethyl acetate. The washings were combined, concentrated under vacuum, and purified by chromatography on silica gel (R_f = 0.25 in 65% hexanes/35% ethyl acetate). The product was obtained as a pale yellow solid (182 mg, 34% yield); mp = 90-91 $^\circ\text{C}$. ^1H NMR (d_6 -benzene): δ 8.55 (d, J = 4.8 Hz, 1 H_a), 7.51 (d, J = 7.9 Hz, 1 H_d), 7.44 (d, J = 7.9 Hz, 1 H_e), 7.07 (t, J = 7.6 Hz, 1 H_c), 7.01 (t, J = 7.9 Hz, 1 H_f), 6.64-6.61 (m, 1 H_b), 6.53 (d, J = 8.2 Hz, 1 H_g), 3.28 (s, 3H), 1.91 (s, 3H). Retention time (GC): 8.56 min.

Substrate **9** (205 mg, 1.14 mmol, 1 equiv), $\text{PhI}(\text{TFA})_2$ (1.09 g, 2.52 mmol, 2.2 equiv), and $\text{Pd}(\text{OAc})_2$ (12.8 mg, 0.06 mmol, 0.05 equiv) were combined in AcOH (7.0 mL) and Ac_2O (7.0 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 3.5 h. GCMS analysis of the crude reaction mixture showed a 14:1 mixture of regioisomers. The reaction mixture was filtered through a plug of glass wool and washed with copious ethyl acetate. The solvent was removed under vacuum, and the resulting black oil was purified by chromatography on silica gel ($R_f = 0.26$ in 20% hexanes/80% ethyl acetate). The product **9a** was obtained as a brown oil (239 mg, 88% yield) as a 20:1 (by GCMS) mixture of regioisomers. ^1H NMR (d_6 -acetone): δ 7.23-7.18 (multiple peaks, 2H), 7.09-7.04 (m, 1H), 3.74 (t, $J = 6.9$ Hz, 2H), 2.38 (t, $J = 7.7$ Hz, 2H), 2.23 (s, 3H), 2.12 (quin, $J = 7.7$ Hz, 2H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 174.30, 169.23, 160.55 (d, $^1J_{\text{CF}} = 242$ Hz), 143.08 (d, $^4J_{\text{CF}} = 3.0$ Hz), 134.19 (d, $^3J_{\text{CF}} = 11$ Hz), 125.89 (d, $^3J_{\text{CF}} = 9.9$ Hz), 114.69 (d, $^2J_{\text{CF}} = 25$ Hz), 114.60 (d, $^2J_{\text{CF}} = 23$ Hz), 50.33, 31.51, 20.93, 19.96. ^{19}F NMR (CDCl_3): -114.96 to -115.01 (m). IR (thin film): 2984, 1766, 1702, 1503 cm^{-1} . HRMS electrospray (m/z): $[\text{M}^+ + \text{Na}]$ calcd for $\text{C}_{12}\text{H}_{12}\text{FNO}_3$, 260.0699; found, 260.0703. GC analysis (RESTEK Rt $\times$ [®]-5, FID detector): 100% integration (two regioisomers).

The regioselectivity of this reaction could not be determined definitively from the ^1H NMR spectrum of **9a**. As a result, **9a** was hydrolyzed to the phenol according to the following procedure in order to assess the regioselectivity. Product **9a** (144 mg, 0.61 mmol, 1 equiv) and K_2CO_3 (12.7 mg, 0.09 mmol, 0.15 equiv) were combined in MeOH (1.3 mL) in a 20 mL vial, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under

vacuum. The product was obtained as a white solid (83 mg, 70% yield); mp = 159-161°C. ^1H NMR (C_6D_6): δ 9.28 (s, 1H), 7.02 (dd, J = 8.9, 5.6 Hz, 1H_a), 6.67-6.63 (m, 1H_b), 6.33 (dd, J = 9.9, 2.9 Hz, 1H_c), 2.61 (t, J = 6.9 Hz, 2H), 1.79 (t, J = 7.9 Hz, 2H), 1.020-0.939 (m, 2H).

Substrate **10** (201 mg, 1.15 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (665 mg, 2.06 mmol, 1.8 equiv), and $\text{Pd}(\text{OAc})_2$ (12.8 mg, 0.06 mmol, 0.05 equiv) were combined in AcOH (13.5 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 12 h. The reaction mixture was filtered through a plug of glass wool and washed with copious ethyl acetate. The solvent was removed under vacuum, and the resulting black oil was purified by chromatography on silica gel (R_f = 0.22 in 20% hexanes/80% ethyl acetate). The product **10a** was obtained as a pale yellow oil (197 mg, 74% yield). ^1H NMR (d_6 -acetone): δ 7.18 (d, J = 2.0 Hz, 1H_c), 7.10 (dd, J = 8.3, 2.1 Hz, 1H_b), 7.06 (d, J = 8.3 Hz, 1H_a), 3.72 (t, J = 7.0 Hz, 2H), 2.38 (t, J = 8.0 Hz, 2H), 2.31 (s, 3H), 2.20 (s, 3H), 2.18-2.10 (m, 2H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 173.97, 169.25, 144.91, 136.61, 132.55, 128.77, 128.59, 124.16, 50.47, 31.58, 20.97, 20.79, 20.02. IR (thin film): 2954, 1763, 1699, 1425 cm^{-1} . HRMS electrospray (m/z): [$\text{M}^+ + \text{Na}$] calcd for $\text{C}_{13}\text{H}_{15}\text{NO}_3$, 256.0950; found, 256.0952. GC analysis (RESTEK Rtx[®]-5, FID detector): 99.5% integration. Only one isomer is observed by GC and ^1H NMR.

Substrate **11** (202 mg, 1.05 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (510 mg, 1.58 mmol, 1.5 equiv), and $\text{Pd}(\text{OAc})_2$ (11.8 mg, 0.05 mmol, 0.05 equiv) were combined in AcOH (12.4 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 3.0 h. The reaction mixture was filtered through a plug of glass wool and washed with copious ethyl acetate. The solvent was removed under vacuum, and the resulting

orange oil was purified by chromatography on silica gel ($R_f = 0.20$ in 20% hexanes/80% ethyl acetate). The product **11a** was obtained as a pale brown solid (193 mg, 73% yield); mp = 96.5-97.5°C. ^1H NMR (d_6 -acetone): δ 7.09 (d, $J = 8.8$ Hz, 1H_a), 6.95 (d, $J = 2.9$ Hz, 1H_c), 6.86 (dd, $J = 8.9, 3.0$ Hz, 1H_b), 3.78 (s, 3H), 3.73 (t, $J = 6.8$ Hz, 2H), 2.38 (t, $J = 8.1$ Hz, 2H), 2.19 (s, 3H), 2.17-2.09 (m, 2H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 173.97, 169.48, 158.32, 140.64, 133.59, 124.99, 113.47, 113.29, 56.06, 50.48, 31.61, 20.93, 20.02. IR (KBr): 2960, 1759, 1690, 1605 cm^{-1} . Anal. Calcd for $\text{C}_{13}\text{H}_{15}\text{NO}_4$: C, 62.64, H, 6.07, N, 5.62; Found: C, 62.46, H, 5.72, N, 5.59. Only one isomer is observed by GC and ^1H NMR.

Substrate **12** (202 mg, 0.91 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (530 mg, 1.64 mmol, 1.8 equiv), and $\text{Pd}(\text{OAc})_2$ (10.2 mg, 0.04 mmol, 0.05 equiv) were combined in AcOH (5.4 mL) and Ac_2O (5.4 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 6.5 h. The reaction mixture was filtered through a plug of glass wool and washed with copious ethyl acetate. The solvent was removed under vacuum, and the resulting brown oil was purified by chromatography on silica gel ($R_f = 0.20$ in 20% hexanes/80% ethyl acetate). The product **12a** was obtained as a light brown oil (179 mg, 70% yield). ^1H NMR (d_6 -acetone): δ 7.10 (d, $J = 8.9$ Hz, 1H_a), 7.05 (d, $J = 2.9$ Hz, 1H_c), 6.97 (dd, $J = 8.9, 2.9$ Hz, 1H_b), 5.18 (s, 2H), 3.73 (t, $J = 6.8$ Hz, 2H), 3.43 (s, 3H), 2.39 (t, $J = 8.1$ Hz, 2H), 2.19 (s, 3H), 2.18-2.10 (m, 2H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 173.99, 169.42, 155.95, 141.54, 133.58, 125.02, 115.84, 115.79, 99.51, 56.19, 50.47, 31.58, 20.94, 20.02. IR (thin film): 2956, 1762, 1699, 1504 cm^{-1} . HRMS electrospray (m/z): $[\text{M}^+ + \text{Na}]$ calcd for $\text{C}_{14}\text{H}_{17}\text{NO}_5$, 302.1004; found, 302.1001. GC analysis (RESTEK Rtx[®]-5, FID detector): 99.4% integration. Only one isomer is observed by GC and ^1H NMR.

Substrate **13** (202 mg, 1.02 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (396 mg, 1.23 mmol, 1.2 equiv), and $\text{Pd}(\text{OAc})_2$ (11.5 mg, 0.05 mmol, 0.05 equiv) were combined in C_6H_6 (3.3 mL) and Ac_2O (3.3 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100 °C for 0.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.20 in 55% hexanes/45% ethyl acetate). The product **13a** was obtained as a yellow oil (213 mg, 82% yield). ^1H NMR (d_6 -acetone): δ 8.73-8.71 (m, 1H_a), 8.43 (d, J = 2.3 Hz, 1H_e), 8.07 (dd, J = 8.4, 2.3 Hz, 1H_i), 7.89 (td, J = 7.5, 1.9 Hz, 1H_c), 7.74 (dt, J = 8.0, 1.1 Hz, 1H_d), 7.37 (ddd, J = 7.5, 4.8, 1.1 Hz, 1H_b), 7.35 (d, J = 8.4 Hz, 1H_g), 2.64 (s, 3H), 2.21 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 196.99, 169.36, 155.47, 152.85, 150.63, 137.54, 136.16, 134.22, 132.01, 130.29, 124.99, 124.50, 123.65, 26.85, 21.01. IR (thin film): 3005, 1766, 1684, 1587 cm^{-1} . Anal. Calcd for $\text{C}_{15}\text{H}_{13}\text{NO}_3$: C, 70.58, H, 5.13, N, 5.49; Found: C, 70.44, H, 5.17, N, 5.39. Only one isomer is observed by GC and ^1H NMR.

Substrate **14** (182 mg, 0.80 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (388 mg, 1.21 mmol, 1.5 equiv), and $\text{Pd}(\text{OAc})_2$ (9.01 mg, 0.04 mmol, 0.05 equiv) were combined in C_6H_6 (2.6 mL) and Ac_2O (2.6 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 0.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.20 in 75% hexanes/25% ethyl acetate). The product **14a** was obtained as a yellow oil (177 mg, 77% yield) as a single isomer. ^1H NMR (d_6 -acetone): δ 8.69 (ddd, J = 4.8, 1.8, 0.9 Hz, 1H_a), 8.13 (d, J = 2.3 Hz, 1H_e), 7.88 (td, J = 7.9, 1.9 Hz, 1H_c), 7.79 (dd, J = 8.5, 2.3 Hz, 1H_i), 7.71 (dt, J = 7.9, 1.0 Hz, 1H_d), 7.36 (ddd, J = 7.5, 4.8, 1.1 Hz, 1H_b), 7.23 (d, J = 8.5 Hz, 1H_g), 3.96 (s, 3H), 2.26 (s, 3H), 2.18 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3): δ 169.54, 155.93, 153.95, 150.52, 149.93, 137.35, 135.34, 133.96, 129.22, 127.83, 124.57, 124.43, 123.39, 62.25, 20.99, 12.42. IR (KBr): 2936, 1765, 1593 cm^{-1} . Anal. Calcd for $\text{C}_{16}\text{H}_{16}\text{N}_2\text{O}_3$: C, 67.59, H, 5.67, N, 9.85; Found: C, 67.39, H, 5.71, N, 9.75. Only one isomer is observed by GC and ^1H NMR.

Substrate **15** (207 mg, 0.98 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (473 mg, 1.47 mmol, 1.5 equiv), and $\text{Pd}(\text{OAc})_2$ (10.9 mg, 0.05 mmol, 0.05 equiv) were combined in C_6H_6 (3.2 mL) and Ac_2O (3.2 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100 °C for 1.5 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel (R_f = 0.32 in 70% hexanes/30% ethyl acetate). The product **15a** was obtained as a yellow oil (204 mg, 77% yield). ^1H NMR (d_6 -acetone): δ 8.68-8.66 (m, 1H), 7.84 (td, J = 8.0, 1.9 Hz, 1H), 7.68-7.66 (multiple peaks, 2H), 7.34-7.29 (multiple peaks, 2H), 7.15 (d, J = 8.2 Hz, 1H), 3.86 (s, 2H), 2.18 (s, 3H), 2.17 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone): δ 205.56, 169.70, 156.22, 150.48, 148.19, 137.29, 134.00, 133.87, 132.84, 131.64, 124.45, 124.38, 123.25, 49.94, 29.63, 21.01. IR (thin film): 3004, 1763, 1714, 1586 cm^{-1} . HRMS electrospray (m/z): $[\text{M}^+ + \text{Na}]$ calcd for $\text{C}_{16}\text{H}_{15}\text{NO}_3$, 292.0950; found, 292.0949. GC analysis (RESTEK Rtx[®]-5, FID detector): 100% integration. Only one isomer is observed by GC and ^1H NMR.

The regioselectivity of this reaction could not be determined definitively from the ^1H NMR spectrum of **15a**. As a result, **15a** was hydrolyzed to the phenol according to the following procedure in order to assess the regioselectivity. Product **15a** (100 mg, 0.37 mmol, 1 equiv) and HCl (1ml) were combined in MeOH (2.0 mL) in a 20 mL vial, and the reaction was stirred for 8 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product was obtained as a orange oil (60.0 mg, 71% yield). ^1H NMR (d_6 -acetone): δ 8.63-8.61 (m, 1H_a),

8.17 (d, $J = 8.3$ Hz, $1H_d$), 8.04-7.99 (m, $1H_c$), 7.86 (d, $J = 2.1$ Hz, $1H_e$), 7.44-7.40 (m, $1H_b$), 7.17 (dd, $J = 8.4, 2.1$ Hz, $1H_f$), 6.89 (d, $J = 8.4$ Hz, $1H_g$), 3.73 (s, 2H), 2.14 (s, 3H).

Substrate **16** (200 mg, 0.83 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (402 mg, 1.25 mmol, 1.5 equiv), and $\text{Pd}(\text{OAc})_2$ (9.32 mg, 0.04 mmol, 0.05 equiv) were combined in C_6H_6 (2.7 mL) and Ac_2O (2.7 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 1.0 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel ($R_f = 0.24$ in 60% hexanes/40% ethyl acetate). The product **16a** was obtained as a yellow oil (182 mg, 74% yield) as a 2:1 mixture of oxime isomers. ^1H NMR (CDCl_3 with a few drops of C_6D_6) (major isomer): δ 8.50 (d, $J = 4.8$ Hz, $1H_a$), 7.49 (td, $J = 7.6, 1.8$ Hz, $1H_c$), 7.40 (d, $J = 2.2$ Hz, $1H_e$), 7.33 (d, $J = 7.9$ Hz, $1H_d$), 7.09 (dd, $J = 8.2, 2.2$ Hz, $1H_f$), 7.02-6.99 (m, $1H_b$), 6.93 (d, 8.2 Hz, $1H_g$), 3.70 (s, 3H), 3.34 (s, 2H), 1.95 (s, 3H), 1.59 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (CDCl_3) (mixture of isomers): δ 169.90, 168.40, 155.15, 150.49, 150.43, 150.35, 149.21, 146.76, 141.16, 137.36, 137.26, 129.15, 124.48, 124.22, 123.99, 122.92, 122.90, 109.91, 106.98, 105.54, 103.48, 103.16, 41.13, 20.99, 20.53. IR (KBr): 2937, 1767, 1586 cm^{-1} . Anal. Calcd for $\text{C}_{17}\text{H}_{18}\text{N}_2\text{O}_3$ (mixture of oxime isomers): C, 68.44, H, 6.08, N, 9.39; Found: C, 68.28, H, 6.26, N, 9.23. Retention time (GC): 10.9 min (major oxime) and 10.7 min (minor oxime). Regioisomers not observed by GC or ^1H NMR.

Substrate **18** (150 mg, 0.75 mmol, 1 equiv), $\text{PhI}(\text{OAc})_2$ (291 mg, 0.90 mmol, 1.2 equiv), and $\text{Pd}(\text{OAc})_2$ (8.43 mg, 0.04 mmol, 0.05 equiv) were combined in C_6H_6 (4.9 mL) in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 60°C for

10 h. The solvent was removed under vacuum, and the resulting orange oil was purified by chromatography on silica gel ($R_f = 0.24$ in 70% hexanes/30% ethyl acetate). The product **18a** was obtained as a yellow oil (55.5 mg, 29% yield) as a 2:1 mixture of regioisomers. ^1H NMR (d_6 -benzene) (major isomer): δ 8.50-8.48 (m, 1H_a), 7.28 (d, $J = 8.0$ Hz, 1H_d), 7.22 (d, $J = 8.2$ Hz, 1H_f), 7.06 (td, $J = 7.9, 1.9$ Hz, 1H_c), 6.62-6.58 (m, 1H_b), 6.53 (d, $J = 8.2$ Hz, 1H_e), 5.24 (s, 2H), 1.81 (s, 3H). $^{13}\text{C}\{^1\text{H}\}$ NMR (d_6 -acetone) (mixture of isomers): δ 169.90, 168.39, 156.15, 150.43, 150.35, 149.21, 146.76, 144.05, 141.16, 137.37, 137.27, 132.96, 129.16, 124.47, 124.22, 123.99, 122.93, 109.91, 106.98, 105.55, 103.49, 103.16, 20.99, 20.52. IR(thin film): 2901, 1765, 1567 cm^{-1} . HRMS electrospray (m/z): $[\text{M}^+ + \text{Na}]$ calcd for $\text{C}_{14}\text{H}_{11}\text{NO}_4$, 280.0586; found, 280.0585. GC analysis (RESTEK Rtx[®]-5, FID detector): 65.8% integration (major isomer), 34.2% integration (minor isomer). Retention time (GC): 9.37 min (major) and 9.60 min (minor).

Bromosesamol^{ix} (500 mg, 2.30 mmol, 1 equiv), Ac_2O (4.6 mL) and pyridine (0.88 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product, 1-acetoxy-2-bromo-4,5-methylenedioxybenzene was obtained as a orange solid (594 mg, 99% yield).

Under a nitrogen atmosphere, 1-acetoxy-2-bromo-4,5-methylenedioxybenzene (501 mg, 1.93 mmol, 1 equiv), and $\text{Pd}(\text{PPh}_3)_4$ (112 mg, 0.10 mmol, 0.05 equiv) were combined in toluene (10 mL), and 2-tributylpyridyltin (783 mg, 2.13 mmol, 1.1 equiv) was added. The reaction mixture diluted with ethyl acetate, filtered through a pad of Celite, and washed with copious ethyl acetate. The washings were combined and concentrated under vacuum. The crude product was dissolved in ethyl acetate (30 mL), extracted with 1M aqueous KF (4 x 30 mL). The combined organic layers were then extracted with brine (1 x 30 mL), dried over MgSO_4 , filtered and concentrated. The resulting yellow oil was

purified by chromatography on silica gel ($R_f = 0.24$ in 70% hexanes/30% ethyl acetate). The product was obtained as a pale yellow solid (103 mg, 21% yield); mp = 88-91 °C. ^1H NMR (d_6 -benzene): δ 8.48 (ddd, $J = 4.8, 1.9, 1.0$ Hz, 1H_a), 7.38 (s, 1H_f), 7.29 (dt, $J = 7.9, 1.0$ Hz, 1H_d), 7.05 (td, $J = 7.5, 1.9$ Hz, 1H_c), 6.61 (s, 1H_e), 6.60-6.57 (m, 1H_b), 5.20 (s, 2H), 1.72 (s, 3H). Retention time (GC): 9.60.

2-bromo-5,6-methylenedioxyphenol^{ix}, x (350 mg, 1.60 mmol, 1 equiv), Ac_2O (3.2 mL) and pyridine (0.61 mL) were combined in a 20 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was stirred for 12 h. The reaction mixture was diluted with CH_2Cl_2 (15 mL) and extracted with H_2O (3 x 15 mL) and brine (1 x 15 mL). The combined organic layers were dried over MgSO_4 , filtered and concentrated under vacuum. The product, 1-acetoxy-6-bromo-2,3-methylenedioxybenzene was obtained as a orange solid (337 mg, 81% yield).

Under a nitrogen atmosphere, 1-acetoxy-6-bromo-2,3-methylenedioxybenzene (337 mg, 1.30 mmol, 1 equiv), and $\text{Pd}(\text{PPh}_3)_4$ (75.1 mg, 0.06 mmol, 0.05 equiv) were combined in toluene (10 mL), and 2-tributylpyridyltin (718 mg, 1.95 mmol, 1.5 equiv) was added. The reaction mixture diluted with ethyl acetate (30 mL), filtered through a pad of Celite, and washed with copious ethyl acetate. The washings were combined and concentrated under vacuum. The crude product was dissolved in ethyl acetate, extracted with 1M aqueous KF (4 x 30mL). The combined organic layers were then extracted with brine (1 x 30 mL), dried over MgSO_4 , filtered and concentrated. The resulting yellow oil was purified by chromatography on silica gel ($R_f = 0.29$ in 70% hexanes/30% ethyl acetate). The product was obtained as a pale yellow oil (58.0 mg, 17% yield). ^1H NMR (d_6 -benzene): δ 8.49 (ddd, $J = 4.8, 1.8, 0.9$ Hz, 1H_a), 7.28 (dt, $J = 7.9, 1.0$ Hz, 1H_d), 7.23 (d, $J = 8.2$ Hz, 1H_f), 7.07 (td, $J = 7.8, 1.8$ Hz, 1H_c), 6.63-6.60 (m, 1H_b), 6.54 (d, $J = 8.2$ Hz, 1H_e), 5.25 (s, 2H), 1.81 (s, 3H). Retention time (GC): 9.37.

Reaction with substrate 17: Substrate **17** (20.0 mg, 0.07 mmol, 1 equiv), PhI(OAc)₂ (33.5 mg, 0.10 mmol, 1.5 equiv), and Pd(OAc)₂ (0.78 mg, 0.003 mmol, 0.05 equiv) were combined in AcOH (0.45 mL), AcOH/Ac₂O (0.23/0.23 mL), C₆H₆ (0.45 mL), C₆H₆/Ac₂O (0.23/0.23 mL), CH₂Cl₂ (0.45 mL) or CH₃CN (0.45 mL) in a 4 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 12 h. The reaction was cooled to room temperature and analyzed by gas chromatography, which showed only starting material.

Reaction with complex 19: Complex **19** (20.0 mg, 0.04 mmol, 1 equiv) and PhI(OAc)₂ (17.1 mg, 0.05 mmol, 1.2 equiv) were combined in AcOH (0.28 mL), AcOH/Ac₂O (0.14/0.14 mL), C₆H₆ (0.28 mL), C₆H₆/Ac₂O (0.14/0.14 mL), CH₂Cl₂ (0.28 mL) or CH₃CN (0.28 mL) in a 4 mL vial. The vial was sealed with a Teflon lined cap, and the reaction was heated at 100°C for 12 h. The reaction was cooled to room temperature and analyzed by ¹H NMR spectroscopy and gas chromatography, which showed no formation of the acetoxylated product.

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