Supporting Information

Remarkable Regioselective Position-10 Bromination of Bacteriopyropheophorbide-a and Ring-B Reduced Pyropheophorbide-a

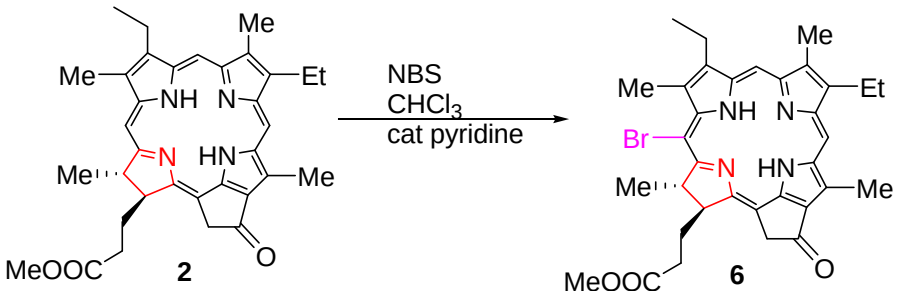
Manivannan Ethirajan[1], Penny Joshi[1], William III White[1], Kei Ohkubo[2], Shunichi Fukuzumi[2,3] and Ravindra K. Pandey[1*]

[1]*Chemistry Division, PDT Center, Cell Stress Biology,Roswell Park Cancer Institute, Buffalo, NY 14263, USA;* [2]*Department of Material and Life Science, Graduate School of Engineering, Osaka University, Osaka 565-0871, Japan*; [3]*Departmentof Bioinspired Science, Ewha Woman's University, Seoul 120-750, Korea*

Contents

Experimental Procedure:

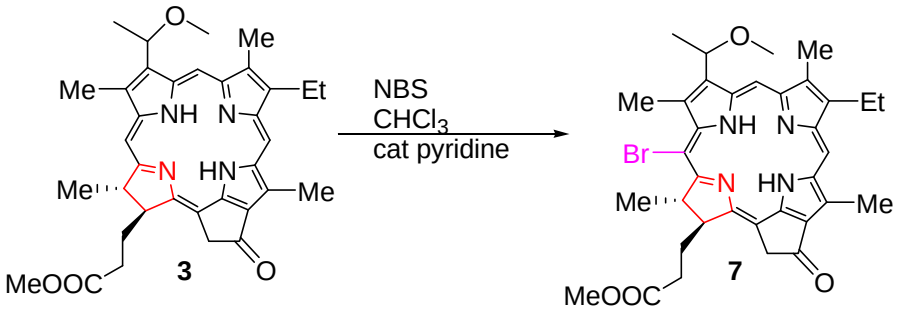
All reactions were carried out in flame-dried glassware under an atmosphere of nitrogen with magnetic stirring. Thin-layer chromatography (TLC) was done on ANALTECH precoated silica gel GF PE sheets (Cat. 159017, layer thickness 0.25 mm) and aluminum oxide NF PE sheets (Cat. 101016, layer thickness 0.2 mm). Column chromatography was performed either over Silica Gel 60 (70-230 mesh) or neutral Alumina (Brockmann grade III, 50 mesh). In some cases preparative TLC plates were also used for the purification (ANALTECH pre-coated silica gel GF glass plate, Cat. 02013, layer thickness 1.0 mm). Solvents were purified as follows: trace amounts of water and oxygen from THF were removed by refluxing over sodium under an inert atmosphere. Dichloromethane was dried over P_2O_5. Anhydrous pyridine and other common chromatographic solvents were obtained from commercial suppliers (J.T. Baker®, EMD® and Aldrich®) and used without further purification. ^{1}H-NMR spectra were recorded on Brucker AMX 400 or Varian 400 spectrometers at 303 K in $CDCl_3$ or CD_3OD. All 2D ^{1}H-NMR (COSY and NOESY) were run on Varian 400 MHz NMR spectrometer. Proton chemical shifts (δ) are reported in parts per million (ppm) relative to $CDCl_3$ (7.26 ppm) or TMS (0.00 ppm). Coupling constants (J) are reported in Hertz (Hz) and s, ss, d, t, q, p, m and br refer to singlet, splitsinglet, doublet, triplet, quartet, pentet, multiplet and broad respectively. Mass spectral data (Electro Spray Ionization, ESI by fusion) were obtained from Biopolymer Facility, Roswell Park Cancer Institute, The high-resolution mass spectrometry analyses were performed at the Mass Spectrometry Facility, Michigan State University, East Lansing, MI. CHN analysis were done at Midwest Microlab LLC., Indianapolis, IN. UV-visible spectrums were recorded on Varian Cary 50 Bio UV-visible spectrophotometer using dichloromethane as solvent. All photophysical experiments were carried out using spectroscopic grade solvents.



20-BromoMeso-Pyroheohorbide 6: ***Pyridinium bromide perbromide as a brominating agent:*** To a stirring solution of **2** (30 mg, 0.055 mmol, 1.0 eq) in 10 mL of dry dichloromethane was added pyridinium tribromide (19.4 mg, 0.061 mmol, 1.1 eq). The reaction mixture was stirred under an argon atmosphere and reaction progress was monitored via TLC. The organic layer was washed with sat. $NaHCO_3$/water/Brine (100 ml x 1 each) and dried over Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified using silica gel chromatography (silca 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio 1:4) to give **6**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 25.3 mg (74%).

NBS as a brominating agent: A mixture of starting material **2** (30 mg, 0.055 mmol, 1.0 eq) and NBS (11 mg, 0.06 mmol, 1.1 eq) in dry dichloromethane (10 ml) with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system delivered the bromo derivative **6**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 28.3 mg, (82%); UV-vis λ_{max} (in CH_2Cl_2): 668 nm (ε 3 x 10^4); ^{1}HNMR (400MHz, $CDCl_3$): δ 9.53 (1H, s, 5-H), 9.43 (1H, s, 10-H), 5.22 (2H, s, 13^1-CH_2), 4.86 (q, 1H, J = 7.2 Hz, 18-H),

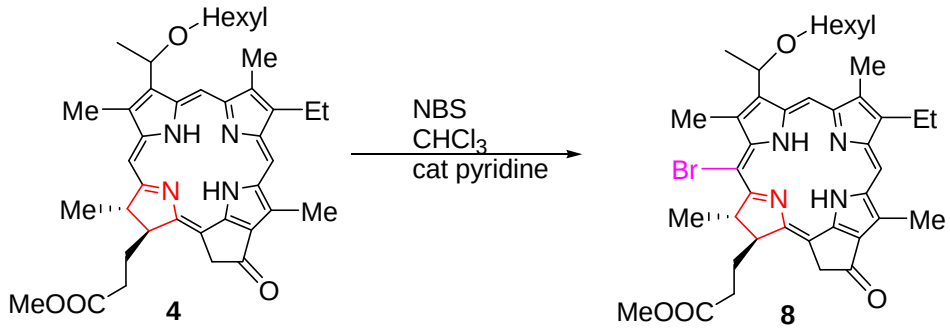
4.11-4.23 (m, 1H, 17-H), 3.90 (2H, q, J = 7.6 Hz, 3^1-CH_2), 3.71 (q, 2H, J = 7.6 Hz, 8^1-CH_2), 3.66 (3H, s, $COOCH_3$), 3.57 (3H, s, 2-CH_3), 3.55 (s, 3H, 7-CH_3), 3.28 (3H, s, 12-CH_3), 2.50-2.61 (m, 2H, 17^2-CH_2), 2.16-2.22 (m, 2H, 17^1-CH_2), 1.68-1.74 (m, 6H, 8^2-CH_3, 3^2-CH_3), 1.59 (d, 3H, J = 7.2 Hz, 18-CH3), 1.15, -1.72 (each 1H, s, NH); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.0, 173.3, 171.8, 160.4, 153.5, 151.6, 148.0, 144.7, 144.5, 139.2, 136.5, 134.1, 132.2, 131.4, 129.1, 106.6, 103.9, 97.1, 94.3, 51.8, 51.62, 51.60, 48.5, 30.9, 29.8, 20.8, 19.7, 19.4, 17.4, 17.25, 17.20, 16.9, 12.1, 11.2. EIMS (*m/z*): 630 (M+H). Elemental Anal. Calcd for $C_{34}H_{37}BrN_4O_3$: C, 64.86; H, 5.92; N, 8.90. Found: C, 65.91; H, 5.79; N, 8.60.



Compound 7 (*a mixture of R and S isomers*): *Pyridinium bromide perbromide as a brominating agent*: To a stirring solution of **3** (30 mg, 0.051 mmol, 1.0 eq) in 10 mL of dry dichloromethane was added pyridinium tribromide (18.2 mg, 0.057 mmol 1.1 eq). The reaction mixture was stirred under an argon atmosphere and reaction progress was monitored via TLC. The organic layer was washed with sat. $NaHCO_3$/water/Brine (100 ml x 1 each) and dried over Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified using silica gel chromatography (silca 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio 1:4) to give **6**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 26.2 mg (76%);

NBS as a brominating agent: A mixture of starting material **3** (30 mg, 0.051 mmol, 1.0 eq) and NBS (10 mg, 0.056 mmol, 1.1 eq) in dry dichloromethane (10 ml) with a catalytic amount of

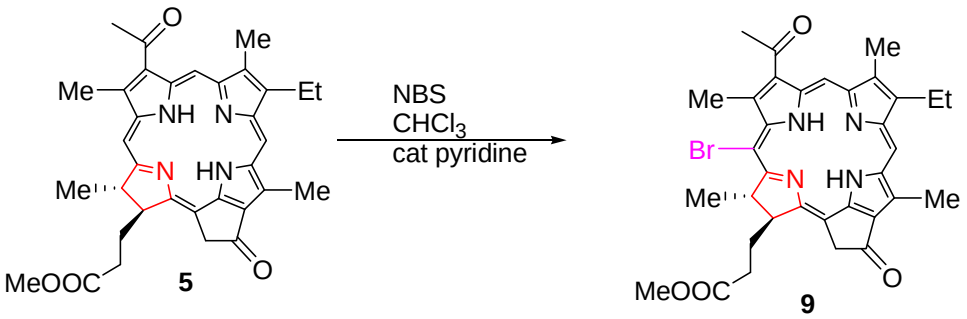
pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system delivered the bromo derivative **7**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 26.3 mg, (79%); UV-vis λ_{max} (in CH_2Cl_2): 670 nm (ε 3.1 x 10^4); ^{1}HNMR (400MHz, $CDCl_3$): δ 10.11 (s, 1H, H-5), 9.54 (s, 1H, H-10), 5.93 (q, 1H, J = 5.2 Hz, CH_3CHOhexyl), 5.23 (s, 2H, CH-13^1), 4.89 (m, 1H, H-17), 4.26 (m, 1H, H-18), 3.67-3.72 (m, 2H, 8-CH_2CH_3), 3.65 (s, 3H, 7-CH_3), 3.61 (s, 3H, 2-CH_3), 3.58 (s, 3H, -OCH_3), 3.52 (s, 3H, COOMe), 3.30 (s, 3H, 12-CH_3), 2.63 (m, 1H, CH-17^1), 2.52 (m, 1H, H-17^2), 2.26 (m, 2H, H-17^2), 2.12 (split d, J = 6.4 Hz, 3H, CH_3CHOMe), 1.70 (t, 3H, 8-CH_2CH_3, J = 7.2 Hz), 1.60 (d, 3H, 18-CH_3, J = 7.6 Hz), 0.84 (brs, 1H, NH), -1.78 (brs, 1H, NH); ^{13}C NMR (100 MHz, $CDCl_3$): δ 193.4, 170.8, 169.0, 168.9, 158.3, 150.8, 149.6, 145.3, 142.0, 138.5, 138.4, 137.13, 137.10, 135.4, 135.3, 134.7, 134.6, 130.9, 130.1, 130.0, 127.07, 127.06, 127.04, 104.1, 101.15, 101.12, 96.62, 96.61, 92.0, 74.8, 74.4, 74.1, 72.39, 72.30, 54.7, 65.7, 49.2, 49.17, 49.16, 49.0, 28.3, 27.2, 22.2, 22.1, 18.2, 16.8, 14.8, 14.47, 14.42, 9.5, 8.7; EIMS (*m/z*): 660 (M+H). Elemental Anal. Calcd for $C_{35}H_{39}BrN_4O_4$: C, 63.73; H, 5.96; N, 8.49. Found: C, 63.93; H, 5.69; N, 8.60.



Compound 8 (*a mixture of R and S isomers*)**:** ***Pyridinium bromide perbromide as a brominating agent*:** To a stirring solution of **4** (50 mg, 0.077 mmol, 1.0 eq) in 10 mL of dry dichloromethane was added pyridinium tribromide (27.1 mg, 0.085 mmol 1.1 eq). The reaction mixture was stirred under an argon atmosphere and reaction progress was monitored via TLC. The organic layer was washed with sat. $NaHCO_3$/water/Brine (100 ml x 1 each) and dried over Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified using silica gel chromatography (silca 60, 40 x 5) by eluting with ethyl acetate and hexane (ratio 1:4) to give **8**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 44.9 mg (80%).

NBS as a brominating agent: A mixture of starting material **4** (50 mg, 0.077 mmol, 1.0 eq) and NBS (15 mg, 0.847 mmol, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system delivered the bromo derivative **8**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 42 mg, (76%); UV-vis λ_{max} (in CH_2Cl_2): 675 nm (ε 3.1 x 10^4); ^{1}H NMR ($CDCl_3$): δ 10.23 and 9.54 (s, 1H *meso*-H); 6.00 (q, 1H C*H*(O-hexyl)-CH_3); 5.22 (s, 2H, CH-13^1); 4.93-4.87 (m, 1H, 18H); 4.27-4.24 (m, 1H, 17H); 3.73 (q, 2H, J = 7.0 Hz, C*H*$_2$,CH_3); 3.66 (s, 3H, 12^1-CH_3); 3.63 (s, 3H, 2^1-CH_3); 3.60 (s, 3H, -$COCH_3$); 3.32 (s, 3H, 7-CH_3); 2.63-2.18 (m, 4H, C*H*$_2$C*H*$_2$$CO_2$Me); 2.13 (split d, 3H, J = 7.2 Hz, 3^2-CH_3); 1.72 (t, 3H, J = 7.6 Hz, CH_2C*H*$_3$); 1.68 (m, 3H, 18^1–CH_3); 1.60 (t, 3H, -$(CH_2)_5$-C*H*$_3$), 1.4 – 0.8 (m, 10H, -(C*H*$_2$)$_5$); -1.78 and -1.82 (each brs, 2H NH); ^{13}C NMR

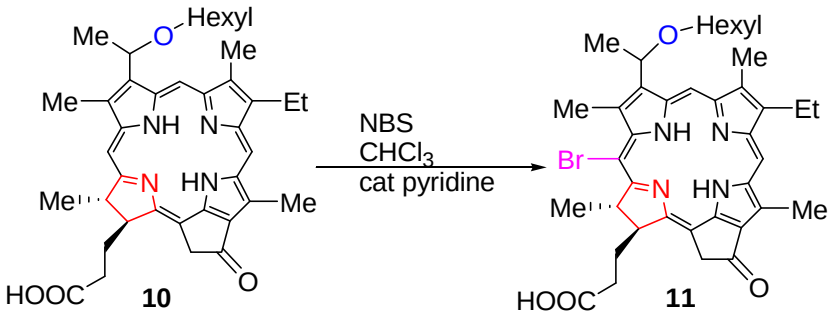
(100 MHz, $CDCl_3$): δ 195.98, 195.97, 173.43, 173.41, 171.6, 171.5, 160.9, 160.8, 153.4, 152.1, 147.97, 147.94, 144.5, 142.1, 141.9, 139.64, 139.62, 138.1, 138.0, 137.29, 137.28, 133.238, 133.230, 132.9, 132.7, 131.6, 129.52, 129.51, 106.71, 106.70, 106.6, 103.67, 103.63, 99.6, 94.6, 94.95, 77.45.77.13, 76.8, 73.2, 93.1, 69.8, 69.7, 51.9, 51.75, 51.72, 51.6, 48.6, 31.82, 31.81, 31.80, 31.7, 30.92, 30.90, 30.3, 30.2, 29.8, 26.14, 26.13, 26.10, 25.0, 24.9, 22.658, 22.651, 22.64, 22.62, 20.88, 20.81, 19.4. 17.4, 17.1, 17.0, 14.06, 14.058, 14.050, 14.03, 14.01, 12.05, 12.04, 11.41, 11.40; EIMS (*m/z*): 730 (M+H). Elemental Anal. Calcd for $C_{40}H_{49}BrN_4O_4$: C, 65.84; H, 6.77; N, 7.68. Found: C, 65.98; H, 6.73; N, 7.52.



Compound 9: ***Pyridinium bromide perbromide as a brominating agent*****:** To a stirring solution of **5** (30 mg, 0.053 mmol, 1.0 eq) in 10 mL of dry dichloromethane was added pyridinium tribromide (18.6 mg, 0.058 mmol 1.1 eq). The reaction mixture was stirred under an argon atmosphere and reaction progress was monitored via TLC. The organic layer was washed with sat. $NaHCO_3$/water/Brine (100 ml x 1 each) and dried over Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified using silica gel chromatography (silca 60, 40 x 5) by eluting with acetone and dichloromethane (ratio 2:98) to give **9**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 24.5 mg (72%).

NBS as a brominating agent**:** A mixture of **5** (25 mg, 0.044 mmol, 1.0 eq) and NBS (8.6 mg, 0.049, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred

at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system to give **9**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield: 22.6 mg (81%); UV-vis λ_{max} (in CH_2Cl_2): 686 nm (ε 2.7 x 10^4); ^{1}H NMR (400 MHz, CDCl3): δ 9.62 (1H, s,5-H), 9.60 (1H, s, 10-H), 5.27-5.29 (broad multiplet, 2H, 13^1-CH_2), 4.90-4.92 (m,1H, 18-H), 4.27-4.29 (m, 1H, 7-H), 3.69-3.74 (6H, s, $COCH_3$ + 12-CH_3, 2H, m, 8CH_2), 3.58 (3H, s, 2-CH_3), 3.26 (3H, s, 7-CH_3), 3.23 (3H, s, $COCH_3$), 2.55–2.60 (2H, m, 17-CH_2*CH_2*), 2.16–2.27 (2H, m, 17-*CH_2*CH_2), 1.70 (3H, t, 8^1-CH_3, J= 7.6 Hz). 1.60 (3H, d, 18-CH_3, J= 7.2 Hz), 0.75 (br s, 1H, NH), -1.96 (br s, 1H, NH); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.3, 195.8, 173.2, 170.6, 162.0, 153.1, 153.0, 147.9, 144.6, 141.3, 141.0, 137.8, 136.1, 133.1, 132.5, 131.0, 130.6, 107.1, 103.4, 100.4, 95.7, 52.1, 51.6, 51.5, 48.6, 34.2, 30.9, 29.7, 20.7, 19.4, 18.9, 17.3, 12.2, 11.2; EIMS (*m/z*): 643 (M+H); HRMS: Calcd. For $C_{34}H_{36}BrN_4O_4$ (M+H): 643.1920; Found: 643.1899.

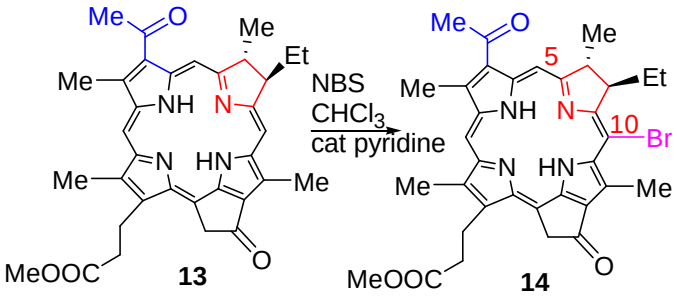


Compound 11 *(a mixture of R and S isomers)*: ***Pyridinium bromide perbromide as a brominating agent*:** To a stirring solution of **10** (50 mg, 0.079 mmol, 1.0 eq) in 10 mL of dry dichloromethane was added pyridinium tribromide (27.6 mg, 0.086 mmol 1.1 eq). The reaction mixture was stirred under an argon atmosphere and reaction progress was monitored via TLC.

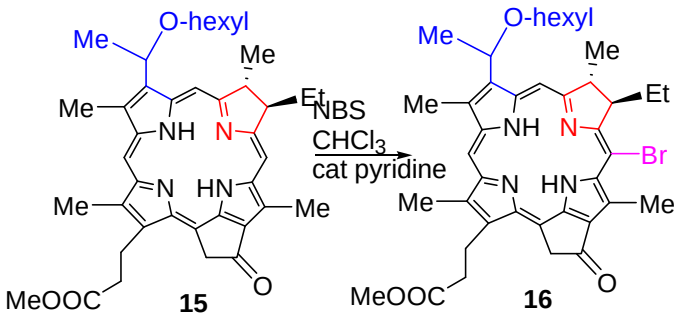
The organic layer was washed with sat. $NaHCO_3$/water/Brine (100 ml x 1 each) and dried over Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified using silica gel chromatography (silca 60, 30 x 5) by eluting with methanol dichloromethane (ratio 5:95) to give **11**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 45.7 mg (81%).

NBS as a brominating agent: A mixture of starting material **10** (50 mg, 0.78 mmol, 1.0 eq) and NBS (15 mg, 0.086 mmol, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with dichloromethane and methanol (ratio of 0.5:10) solvent mixture system delivered the bromo derivative **11**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 40 mg, (72%); UV-vis λ_{max} (in CH_2Cl_2): 673 nm (ε 3.1 x 10^4); ^{1}H NMR ($CDCl_3$): δ 10.19 (s, 1H *meso*-H); 9.55 (s, 1H *meso*-H); 5.96 (m, 1H C*H*(O-hexyl)-CH_3); 5.22 (s, 2H, 13^1-CH_2); 4.87-4.91 (m, 1H, 18H); 4.24-4.27 (m, 1H, 17H); 3.72 (q, 2H, J = 7.0 Hz, C*H*$_2$,CH_3); 3.66 (s, 3H, 12^1 -CH_3); 3.60 (s, 3H, 2^1 -CH_3); 2.76 (s, 3H, 7^1 -CH_3); 2.57-2.67 (m, 1H, 17^1-C*H*$_2$); 2.49-2.56 (m, 1H, 17^1-C*H*$_2$); 2.18-2.26 (m, 2H, 17^2-C*H*$_2$); 2.13 (split d, 3H, J = 7.0 Hz, 3^2-CH_3); 1.72 (t, 3H, J = 7.6 Hz, CH_2C*H*$_3$); 1.68 (s, 3H, 18^1 –CH_3); 1.16–1.40 (m, 10H (C*H*$_2$)$_5$); 0.80 (t, 3H, J = 7.2 Hz, $(CH_2)_5$-C*H*$_3$), 0.76 and -1.78 (each s, 2H, NH); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.1, 171.5, 160.6, 153.4, 152.1, 148.0, 144.5, 142.0, 139.6, 138.1, 137.2, 133.2, 132.7, 131.5, 129.5, 106.6, 103.8, 99.5, 73.1, 69.6, 51.8, 51.5, 48.5, 31.69, 31.66, 30.53, 30.2, 30.1, 29.5, 26.0, 25.9, 24.9, 22.53, 22.51, 20.7, 19.4, 17.3, 17.0, 16.9, 13.93, 13.90, 12.1, 11.3. EIMS (*m/z*): 716

(M+H);. Elemental Anal. Calcd for $C_{39}H_{47}BrN_4O_4$: C, 65.45; H, 6.62; N, 7.83. Found: C, 64.93; H, 6.59; N, 7.60.

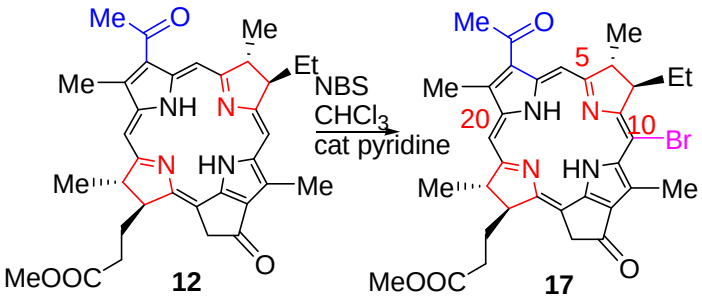


Compound 14: ***NBS as a brominating agent:*** A mixture of **13** (30 mg, 0.053 mmol, 1.0 eq) and NBS (10.4 mg, 0.059, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system to give **14**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 22.5mg, (66%); UV-vis λ_{max} (in CH_2Cl_2): 691 nm (ε 3.8 x 10^4); ^{1}H NMR (400 MHz, CDCl3): 9.24 (1H, s, 20-H), 9.20 (1H, s, 5-H), 5.29 (dd, 2H, 13^1-CH_2, J = 15 & 36, 13^1-CH_2), 4.41-4.45 (m, 2H, 8-H + 7-H), 3.76 (3H, s, $COOCH_3$), 3.70-3.74 (5H, s, 12-CH_3 & t of 2H of 17 CH_2 embedded), 3.57 (3H, s, 2-CH_3), 3.22 (3H, s, 18-CH_3), 3.15 (3H, s, $COCH_3$), 2.83 (d, 2H, 17-*CH_2*CH_2, J= 8.0 Hz), 2.32-2.60 (1H, m, 8^1-H), 1.76-1.79 (1H, m, 8^1-H), 1.74 (3H, d, 7-CH_3, J= 7.2 Hz), 1.07 (3H, t, 8^2-CH_3, J= 7.6 Hz), 0.25 (br s, 1H, NH); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.3, 193.3, 170.6, 170.3, 164.3, 141.2, 138.1, 137.57, 137.52, 139.3, 136.2, 134.1, 133.2, 130.7, 123.3, 114.1, 96.66, 96.65, 95.4, 94.2, 55.4, 49.3, 46.5, 46.3, 33.3, 33.2, 30.7, 24.8, 20.7, 19.9, 13.8, 11.1, 8.69, 8.64; EIMS (*m/z*): 643 (M+H). HRMS: Calcd. For $C_{34}H_{36}BrN_4O_4$ (M+H): 643.1920; Found: 643.1936.



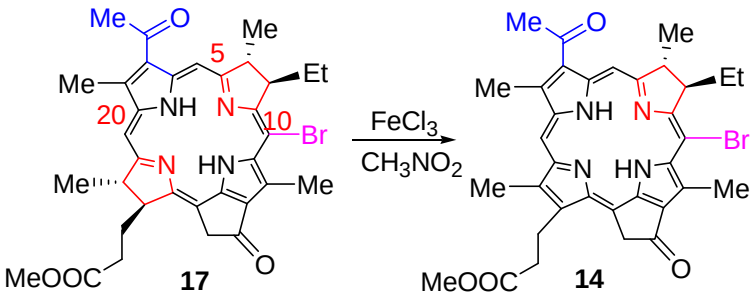
Compound 16 (*a mixture of R and S isomers*)**:** ***NBS as a brominating agent*****:** A mixture of **15** (25 mg, 0.038 mmol, 1.0 eq) and NBS (7.5 mg, 0.042, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system to give **16**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 17.9mg (64%); UV-vis λ_{max} (in CH_2Cl_2): 664 nm (ε 3.0 x 10^4).^{1}H NMR (400 MHz, CDCl3): δ 8.94 (s, 1H, 5-H), 8.88 (s, 1H, 20-H), 5.74-5.77 (m, 1H, 3^1-H), 5.10-5.26 (m, 2H, 13^1-CH_2), 4.34-4.38 (m, 1H, 8-H), 4.28-4.32 (m, 1H, 7-H), 3.73 (s, 6H, $COOCH_3$ + 12-CH_3), 3.66 (m, 2H, 17-CH_2), 3.50-3.55 (m, 2H, 3^1-OCH_2), 3.36/3.34 (s, 3H, 2-CH_3), 3.08 (s, 3H, 18-CH_3), 2.81 (t, 2H,17^1-CH_2 J= 7.2 Hz), 2.37-2.41 (m, 1H, 8^1-H), 1.72-1.78 (m, 1H, 8^1-H), 2.10/2.07 (d, 3H, 3^1-CH3, J= 6.4 Hz), 1.67-1.75 (m, 5H, 7-CH_3 + 3^1-OCH_2CH_2), 1.21-1.26 (m, 6H, 3^1-O*$CH_2CH_2CH_2CH_2CH_2$*CH_3), 1.03-1.12 (m, 3H, 3^1-$OCH_2CH_2CH_2CH_2CH_2$*CH_3*), 0.74-0.80 (m, 3H, 8^1-CH_3), -0.34 (br s, 1H, NH), -1.52 (br s, 1H, NH). ^{13}C NMR (100 MHz, $CDCl_3$): δ 195.73, 195.70, 173.3, 173.2,172.9, 165.36, 165.32, 156.16, 156.14, 146.2, 143.59, 143.55, 140.2, 140.1, 139.83, 139.82, 139.7, 139.0, 138.13, 138.12, 137.27, 137.22, 136.21, 136.28, 134.62, 134.60, 123.59, 123.58, 116.33,116.30, 97.7, 96.3, 96.2, 94.96, 94.87, 72.6, 72.3, 69.7, 69.5, 57.7, 57.6,

51.7, 49.2, 49.1, 48.59, 48.58, 35.7, 31.7, 31.6, 30.17, 30.12, 27.4, 26.2, 26.0, 24.4, 24.1, 23.3, 23.0, 22.6, 22.5, 22.1, 16.1, 16.1, 14.0, 13.96, 11.4, 11.2, 11.0, 10.9; EIMS (*m/z*): 731.4 (M+H); Elemental Anal. Calcd for $C_{40}H_{49}BrN_4O_4$: C, 65.84; H, 6.77; N, 7.68. Found: C, 66.07; H, 6.93; N, 7.39.

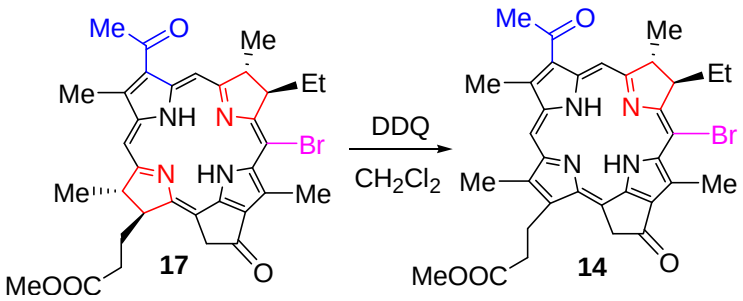


Compound 17: ***NBS as a brominating agent:*** A mixture of starting material **12** (50 mg, 0.088 mmol, 1.0 eq) and NBS (17 mg, 0.097 mmol, 1.1 eq) in dry dichloromethane with a catalytic amount of pyridine (~100 ul) were stirred at room temperature under argon atmosphere. Progress of reaction was monitored by TLC. The organic layer was washed with water (1 x 100 ml) and dried with Na_2SO_4, filtered and the solvent was removed under pressure. The resulting crude product was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system delivered the bromo derivative **17**. This product was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield 45.0 mg, (80%); UV-vis λ_{max} (in CH_2Cl_2): 746 nm (ε 3.7 x 10^4).^{1}H NMR (400 MHz, CDCl3): 8.73 (1H, s,5-H), 8.24 (1H, s, 20-H), 4.99 (d, 1H, 13^1-CH_2), 4.79 (d, 1H, 13^2-CH_2), 4.18-4.19 (m,1H, 18-H), 4.15-4.16 (m, 1H, 7-H), 4.14 (1H, dt, 17-H), 4.03 (1H, dt, 8-H), 3.62 (6H, s, $COCH_3$ + 12 CH_3), 3.39 (3H, s, 2-CH_3), 3.11 (3H, s, $COCH_3$), 2.47–2.68 (2H, m, 17-CH_2CH_2), 2.26–2.30 (3H, m, 2H of 17-CH_2CH_2 1H of 8-CH), 2.15-2.17 (1H, 8-CH), 1.69 (3H, d, 7-CH_3), 1.59 (3H, d, 18-CH_3), 1.03 (3H, t, 8^1-CH_3); ^{13}C NMR (100 MHz, $CDCl_3$): δ 198.9, 195.7, 173.3, 171.9, 170.4, 162.5, 156.5, 145.8, 139.6, 137.3, 136.9, 134.9, 133.7, 131.3, 123.0,

109.5, 100.7, 97.9, 96.0, 56.9, 51.7, 50.8, 49.4, 48.9, 47.7, 33.2, 30.8, 29.8, 29.6, 27.2, 22.6, 15.7, 13.2, 11.1. EIMS (*m/z*): 645 (M+H). HRMS: Calcd. For $C_{34}H_{38}BrN_4O_4$ (M+H): 645.2076; Found: 645.2087.

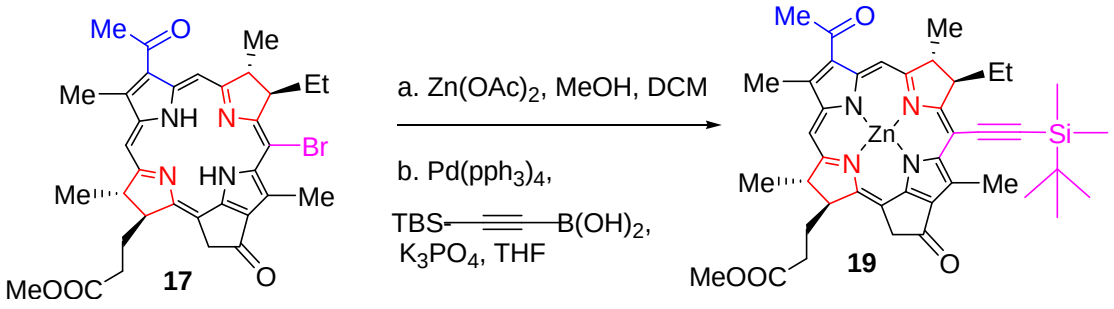


Compound 14 by $FeCl_3$ reaction: Compound **17** (15 mg, 0.023 mmol, 1.0 eq) was dissolved in dichloromethane (20 mL). To this mixture was added slowly a nitromethane solution of $FeCl_3$ $6H_2O$ (25 mg, 0.093 mmol, 4.0 eq). The resulting reaction mixture was stirred at room temperature for 15 minutes, quenched by addition of 10 mL of methanol, and washed with water (3 x 100 ml) three times. The organic layer was separated and dried over anhydrous Na_2SO_4 and solvent was removed under vacuum. The residue obtained was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system to give **14.** The product obtained was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield: 11.1 mg (75 %); (NMR matched exactly with Compound **14**).



Compound 14 by DDQ reaction: Compound **17** (15 mg, 0.023 mmol, 1.0 eq) was dissolved in dichloromethane (20 mL). To this mixture was added slowly a CH_2Cl_2 solution of DDQ (21 mg,

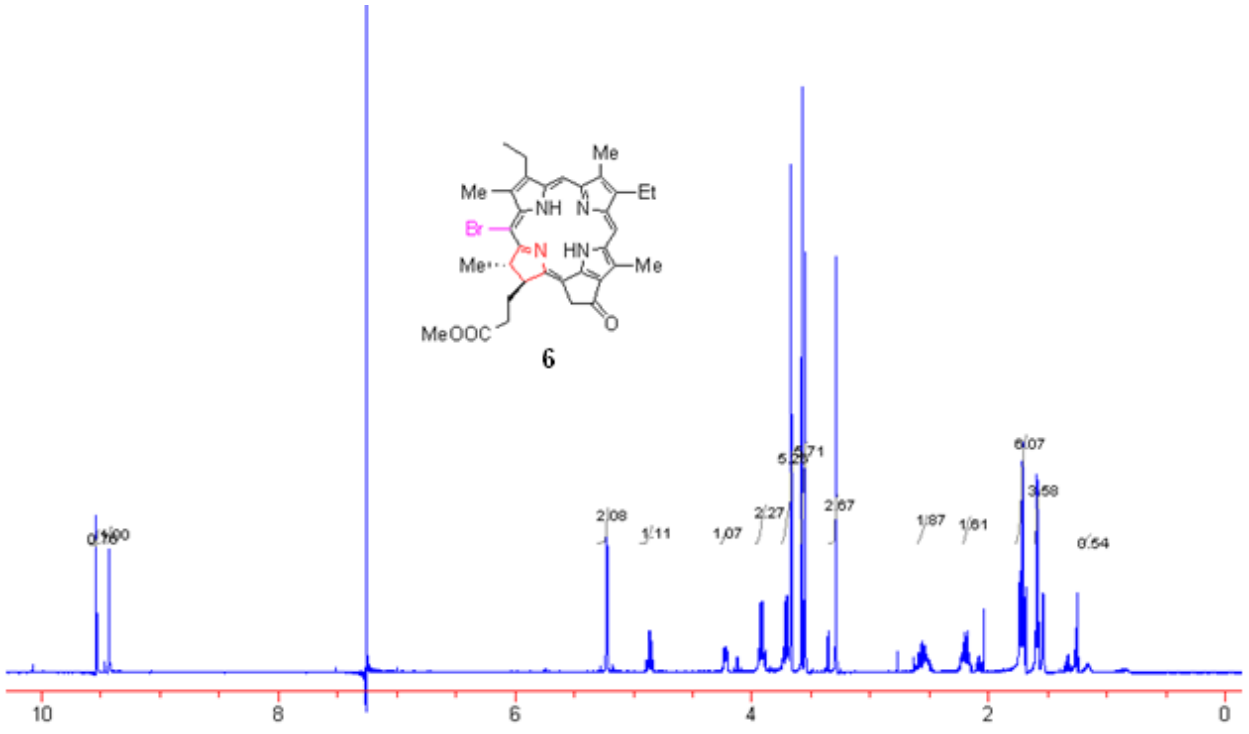
0.093 mmol, 4.0 eq). The resulting mixture was stirred at room temperature for 30 minutes and washed with water three times. The organic layer was separated and dried over anhydrous Na_2SO_4 and solvent was removed under vacuum. The residue obtained was purified by silica gel column chromatography (silica 60, 30 x 5) by eluting with ethyl acetate and hexane (ratio of 1:3) solvent mixture system to give **14.** The product obtained was further purified by precipitation with dichloromethane-hexane solvent mixture. Yield: 10.4 mg (70%); (NMR matched exactly with Compound **14**).

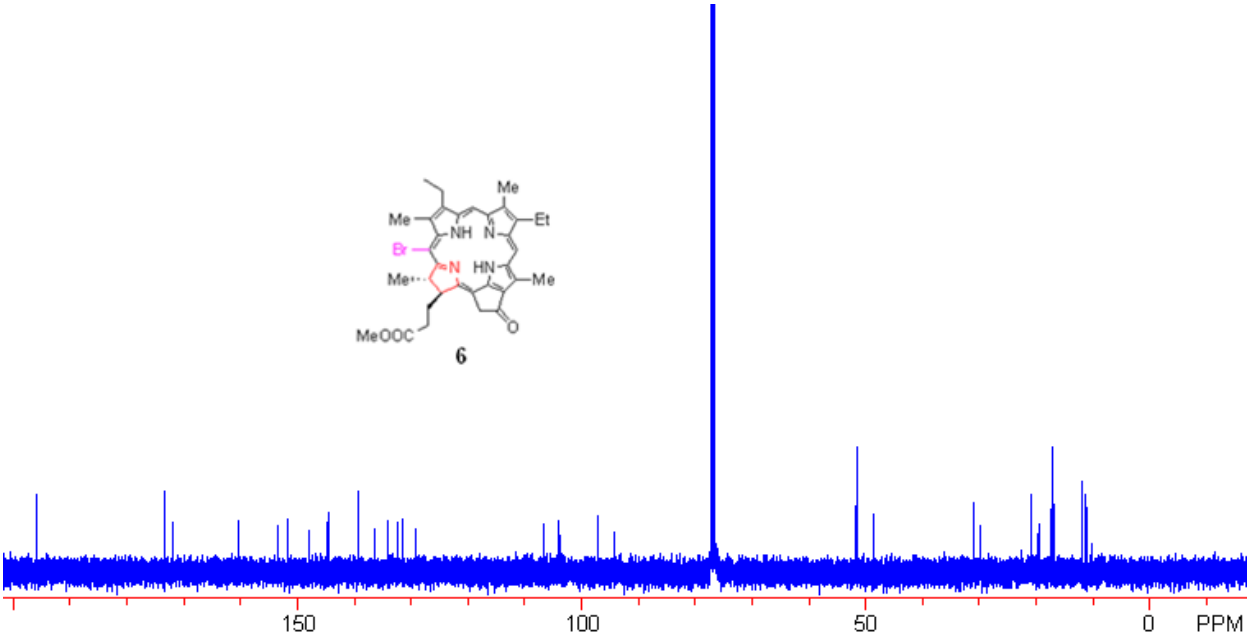


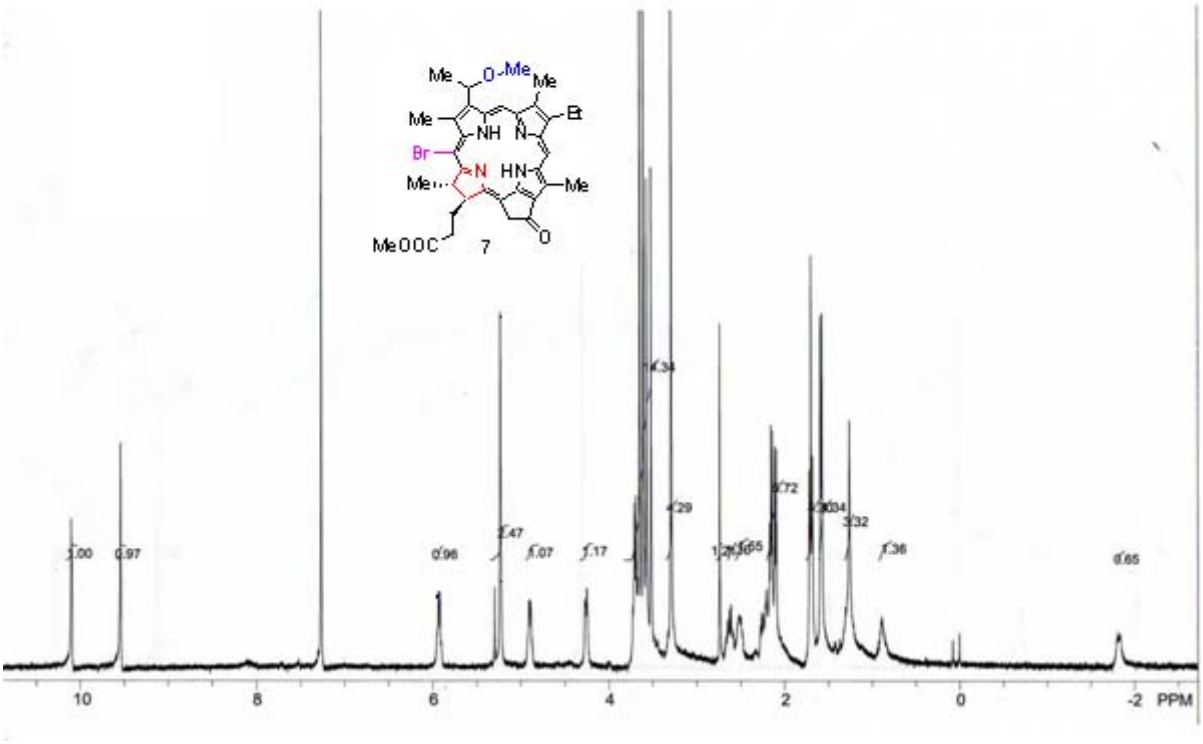
Compound 19: In a dry RBF (100 ml), 10-Bromo-bacteriopyropheophorbide **17** (50.0 mg, 0.062 mmol), was refluxed with $Zn(OAc)_2$ (219 mg, 0.62 mmol) in MeOH:DCM (4 ml: 16 ml) solvent mixture for 3hrs. The resulting solution was washed with sat. sodium bicarbonate solution (1 x 50 ml), followed by water (1 x 50 ml) and dried over Na_2SO_4. The crude obtained on evoparating the solvent was dried and used as such for the next step. The crude (10-bromo-Zn-bacteriopyropheophorbide, 1eq) was treated with boronic acid (82 mg, 0.31 mmol), were dissolved in THF (20 mL) under Ar atm. A dry nitrogen was bubbled through the stirring solution (30 min) and then tetrakis(triphenylphosphine) palladium (0) (8 mg, 10 mol%) and potassium phosphate (19 mg, 0.09 mmol) were added. The reaction mixture was then refluxed for 12 hrs. After cooling to room temperature, the solution was diluted with chloroform and washed with saturated sodium bicarbonate solution, water and finally with brine (each 1x 100 ml). On evaporating the organic solvent under reduced pressure gave a residue. The crude

mixture was chromatographed on a silica gel column using ethylacetate/hexane (1:3) solvent system as the mobile phase to deliver a green color compound **19**. Yield 19.0 mg, (40%); UV-vis λ_{max} (in CH_2Cl_2): 742 nm; 1H NMR (400 MHz, CDCl3): δ 9.55 (s, 1H, 5-H), 8.57 (s, 1H, 20-H), 4.92 (dd, 2H, J = 16.4, 37.4, 13^1-CH_2), .46-4.49 (m,1H, 17-H), 4.25-4.27 (m, 1H, 8-H), 3.68-3.74 (m, 2H, 18-H, 7-H), 3.60 (s, 3H, COOCH3), 3.40 (s, 3H, 12-CH3), 3.16 (s, 3H, 2-CH3), 2.98 (s, 3H, -COCH3), 2.43–2.53 (2H, m, 17-CH_2CH_2), 2.13–2.30 (3H, m, 2H of 17-CH_2CH_2 1H of 8-CH), 1.84 (3H, d, J= 7.2, 7-CH_3), 1.69 (3H, d, J= 7.0, 18-CH_3), 1.47 (s, 9H, $Si(Me)_3$),1.75 (s, 6H, $Si(Me)_2$), 0.44 (3H, t, 8^1-CH_3); ^{13}C NMR (100 MHz, $CDCl_3$): δ 196.5, 192.1, 173.3, 167.2, 161.0, 152.0, 148.5, 146.3, 143.7, 135.7, 135.1, 131.0, 114.6, 106.0, 105.7, 102.4, 102.2, 98.6, 95.0, 93.1, 51.6, 50.8, 48.4, 48.0, 32.9, 30.5, 29.5, 27.2, 26.4, 26.0, 23.6, 19.4, 17.4, 13.3, 12.7, 11.0, 10.9, -4.3, -10.2. EIMS (*m/z*): 768 (M+). HRMS: Calcd. For $C_{42}H_{50}N_4O_4SiZn$: 766.2893; Found: 766.2883.

Copies of ^{1}H- NMR (400 MHz) and ^{13}C-NMR (100 MHz) spectra



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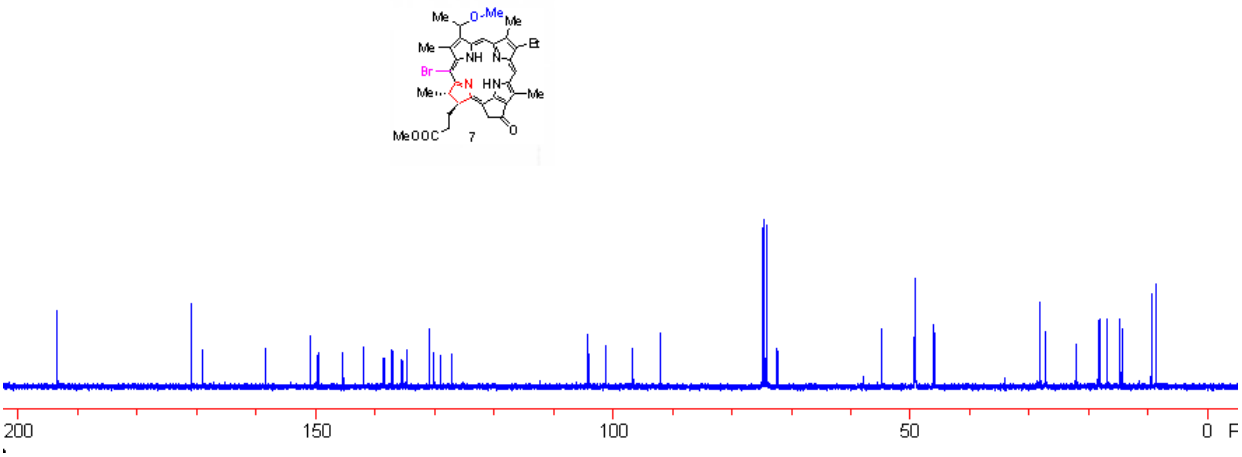
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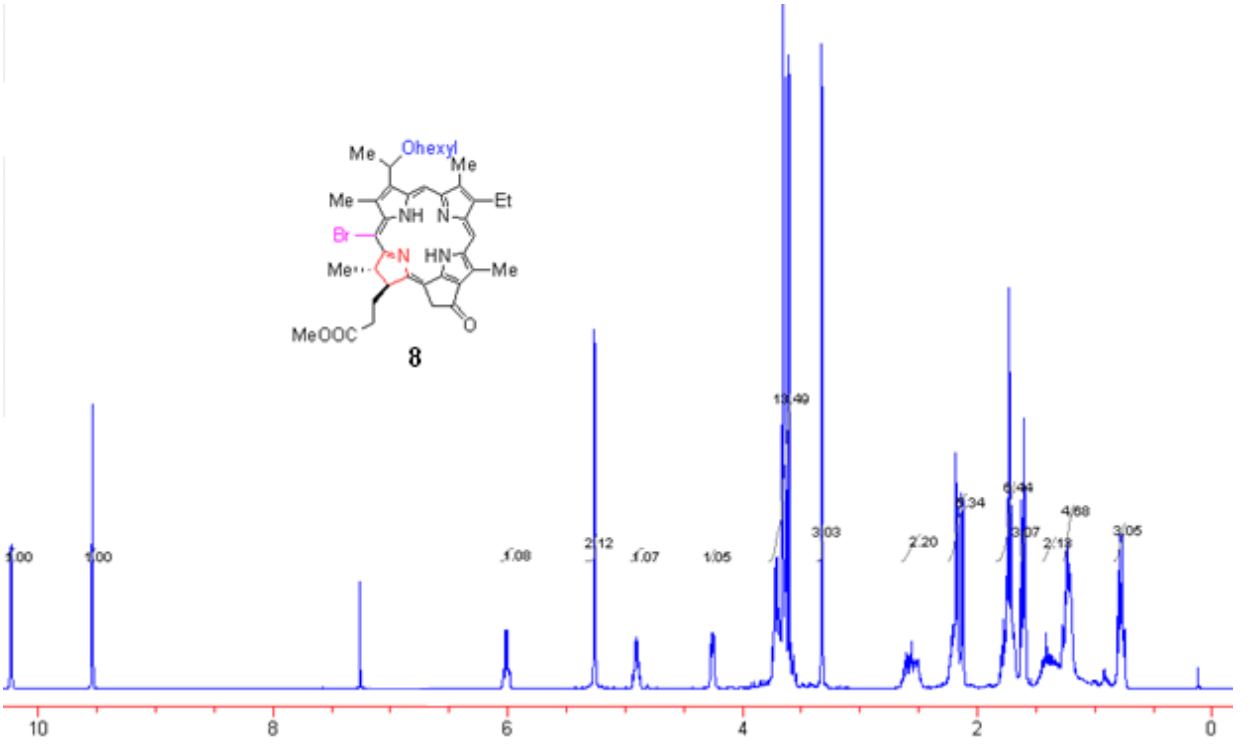
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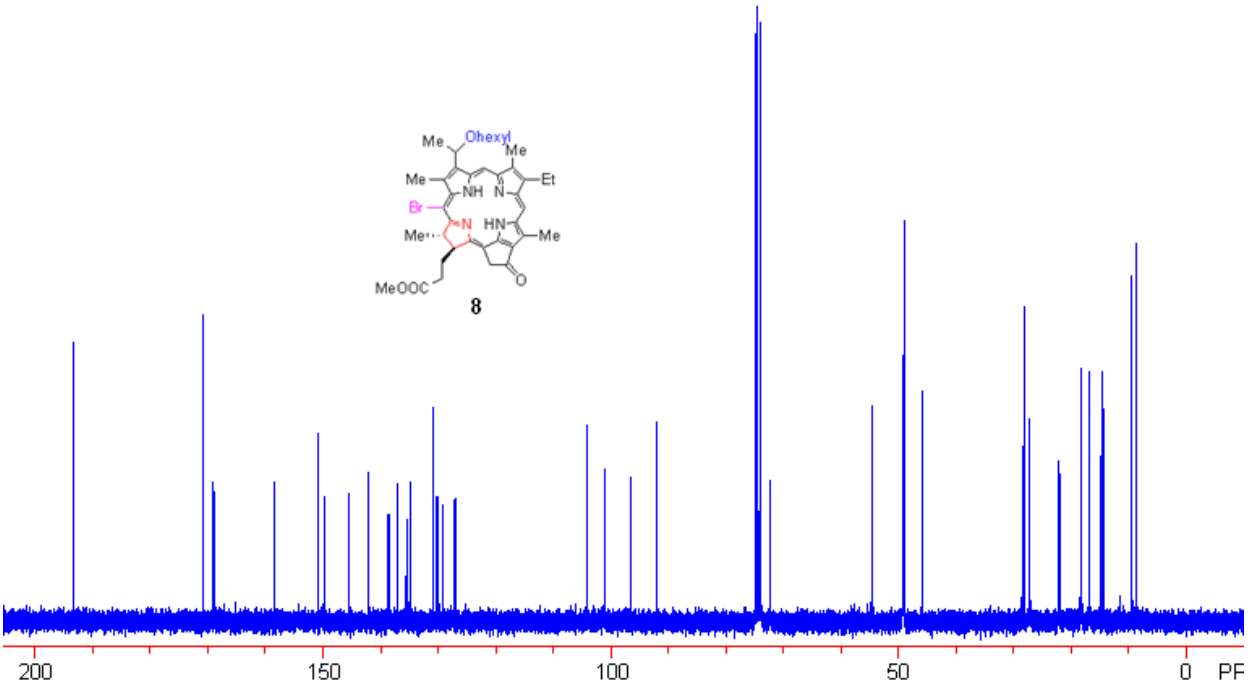
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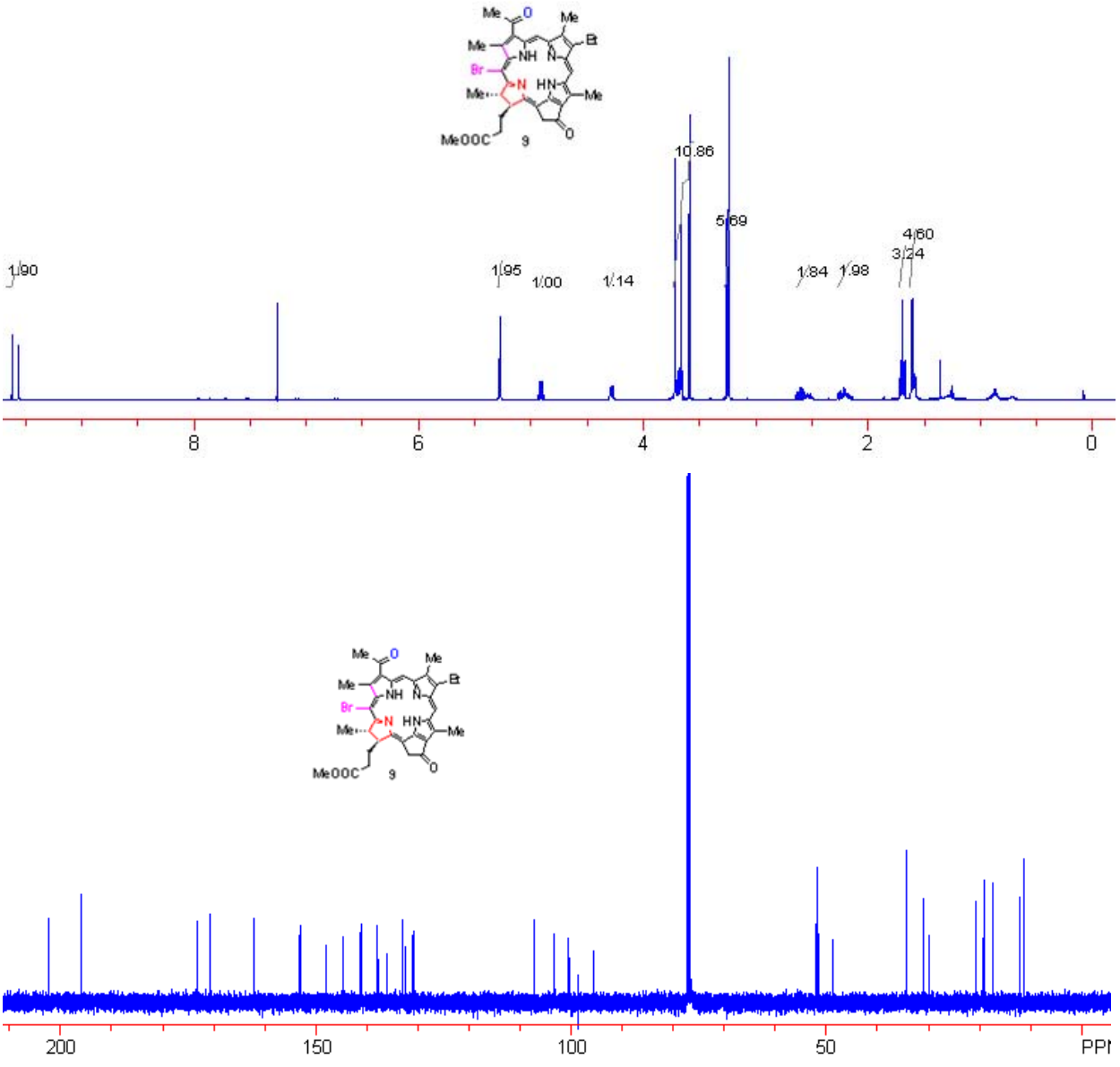
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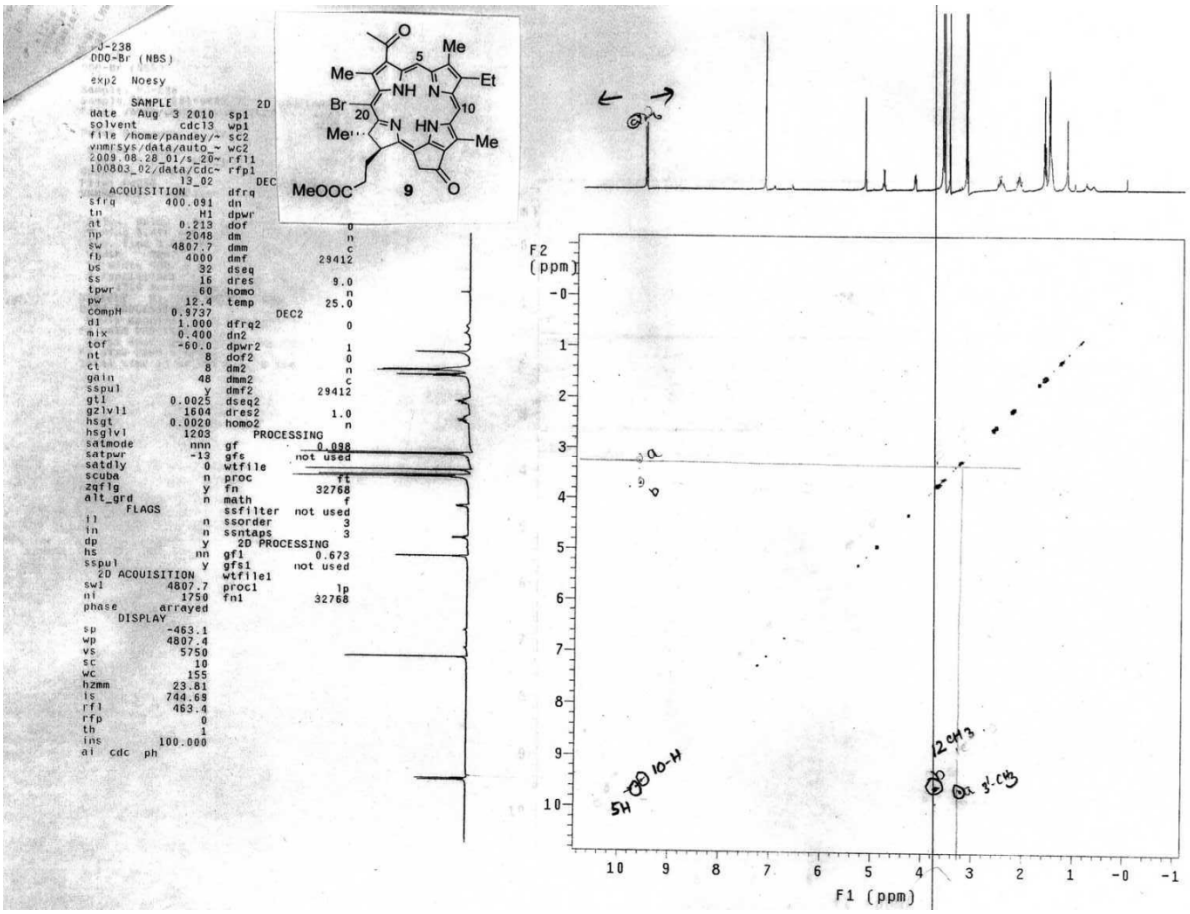
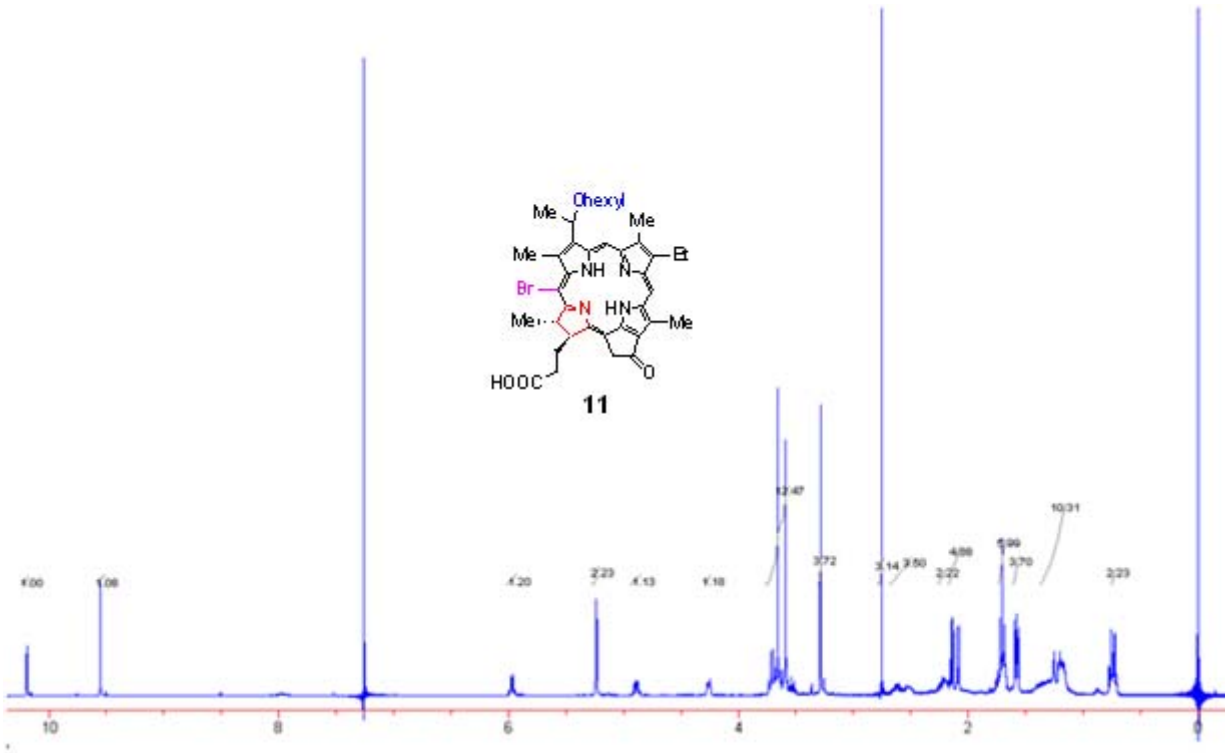
NOESY spectra of Compound **9**

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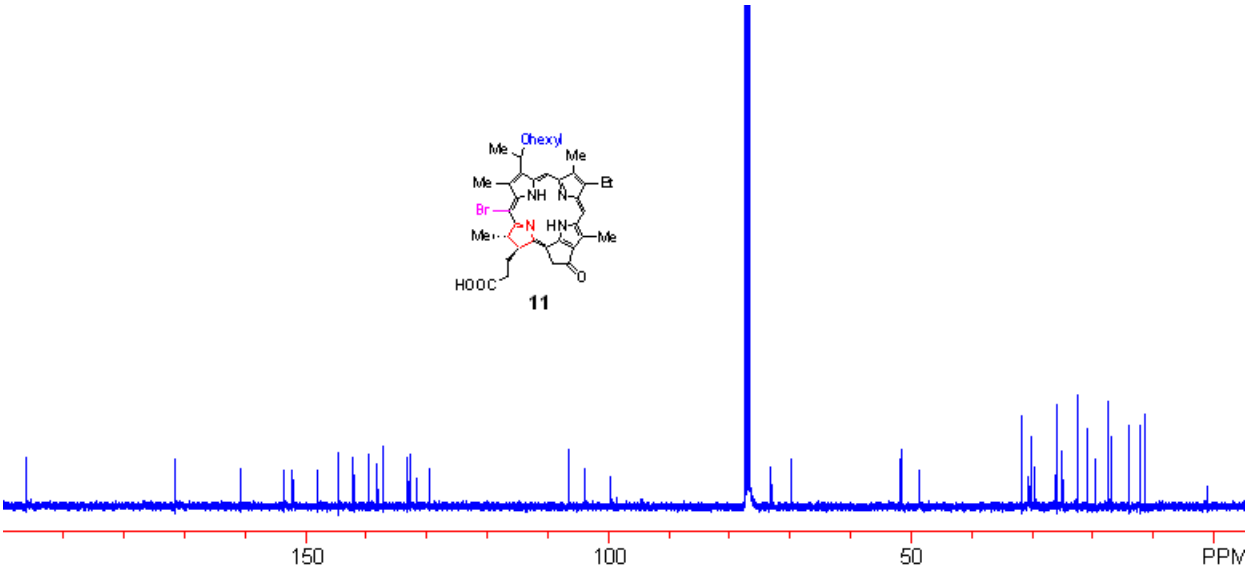
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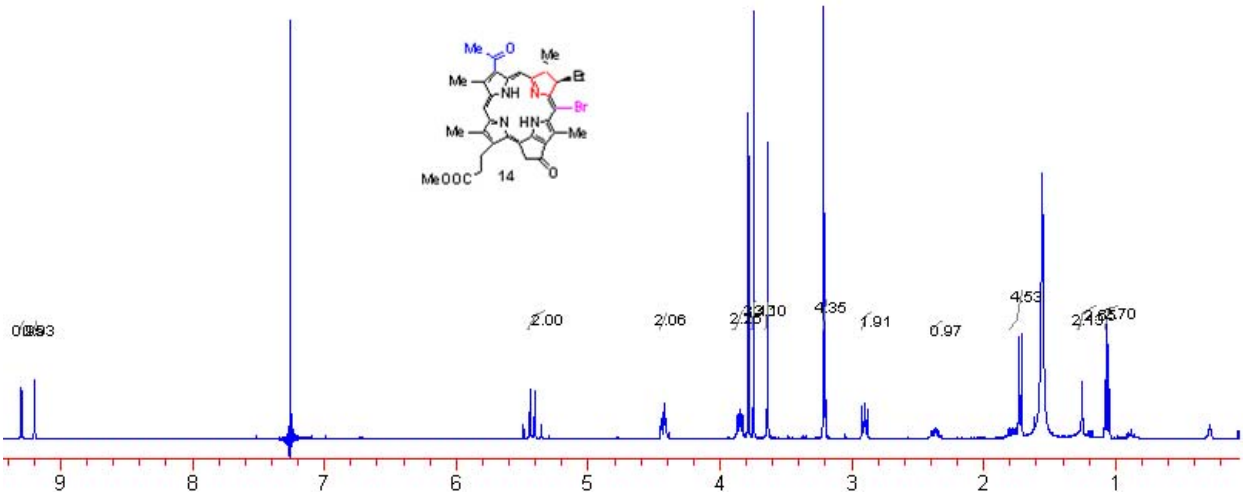
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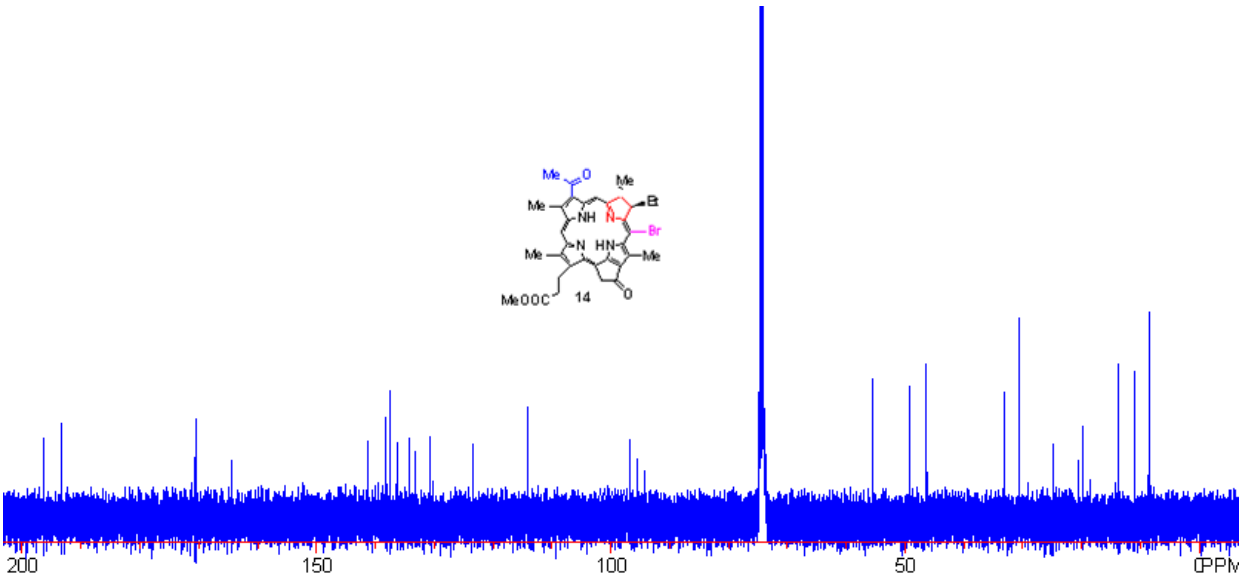
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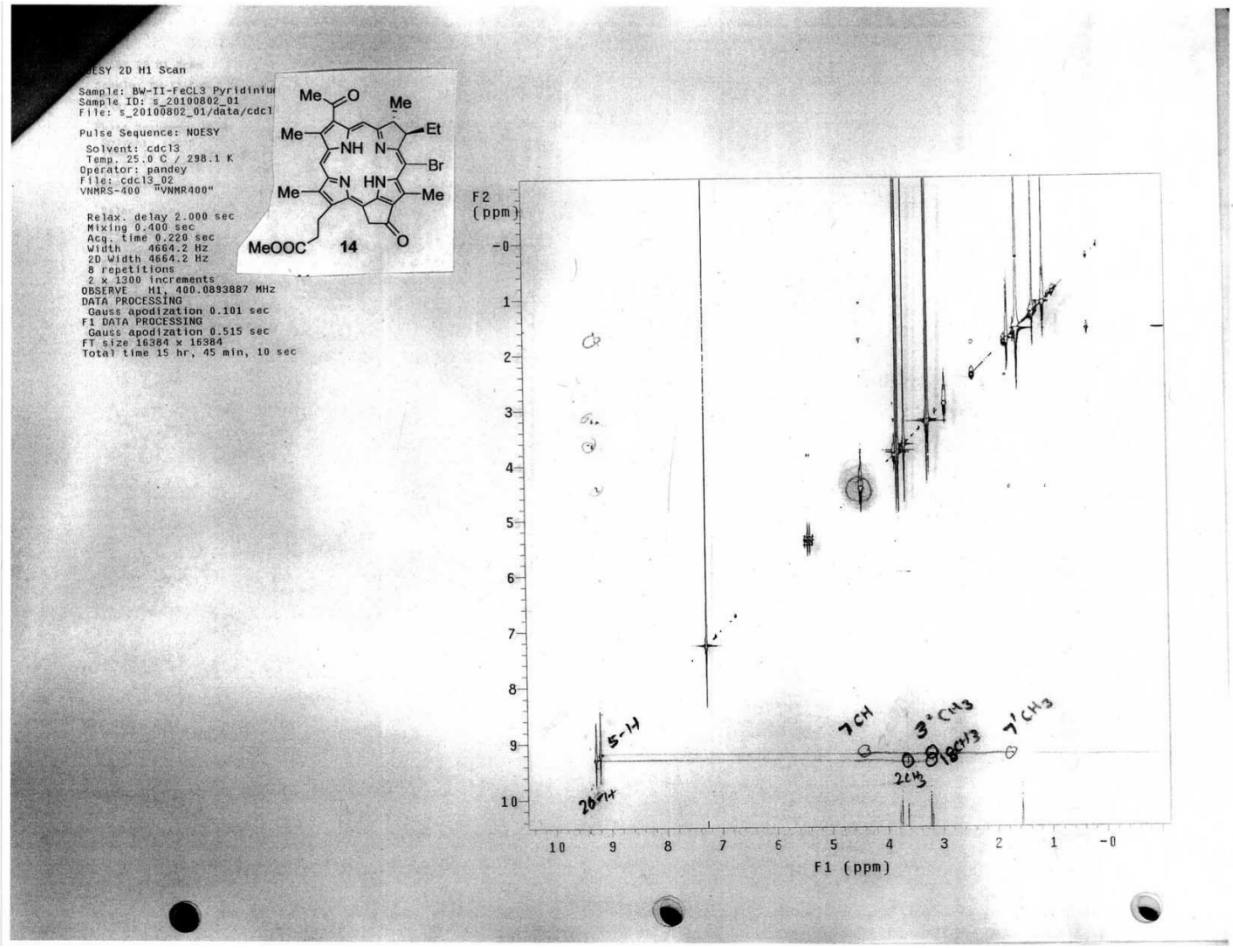
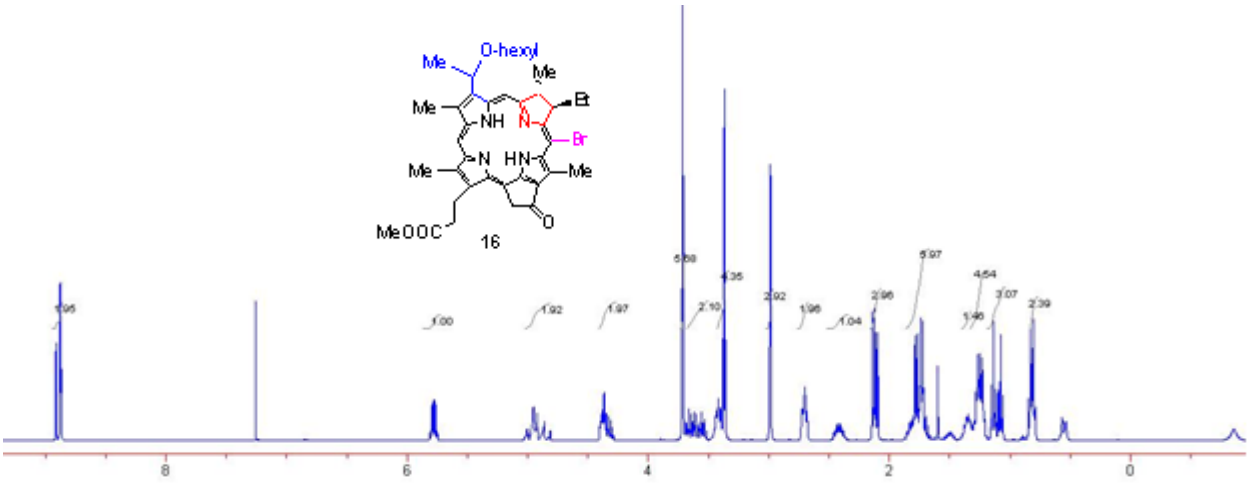
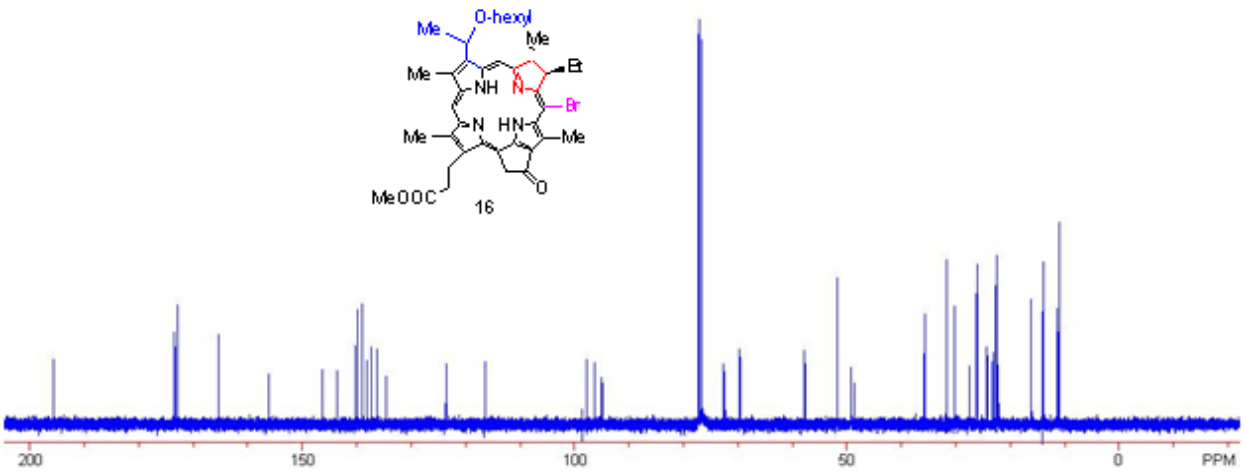
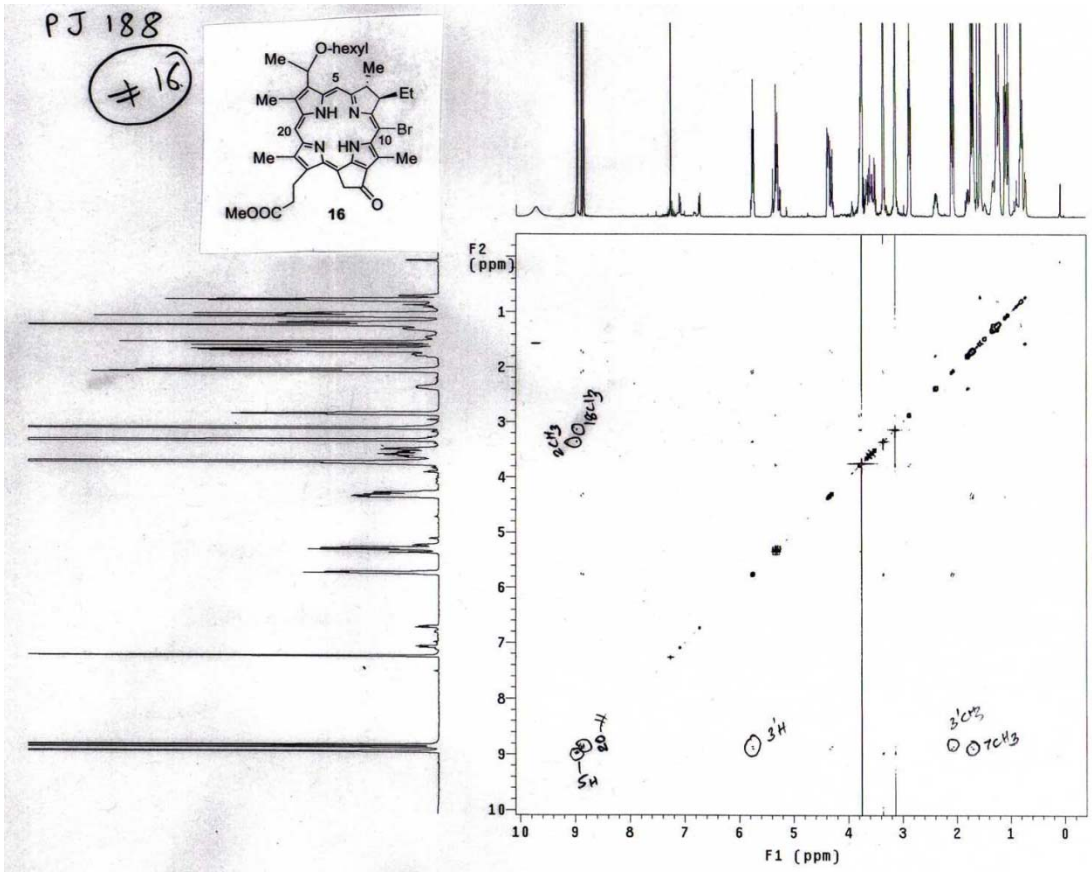
NOESY spectra of Compound **14**

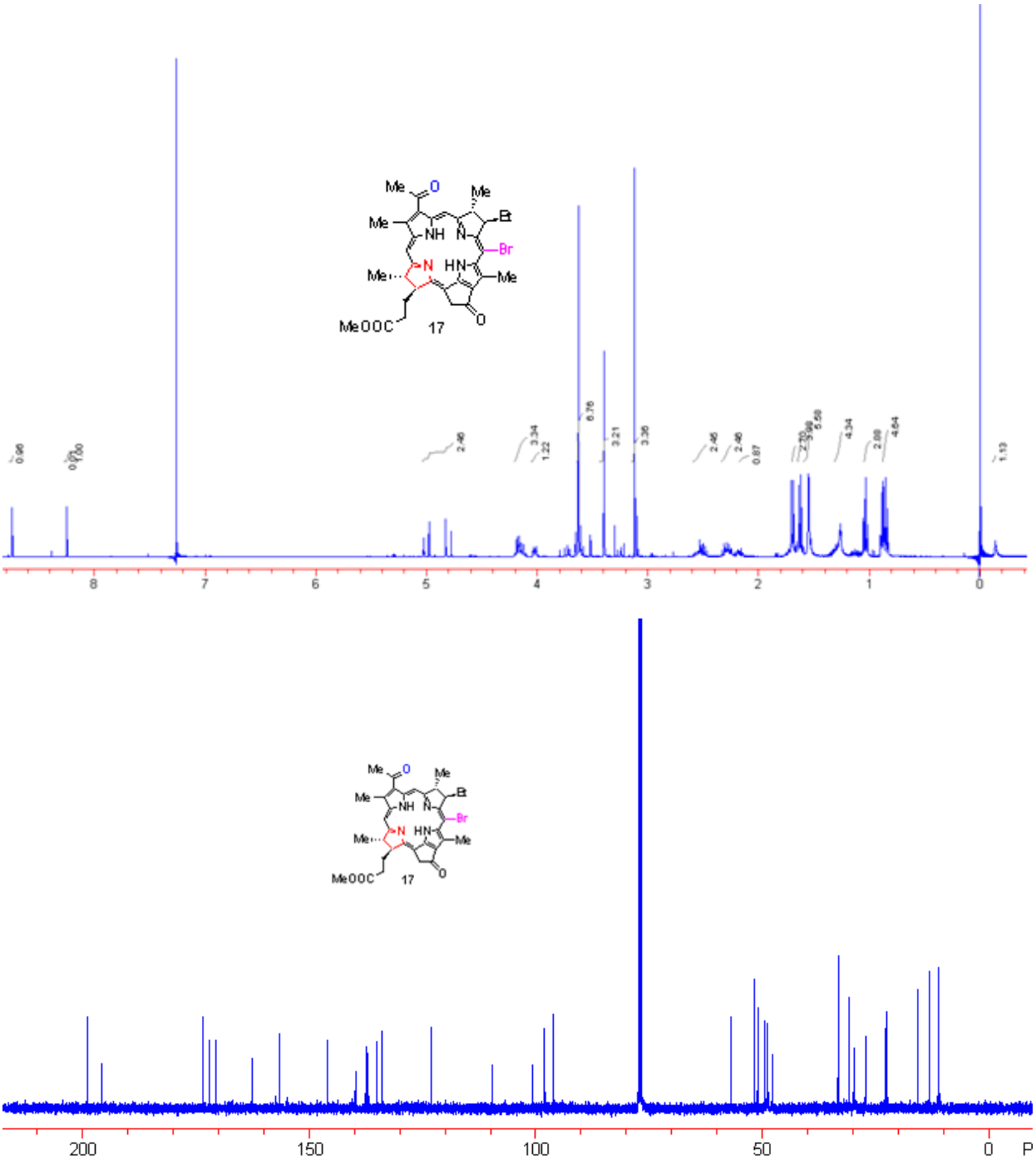






NOESY spectra of Compound **16**

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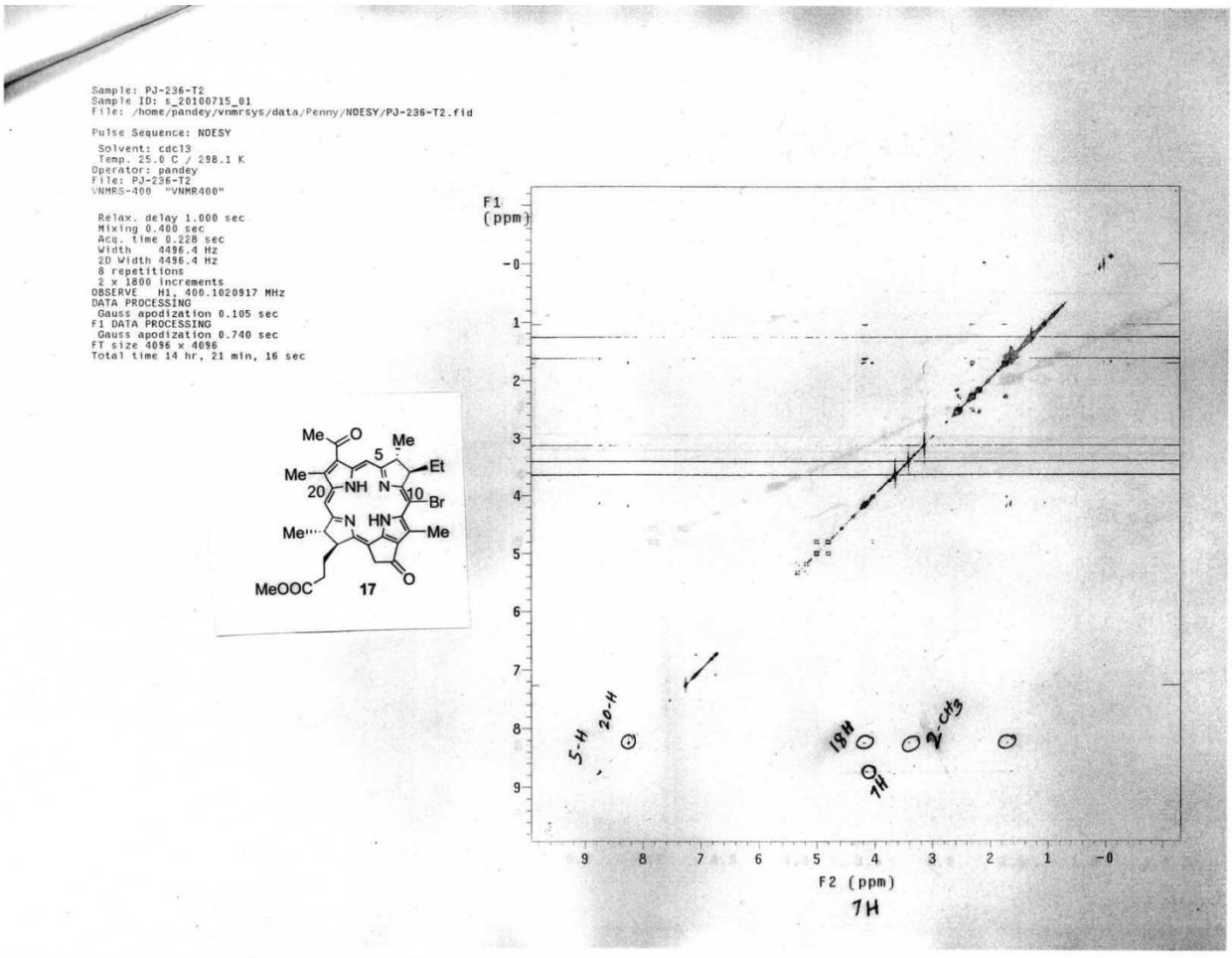
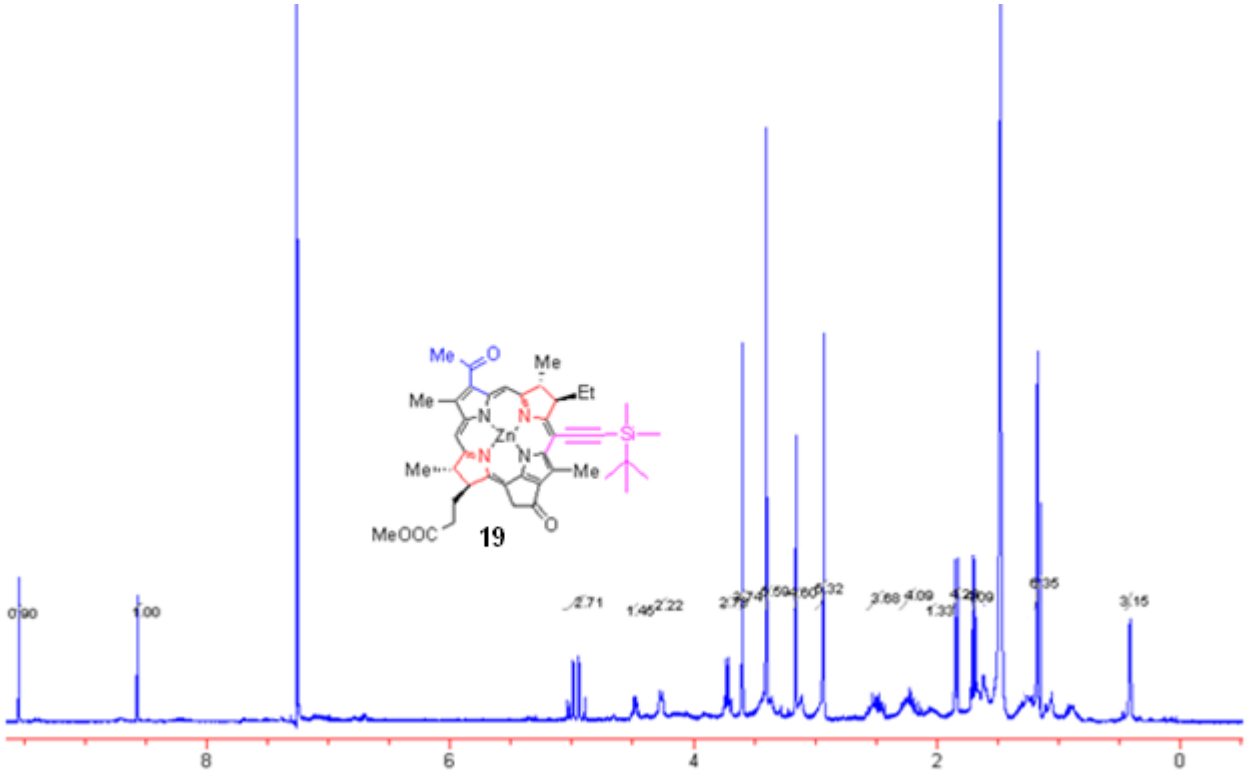
NOESY spectra of Compound **17**

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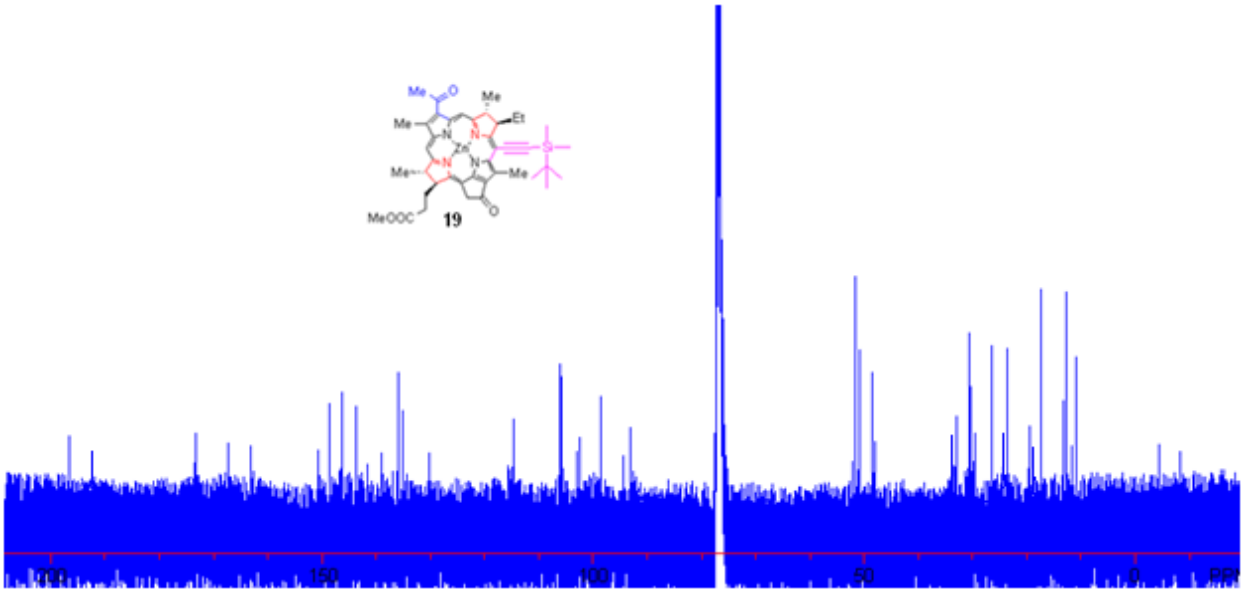
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