Dialyzable Carbosilane Dendrimers as Soluble Supports for the Functionalization of Pyridine Fragments via Palladium-Catalyzed Coupling Reactions.

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Experimental data

General: All syntheses were performed under an atmosphere of dry nitrogen using standard Schlenk techniques. Solvents were dried and distilled prior to use. ¹H, ¹³C{¹H} and ²⁹Si NMR spectra were recorded using a Varian Inova 300 MHz spectrometer. Microanalyses were performed by Kolbe Microanalytical Laboratories, Mühlheim a/d Ruhr, Germany. Membranes used for passive dialysis are commercially available (Sigma: Dialysis Tubing, benzoylated (cut off = 1200 g.mol⁻¹).

General procedure for the linkage reaction:⁽ⁱ⁾ To a solution of dry diisopropylamine (2.2 equiv) in THF (1.2 mL per mmol of 3-bromopyridine) under argon at -80 °C was added *via* syringe *n*-butyllithium (1.6 M in hexane, 2.2 equiv). This solution was stirred at -80 °C for 30 minutes, cooled down to -105 °C and then was treated *via* syringe by a slow addition of 3-bromopyridine (2 equiv), keeping internal temperature below -100 °C. The reaction mixture was stirred 10 minutes at

-100 °C and the resulting lithiopyridine complex was quenched with a solution of the electrophile (1 equiv) in THF (2 mL per mmol of electrophile). After a slow warm up from -100 °C to 0 °C (ca. 2 h), the reaction mixture was hydrolysed by addition of triethylamine (2.2 equiv) and methanol (2.2 equiv). Then the mixture was allowed to room temperature and extracted two times with ethyl acetate and water. The combined organic layers were washed with brine, dried over MgSO₄, filtered and evaporated to dryness. The crude was purified by column chromatography using silica gel and ethyl acetate as eluent or by passive dialysis to give the corresponding linked pyridine.

3-bromo-4-trimethylsilanylpuridine 2:⁽ⁱⁱ⁾ Diisopropylamine (4.1 mL, 29.2 mmol), n-butyllithium (18.2 mL, 29.2 mmol), THF (32 mL), then 3-bromopyridine **1** (2.57 mL, 26.7 mmol), chlorotrimethylsilane (1.5 mL, 12.2 mmol) in 10 mL of THF. Column chromatography using pure ethyl acetate afforded the 3-bromo-4-trimethylsilanylpuridine **2** as colorless oil (2.56 g, 91% yield). ¹H NMR (CDCl₃): δ 8.58 (s, 1 H, Ar-H), 8.40 (d, 1 H, ³J_{H-H} = 4.8 Hz, Ar-H), 7.24 (d, 1 H, ³J_{H-H} = 4.8 Hz, Ar-H), 0.35 (s, 9 H, Si-CH₃). ¹³C NMR (CDCl₃): δ 150.4 (Ar-CH), 149.5 (quaternary C), 146.2, 129.3 (2 x Ar-CH), 127.8 (quaternary C), -2.1 (Si(CH₃)₂). ²⁹Si NMR (CDCl₃): δ 0.22.

[3-bromo-4-G0-puridine] 11: Diisopropylamine (0.68 mL, 4.84 mmol), n-butyllithium (3.0 mL, 4.84 mmol), THF (7 mL), then 3-bromopyridine **1** (0.43 mL, 4.46 mmol), chlorocarbosilane-G0 **9** (0.43 g, 0.75 mmol) in 5 mL of THF. Column chromatography using pure ethyl acetate afforded the 3-bromo-4-G0-puridine **11** as colorless oil (0.48 g, 61% yield). ¹H NMR (CDCl₃): δ 8.58 (s, 4 H, Ar-H), 8.40 (d, 4 H, ³J_{H-H} = 4.5 Hz, Ar-H), 7.22 (d, 4 H, ³J_{H-H} = 4.5 Hz, Ar-H), 1.24-1.15 (m, 8 H, C-CH₂-C), 0.98-0.94 (m, 8 H, CH₂-Si-Ar), 0.48-0.40 (m, 8 H, CH₂-Si-CH₂), 0.32 (s, 24

H, Si-CH₃). ¹³C NMR (CDCl₃): δ 151.0 (Ar-CH), 149.9 (quaternary C), 146.7, 130.2 (2 x Ar-CH), 128.4 (quaternary C), 19.1, 18.2, 16.9 (3 x CH₂), -3.0 (Si(CH₃)₂). ²⁹Si NMR (CDCl₃): δ 0.78 (Si core), 0.66 (4 x Si). Anal. Calc. for C₄₀H₆₀Br₄N₄Si₅: C 45.45, H 5.72, N 5.30, Si 13.29. Found: C 45.58, H 5.70, N 5.21, Si 13.32.

[3-bromo-4-G1-pyridine]: G1-(3BrPy)₁₀(OCH₃)₂ **12**: Diisopropylamine (2.1 mL, 14.7 mmol), n-butyllithium (9.2 mL, 14.7 mmol), THF (16 mL), then 3-bromopyridine **1** (1.3 mL, 13.4 mmol), chlorocarbosilane-G1 **10** (1.08 g, 0.56 mmol) in 10 mL of THF. Hydrolysis with NEt₃ (2.1 mL, 14.7 mmol) and methanol (0.6 mL, 14.7 mmol). The crude material (ca. 1.5 g) was diluted in 20 mL of technical methanol and placed into a membrane bag. This bag was then placed into a beaker containing 400 mL of methanol and the solution was slowly stirred overnight at room temperature. Evaporation of the internal solution of the bag afforded the G1-(3BrPy)₁₀(OCH₃)₂ **12** as brown oil (1.30 g, 74% yield). ¹H NMR (CDCl₃): δ 8.53 (br s, 10 H, Ar-H), 8.36 (br s, 10 H, Ar-H), 7.18 (br s, 10 H, Ar-H), 3.30 (s, 6 H, 2 x OCH₃), 1.40-1.08 (m, 40 H, C-CH₂-C), 0.89 (br s, 24 H, CH₂-Si-Ar), 0.44 (br s, 32 H, CH₂-Si-CH₂), 0.27 (s, 60 H, Si(CH₃)₂(Ar)), -0.01 (s, 12 H, Si(CH₃)₂(OCH₃)). ¹³C NMR (CDCl₃): δ 151.0 (Ar-CH), 149.8 (quaternary C), 146.7, 130.2 (2 x Ar-CH), 128.4 (quaternary C), 47.3 (OCH₃), 20.9, 20.6, 19.9, 19.8, 19.1, 18.3, 17.7, 17.0 (CH₂), -2.6 (Si(CH₃)₂(Ar)), -3.0 (Si(CH₃)₂(OCH₃)). ²⁹Si NMR (CDCl₃): δ 18.7 (2 x Si-OCH₃), 0.79 (Si core), 0.61 (10 x Si-Ar), -3.91 (Si inner).

G1-(3BrPy)₁₂ **13**: Diisopropylamine (1.67 mL, 11.9 mmol), n-butyllithium (7.4 mL, 11.9 mmol), THF (15 mL), then 3-bromopyridine **1** (1.04 mL, 10.8 mmol), chlorocarbosilane-G1 **10** (0.87 g, 0.45 mmol) in 10 mL of THF. Hydrolysis with NEt₃ (1.7 mL, 11.9 mmol) and methanol (0.5 mL, 11.9 mmol). The crude material (ca. 1.5 g) was diluted in 20 mL of technical methanol and placed into a membrane bag. This

bag was then placed into a beaker containing 400 mL of methanol and the solution was slowly stirred overnight at room temperature. Evaporation of the internal solution of the bag afforded the G1-(3BrPy)₁₂ **13** as brown oil (1.17 g, 77% yield). ¹H NMR (CDCl₃): δ 8.51 (br s, 12 H, Ar-H), 8.33 (br s, 12 H, Ar-H), 7.17 (br s, 12 H, Ar-H), 1.44-1.01 (m, 40 H, C-CH₂-C), 0.90 (br s, 24 H, CH₂-Si-Ar), 0.41 (br s, 32 H, CH₂-Si-CH₂), 0.24 (s, 72 H, Si(CH₃)₂(Ar)). ¹³C NMR (CDCl₃): δ 150.9 (Ar-CH), 149.6 (quaternary C), 146.6, 130.1 (2 x Ar-CH), 128.4 (quaternary C), 21.0, 20.1, 19.1, 18.3, 17.6, 17.0 (CH₂), -3.0 (Si(CH₃)₂(Ar)). ²⁹Si NMR (CDCl₃): δ 0.77 (Si core), 0.52 (10 x Si-Ar), -4.02 (Si inner).

General procedure for the Suzuki coupling reaction:⁽ⁱⁱⁱ⁾ To a solution of silylated pyridine (1 equiv) in degassed toluene (5 mL per mmol) and degassed EtOH (1 mL per mmol) were added Pd(PPh₃)₄ (1 or 2 mol%), 2 M Na₂CO₃ degassed solution (2 mL, 5 equiv) and the boronic acid (1.5 equiv). The mixture was vigorously stirred and heated at reflux for 16 hours. After cooling down and addition of water, the mixture was extracted two times with ethyl acetate. The combined organic layers were washed with aqueous 1 M NaHCO₃ solution then water, dried over MgSO₄, filtered and evaporated to dryness. Column chromatography over silica gel using an appropriate mixture of ethyl acetate and hexane or passive dialysis afforded the corresponding bi-aryl compounds.

3-*p*-tolyl-4-trimethylsilanylp pyridine 3: 3-bromo-4-trimethylsilanylp pyridine **2** (0.46 g, 2.0 mmol) in 10 mL of degassed toluene and 2 mL of degassed ethanol, Pd(PPh₃)₄ (23.1 mg, 1 mol%), Na₂CO₃ (5 mL, 2 M degassed solution), *p*-tolueneboronic acid (0.408 g, 3.0 mmol). Column chromatography using ethyl acetate/hexane (1/1) afforded the 3-*p*-tolyl-4-trimethylsilanylp pyridine **3** as colorless oil (0.411 g, 85%

yield). ^1H NMR (CDCl_3): δ 8.53 (d, 1 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-H), 8.43 (s, 1 H, Ar-H), 7.44 (d, 1 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-H), 7.21 (d(AB), 2 H, $^3J_{\text{H-H}} = 7.8$ Hz, Ar-H Phenyl), 7.16 (d(AB), 2 H, $^3J_{\text{H-H}} = 7.8$ Hz, Ar-H Phenyl), 2.40 (s, 3 H, Ar-CH₃), 0.04 (s, 9 H, Si-CH₃). ^{13}C NMR (CDCl_3): δ 149.3 (Ar-CH), 148.0 (quaternary C), 147.0 (Ar-CH), 143.9, 137.8, 137.4 (3 x quaternary C), 129.3, 128.6, 128.5 (3 x Ar-CH), 21.2 (Ar-CH₃), -0.2 (Si(CH₃)₂). ^{29}Si NMR (CDCl_3): δ -2.78. Anal. Calc. for C₁₅H₁₉NSi: C 74.63, H 7.93, N 5.80, Si 11.63. Found: C 74.71, H 7.86, N 5.74, Si 11.58.

[3-*p*-tolyl-4-G0-pyridine] 14: 3-bromo-4-G0-pyridine **11** (400 mg, 0.38 mmol) in 10 mL of degassed toluene and 2 mL of degassed ethanol, Pd(PPh₃)₄ (17.5 mg, 4x1 mol%), Na₂CO₃ (3.8 mL, 2 M degassed solution), *p*-tolueneboronic acid (309 mg, 2.27 mmol). Column chromatography using ethyl acetate/hexane (1/1) afforded the 3-*p*-tolyl-4-G0-pyridine **14** as colorless oil (380 mg, 91% yield). ^1H NMR (CDCl_3): δ 8.49 (d, 4 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-H), 8.40 (s, 4 H, Ar-H), 7.37 (d, 4 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-CH), 7.17 (d(AB), 8 H, $^3J_{\text{H-H}} = 7.8$ Hz, Ar-H Phenyl), 7.11 (d(AB), 8 H, $^3J_{\text{H-H}} = 7.8$ Hz, Ar-H Phenyl), 2.38 (s, 12 H, Ar-CH₃), 1.15-1.04 (m, 8 H, C-CH₂-C), 0.52-0.45 (m, 8 H, CH₂-Si-Ar), 0.36-0.25 (m, 8 H, CH₂-Si-CH₂), -0.05 (s, 24 H, Si-CH₃). ^{13}C NMR (CDCl_3): δ 149.3 (Ar-CH), 147.3 (quaternary C), 146.9 (Ar-CH), 144.0, 137.7, 137.4, 132.1 (quaternary C), 129.3, 128.7, 128.6, 128.4 (Ar-CH), 21.2 (Ar-CH₃), 20.9, 18.4, 17.2 (3 x CH₂), -1.9 (Si(CH₃)₂). ^{29}Si NMR (CDCl_3): δ 0.38 (Si core), -2.45 (4 x Si). Anal. Calc. for C₆₈H₈₈N₄Si₅: C 74.12, H 8.05, N 5.08, Si 12.74. Found: C 74.21, H 8.11, N 4.97, Si 12.61.

[3-*p*-tolyl-4-G1-pyridine]: G1-(3-*p*-tolylPy)₁₂ **15**: G1-(3BrPy)₁₂ **13** (200 mg, 0.06 mmol) in 10 mL of degassed toluene and 2 mL of degassed ethanol, Pd(PPh₃)₄ (16.3 mg, 12x1 mol%), Na₂CO₃ (1.8 mL, 2 M degassed solution), *p*-tolueneboronic acid (144 mg, 1.06 mmol). The crude material (ca. 0.4 g) was diluted in 10 mL of technical

methanol and placed into a membrane bag. This bag was then placed into a beaker containing 200 mL of methanol and the solution was slowly stirred overnight at room temperature. Evaporation of the internal solution of the bag afforded the G1-(3-*p*-tolylPy)₁₂ **15** as brown oil (160 mg, 77% yield). ¹H NMR (CDCl₃): δ 8.44 (br s, 12 H, Ar-H), 8.38 (br s, 12 H, Ar-H), 7.32 (br s, 12 H, Ar-H), 7.25-7.05 (br m, 48 H, Ar-H Phenyl), 2.53 (s, 36 H, Ar-CH₃), 1.20-1.00 (m, 40 H, C-CH₂-C), 0.65-0.25 (br m, 56 H, CH₂-Si-Ar and CH₂-Si-CH₂), -0.10 (s, 72 H, Si(CH₃)₂(Ar)). ¹³C NMR (CDCl₃): δ 149.3 (Ar-CH), 146.9 (quaternary C), 143.9, 137.6, 137.3 (quaternary C), 130.1, 128.4 (2 x Ar-CH), 21.1, 21.0, 20.1, 18.4, 17.4, 17.2 (CH₂), -1.9 (Si(CH₃)₂(Ar)). ²⁹Si NMR (CDCl₃): δ 0.8 (Si core), -2.5 (Si-Ar), -3.9 (Si inner).

General procedure for the Heck coupling reaction:^(iv) To a solution of silylated pyridine (1 equiv) in dry *N,N*-dimethylformamide (5 ml per mmol) were added Pd(OAc)₂ (2.5 mol %), PPh₃ (5 mol%), NEt₃ (5 equiv) and ethyl acrylate (1.5 equiv). The reaction mixture was heated 16 hours at 130 °C. The mixture was then cooled down to room temperature, diluted with water, extracted with ethyl acetate and dried over MgSO₄. The resulting solution was filtered through a short plug of Celite and evaporated to dryness. The crude material was then purified by column chromatography using an appropriate mixture of ethyl acetate and hexane or by passive dialysis.

3-(4-trimethylsilylpyridin-3-yl)-acrylic acid ethyl ester 4: 3-bromo-4-trimethylsilylpyridine **2** (0.50 g, 2.17 mmol) in 11 mL of DMF, Pd(OAc)₂ (12.2 mg, 2.5 mol %), PPh₃ (28.5 mg, 5 mol%), NEt₃ (1.4 mL, 6.5 mmol) and ethyl acrylate (0.38 mL, 3.48 mmol). Column chromatography using ethyl acetate/hexane (1/2) afforded the 3-(4-trimethylsilylpyridin-3-yl)-acrylic acid ethyl ester **4** as colorless

oil (452 mg, 85% yield). ^1H NMR (CDCl_3): δ 8.71 (br s, 1 H, Ar-H), 8.44 (d, 1 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-H), 7.91 (d, 1 H, $^3J_{\text{H-H}} = 15.8$ Hz, $\text{CH}=\text{CHCO}_2\text{Et}$), 7.33 (d, 1 H, $^3J_{\text{H-H}} = 4.8$ Hz, Ar-H), 6.33 (d, 1 H, $^3J_{\text{H-H}} = 15.8$ Hz, $\text{CH}=\text{CHCO}_2\text{Et}$), 4.20 (q, 2 H, $^3J_{\text{H-H}} = 7.1$ Hz, CH_2CH_3), 1.27 (t, 3 H, $^3J_{\text{H-H}} = 7.1$ Hz, CH_2CH_3), 0.31 (s, 9 H, Si- CH_3). ^{13}C NMR (CDCl_3): δ 166.0 (C=O), 149.7 (quaternary C), 148.9 (Ar-CH), 146.7 (Ar-CH), 142.5 ($\text{CH}=\text{CHCO}_2\text{Et}$), 135.4 (quaternary C), 128.3 (Ar-CH), 120.5 ($\text{CH}=\text{CHCO}_2\text{Et}$), 60.5 (CH_2CH_3), 14.1 (CH_2CH_3), -0.76 ($\text{Si}(\text{CH}_3)_2$). ^{29}Si NMR (CDCl_3): δ -2.88. Anal. Calc. for $\text{C}_{13}\text{H}_{19}\text{NO}_2\text{Si}$: C 62.61, H 7.68, N 5.62, Si 11.26. Found: C 62.70, H 7.58, N 5.58, Si 11.34.

3-(4-G1-pyridin-3-yl)-acrylic acid ethyl ester 16: 3-bromo-4-G1-pyridine **13** (200 mg, 0.06 mmol) in 10 mL of DMF, $\text{Pd}(\text{OAc})_2$ (4.0 mg, 12x2.5 mol %), PPh_3 (9.3 mg, 12x5 mol%), NEt_3 (0.5 mL, 3.5 mmol) and ethyl acrylate (0.12 mL, 1.06 mmol). The crude material (ca. 0.4 g) was diluted in 10 mL of technical methanol and placed into a membrane bag. This bag was then placed into a beaker containing 200 mL of methanol and the solution was slowly stirred overnight at room temperature. Evaporation of the internal solution of the bag afforded the 3-(4-G1-pyridin-3-yl)-acrylic acid ethyl ester **16** as brown oil (171 mg, 80% yield). ^1H NMR (CDCl_3): δ 8.73 (br s, 12 H, Ar-H), 8.45 (br s, 12 H, Ar-H), 7.91 (d, 12 H, $^3J_{\text{H-H}} = 16.2$ Hz, $\text{CH}=\text{CHCO}_2\text{Et}$), 7.30 (br s, 12 H, Ar-H), 6.34 (d, 12 H, $^3J_{\text{H-H}} = 16.2$ Hz, $\text{CH}=\text{CHCO}_2\text{Et}$), 4.25-4.15 (m, 24 H, CH_2CH_3), 1.40-1.05 (m, 76 H, CH_2CH_3 , C- CH_2 -C), 0.95-0.70 (br m, 24 H, CH_2 -Si-Ar), 0.48 (br s, 32 H, CH_2 -Si- CH_2), 0.29 (s, 72 H, $\text{Si}(\text{CH}_3)_2(\text{Ar})$). ^{13}C NMR (CDCl_3): δ 166.1 (C=O), 150.0 (quaternary C), 148.9, 146.9 (2 x Ar-CH), 142.6 ($\text{CH}=\text{CHCO}_2\text{Et}$), 135.5 (quaternary C), 128.5 (Ar-CH), 120.6 ($\text{CH}=\text{CHCO}_2\text{Et}$), 60.6 (CH_2CH_3), 20.4, 20.2, 18.4, 17.9, 17.1 (CH_2), 14.2 (CH_2CH_3), -2.2 ($\text{Si}(\text{CH}_3)_2(\text{Ar})$). ^{29}Si NMR (CDCl_3): δ 0.8 (Si core), -2.5 (Si-Ar), -3.8 (Si inner).

General procedure for the Sonogashira coupling reaction:^(v) To a solution of silylated pyridine (1 equiv) in dry tetrahydrofuran (5 mL per mmol) were added $\text{PdCl}_2(\text{PPh}_3)_2$ (5 mol%), PPh_3 (10 mol%), NEt_3 (2 equiv), phenylacetylene (1.5 equiv) and copper iodide (10 mol%). The reaction mixture was then heated at reflux 16 hours. The mixture was cooled down to room temperature, diluted with water, extracted with ethyl acetate and dried over MgSO_4 . The resulting solution was filtered through a short plug of Celite and evaporated to dryness. The crude material was purified by column chromatography using an appropriate mixture of ethyl acetate and hexane or by passive dialysis.

3-phenylethynyl-4-trimethylsilanylpuridine 5: 3-bromo-4-trimethylsilanylpuridine **2** (0.30 g, 1.3 mmol) in 10 mL of THF, $\text{PdCl}_2(\text{PPh}_3)_2$ (45.8 mg, 5 mol%), PPh_3 (34.2 mg, 10 mol%), NEt_3 (0.4 mL, 2.6 mmol), phenylacetylene (0.21 mL, 1.95 mmol) and copper iodide (24.8 mg, 10 mol%). Column chromatography using ethyl acetate/hexane (1/5) afforded the 3-phenylethynyl-4-trimethylsilanylpuridine **5** as colorless oil (0.29 g, 88% yield). ^1H NMR (CDCl_3): δ 8.72 (br s, 1 H, Ar-H), 8.48 (d, 1 H, $^3J_{\text{H-H}} = 4.7$ Hz, Ar-H), 7.58-7.50 (m, 2 H, 2 x Ar-H), 7.40-7.34 (m, 4 H, 4 x Ar-H), 0.44 (s, 9 H, Si- CH_3). ^{13}C NMR (CDCl_3): δ 152.1 (Ar-CH), 151.5 (quaternary C), 147.3 (Ar-CH), 131.3 (Ar-CH), 128.7, 128.5 (2 x Ar-CH), 127.9 (Ar-CH), 125.4 (quaternary C), 122.7 (quaternary C), 94.8 ($\text{C}\equiv\text{CPh}$), 87.9 ($\text{C}\equiv\text{CPh}$), -1.7 ($\text{Si}(\text{CH}_3)_2$). ^{29}Si NMR (CDCl_3): δ -3.13. Anal. Calc. for $\text{C}_{16}\text{H}_{17}\text{NSi}$: C 76.44, H 6.82, N 5.57, Si 11.17. Found: C 76.35, H 6.76, N 5.48, Si 11.23.

[3-phenylethynyl-4-G1-pyridine] 17: 3-bromo-4-G1-pyridine **13** (200 mg, 0.06 mmol) in 10 mL of THF, $\text{PdCl}_2(\text{PPh}_3)_2$ (24.8 mg, 12x5 mol%), PPh_3 (18.5 mg, 12x10 mol%), NEt_3 (0.2 mL, 1.4 mmol), phenylacetylene (0.12 mL, 1.06 mmol) and copper

iodide (13.5 mg, 12x10 mol%). The crude material (ca. 0.3 g) was diluted in 10 mL of technical dichloromethane and placed into a membrane bag. This bag was then placed into a beaker containing 200 mL of dichloromethane and the solution was slowly stirred overnight at room temperature. Evaporation of the internal solution of the bag afforded the 3-phenylethynyl-4-G1-pyridine **17** as brown oil (149 mg, 70% yield). ¹H NMR (CDCl₃): δ 8.63 (br s, 12 H, Ar-H), 8.47 (br s, 12 H, Ar-CH), 7.90-7.60 (br m, 12 H, Ar-H), 7.54-7.46 (m, 12 H, Ar-H), 7.40-7.16 (br m, 48 H, Ar-H), 1.50-1.15 (br m, 40 H, C-CH₂-C), 1.05-0.90 (br m, 24 H, CH₂-Si-Ar), 0.70-0.35 (br m, 32 H, CH₂-Si-CH₂), 0.33 (s, 72 H, Si-CH₃). ¹³C NMR (CDCl₃): δ 151.2 (Ar-CH), 150.3 (quaternary C), 146.9, 132.0, 129.6, 128.5, 128.4 (Ar-CH), 121.5 (quaternary C), 93.8 (C≡CPh), 88.1 (C≡CPh), 21.0, 19.3, 18.5, 17.9, 17.2 (CH₂), -2.8 (Si(CH₃)₂). ²⁹Si NMR (CDCl₃): δ 0.7 (Si core), -3.2 (Si-Ar), -3.9 (Si inner).

General procedure for the desilylation reaction using tetrabutylammonium fluoride:^(vi) To a solution of silylated pyridine (1 equiv) in tetrahydrofuran (5 mL per mmol) was added a solution of tetrabutylammonium fluoride (2 equiv, 1 M in solution in THF) at room temperature. The reaction mixture was stirred overnight at room temperature. The mixture was extracted with ethyl acetate and a solution of saturated NaHCO₃ solution, washed of the organic layers with water, dried over MgSO₄ and evaporated to dryness. The crude was then filtered through a short plug of silica using ethyl acetate as eluent.

3-*p*-tolylpyridine 6:^(vii) 3-*p*-tolyl-4-trimethylsilylpyridine **3** (300 mg, 1.2 mmol) in 6 mL of THF, and nBu₄NF (2.5 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-*p*-tolylpyridine **6** as white powder (198 mg, 94%).

G1-(3-*p*-tolylPy)₁₂ **15** (250 mg, 0.07 mmol) in 5 mL of THF, and nBu₄NF (1.7 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-*p*-tolylpyridine **6** as white powder (130 mg, 90%). ¹H NMR (CDCl₃): δ 8.75 (d, 1 H, ³J_{H-H} = 2.7 Hz, Ar-H), 8.47 (dd, 1 H, ³J_{H-H} = 4.8 Hz, ⁴J_{H-H} = 0.9 Hz, Ar-H), 7.72 (dm, 1 H, ³J_{H-H} = 8.1 Hz), 7.37 (d(AB), 2 H, ³J_{H-H} = 8.4 Hz, Ar-H Phenyl), 7.26-7.18 (m, 1 H, Ar-H), 7.17 (d(AB), 2 H, ³J_{H-H} = 8.4 Hz, Ar-H Phenyl), 2.30 (s, 3H, Ar-CH₃). ¹³C NMR (CDCl₃): δ 148.0 (Ar-CH), 138.0, 136.6, 134.8 (3 x quaternary C), 134.1, 129.7, 128.1, 126.9, 123.5 (Ar-CH), 21.4 (Ar-CH₃). Anal. Calc. for C₁₂H₁₁N: C 85.17, H 6.55, N 8.28. Found: C 85.10, H 6.48, N 8.16.

3-pyridin-3-yl-acrylic acid ethyl ester 7:^(viii) 3-(4-trimethylsilanylpiperidin-3-yl)-acrylic acid ethyl ester **4** (240 mg, 0.96 mmol) in 5 mL of THF, and nBu₄NF (1.9 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-pyridin-3-yl-acrylic acid ethyl ester **7** as white powder (155 mg, 91%). 3-(4-G1-piperidin-3-yl)-acrylic acid ethyl ester **16** (200 mg, 0.055 mmol) in 5 mL of THF, and nBu₄NF (1.3 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-pyridin-3-yl-acrylic acid ethyl ester **7** as white powder (101 mg, 85%). ¹H NMR (CDCl₃): δ 8.70 (s, 1 H, Ar-H), 8.55 (d, 1 H, ³J_{H-H} = 4.7 Hz, Ar-H), 7.79 (dm, 1 H, ³J_{H-H} = 8.0 Hz), 7.62 (d, 1 H, ³J_{H-H} = 16.2 Hz, CH=CHCO₂Et), 7.30-7.26 (m, 1 H, Ar-H), 6.46 (d, 1 H, ³J_{H-H} = 16.2 Hz, CH=CHCO₂Et), 4.23 (q, 2 H, ³J_{H-H} = 6.0 Hz, CH₂CH₃), 1.29 (t, 3 H, ³J_{H-H} = 6.0 Hz, CH₂CH₃). ¹³C NMR (CDCl₃): δ 166.1 (C=O), 150.8, 149.5 (Ar-CH), 140.7 (CH=CHCO₂Et), 134.1, 123.6 (Ar-CH), 120.4 (CH=CHCO₂Et), 112.1 (quaternary C), 60.6 (CH₂CH₃), 14.1 (CH₂CH₃). Anal. Calc. for C₁₀H₁₁N: C 67.78, H 6.26, N 7.90. Found: C 67.63, H 6.34, N 7.95.

3-phenylethynylpyridine 8:^(ix) 3-phenylethynyl-4-trimethylsilylpyridine **5** (180 mg, 0.72 mmol) in 5 mL of THF, and nBu₄NF (1.4 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-phenylethynylpyridine **8** as white solid (122 mg, 93%).

3-phenylethynyl-4-G1-pyridine **17** (200 mg, 0.054 mmol) in 5 mL of THF, and nBu₄NF (1.3 mL, 1 M solution in THF). Filtration through a plug of silica using ethyl acetate as eluent afforded the 3-phenylethynylpyridine **8** as slight orange solid (95 mg, 81%). ¹H NMR (CDCl₃): δ 8.77 (s, 1 H, Ar-H), 8.53 (d, 1 H, ³J_{H-H} = 4.7 Hz, Ar-H), 7.80 (dm, 1 H, ³J_{H-H} = 8.0 Hz), 7.56-7.52 (m, 2 H, Ar-CH), 7.37-7.34 (m, 3 H, Ar-H), 7.29-7.24 (m, 1 H, Ar-CH). ¹³C NMR (CDCl₃): δ 152.0, 149.3, 138.6, 131.7, 128.8, 128.4, 127.9 (Ar-CH), 126.3, 123.1 (quaternary C), 93.9 (C≡CPh), 88.7 (C≡CPh). Anal. Calc. for C₁₃H₉N: C 87.12, H 5.06, N 7.82. Found: C 87.18, H 5.11, N 7.68.

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Figure 2: ^1H NMR of the filtrate from dialysis.

173 memb. #2
(alk in ReOH)

JUN 73 memb 2