Electronic Supplementary Information #1

Revisiting Secondary Interactions in Neighboring Group Participation, Exemplified by Reactivity Changes of Iminylium Intermediates

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Experimental Sections

Synthesis of Compounds

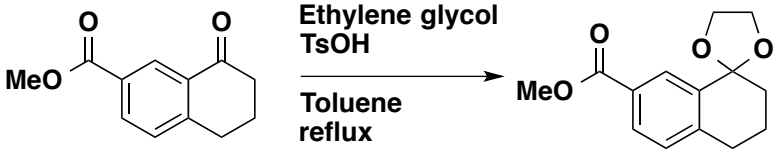
General Methods:

All reactions were carried out under argon atmosphere in oven-dried glasswares. All commercially available compounds and solvents were used as received unless otherwise mentioned. N-Bromosuccinimide (NBS) was recrystallized from hot water. NaH was washed with hexane before use and measured under argon atmosphere. Triethylamine was purified by distillation over CaH.

Open column chromatography was carried out using Kanto chemical silica gel (silica gel 60 N (100-210 μ m)). Melting points were determined with a Yanaco micro melting point apparatus without correction. ^{1}H- (400 MHz) and ^{13}C- (100 MHz) NMR spectra were recorded on a Bruker Avance 400. Chemical shifts were calibrated with tetramethylsilane and solvent as an internal standard or with the solvent peak, and are shown in ppm (δ) values, and coupling constants are shown in hertz (Hz). The following abbreviations are used: s = singlet, d = doublet, t = triplet, q = quartet, dd = double doublet, dt = double triplet, dq = double quartet, h = hextet, m = multiplet, brs = broad singlet, br = broad signal. Temperature was calibrated using methanol according to the reported method.[1] Electron spray ionization time-of-flight mass spectra (ESI-TOF MS) were recorded on a Bruker micrOTOF-05 to give high-resolution mass spectra (HRMS). The combustion analyses were carried out in the microanalytical laboratory of this department.

Synthesis of *peri*-Br compounds

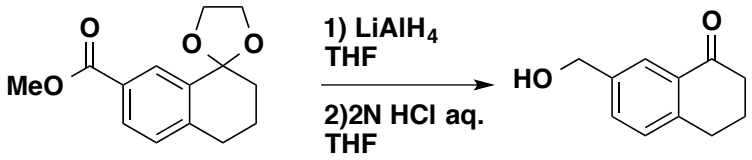
Synthesis of 3b



To a solution of 7-COOMe tetralone[2] (5.3652 g, 26.3 mmol) in toluene (150.0 mL) was added ethylene glycol (5.36 mL) and TsOH·H_2O (25.0 mg, 0.5%). The whole was heated to reflux for 12 hr with removing water with a dean-stark apparatus (azeotropic

conditions). The reaction mixture was cooled to room temperature and washed with saturated aqueous solution of sodium bicarbonate. Solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate = 10 : 1) to afford desired acetal (6.6357 g, quantitative., coloreless oil)

^{1}H NMR ($CDCl_3$): 8.184 (1H, d, J=2.0), 7.908 (1H, dd, J=7.6, 1.6), 7.188 (1H, d, J=8.0), 4.151-4.102 (2H, m), 3.935-3.904 (2H, m), 3.896 (3H, s), 2.878-2.864 (2H, m), 2.068-1.977 (4H, m). ^{13}C NMR ($CDCl_3$): 166.98, 143.87, 137.81, 129.30, 128.79, 128.23, 127.94, 106.73, 65.20, 51.97, 33.46, 29.26, 20.47.

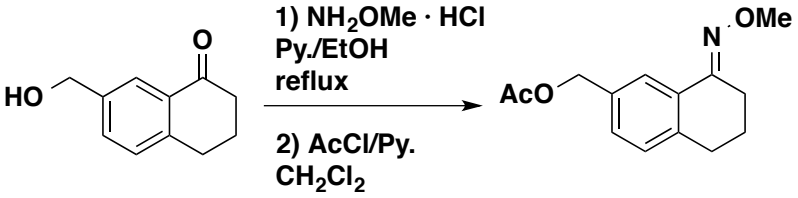


To a suspension of $LiAlH_4$ (4.0 g, 10.5 mmol) in THF (100 mL) was slowly added a solution of 7-COOMe tetralone acetal (6.3112 g, 25.2 mmol) in THF (50 mL) at 0 °C. The whole was stirred for 30 min at 0 °C and diluted with THF (150 mL). The reaction was quenched with sequential addition of water (4 mL), 15% aqueous solution of NaOH (4 mL) and water (12 mL). Anhydrous sodium sulfate was added and the whole was filtered with celite. The filtrate was concentrated to obtain the alcohol as a yellow oil.

The above oil was dissolved in THF (50.0 mL) and 2 M aqueous solution of HCl (25 mL) was added at 0 °C. The whole was stirred for 15 min at the same temperature and extracted with ethyl acetate. Combined organic phase was dried over anhydrous sodium sulfate, concentrated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 1 : 1) to afford 7-CH_2OH tetralone (3.9216 g, colorless oil, 87%, 2 steps).

^{1}H NMR ($CDCl_3$): 7.969 (1H, d, J=1.6), 7.498 (1H, dd, J=2.0, 8.0), 7.242 (1H, d, J=8.0), 4.680 (2H, d, J=4.4), 2.941 (2H, t, J=6.0), 2.631 (2H, t, J=6.4), 2.298-2.272 (1H, br), 2.157-2.081 (2H, m). ^{13}C NMR ($CDCl_3$): 198.54, 143.83, 139.58, 132.52, 132.19, 129.13, 125.44, 64.65, 39.13, 29.45, 23.27.

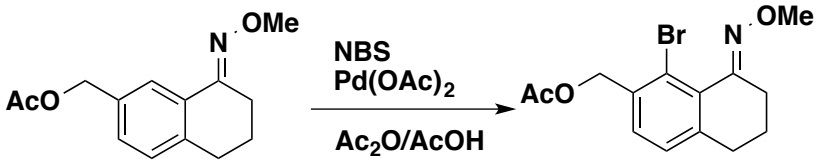
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}NaO_2^+$: 199.0723; Found: 199.0743.



7-CH_2OH tetralone (3.9000 g, 22.13 mmol) and O-methyl hydroxylamine hydrochloride (3.0145g, 36.09 mmol) were dissolved in ethanol (70 mL), and pyridine (7.0 mL) was added to the mixture. The whole was heated to reflux and stirred for 1 hr. The reaction mixture was concentrated and diluted with dichloromethane. The organic solution was sequentially washed with 2 M aqueous solution of HCl, brine and dried over anhydrous sodium sulfate. The solvent was evaporated to afford a yellow oil.

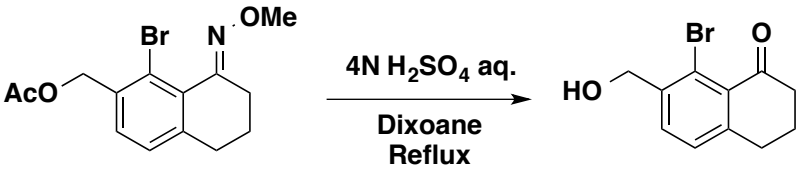
The oil was dissolved in dichloromethane (70 mL) and 7.0 mL of pyridine was added. Acetyl chloride (4.0 mL) was then added dropwise at 0 °C. The whole was stirred for 5 min and washed with water, brine, dried over sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 8 : 1) to afford 7-CH_2OAc tetalone methyl oxime (5.3539 g, yellow oil, 98%, 2 steps).

^1H NMR ($CDCl_3$): 7.991 (1H, d, J=1.6), 7.263 (1H, d, J= 2.0), 7.157 (1H, d, J=8.0), 5.102 (2H, s), 4.022 (3H, s), 2.773-2.731 (4H, m), 2.119 (3H, s), 1.890-1.826 (2H, m).^{13}C NMR ($CDCl_3$): 170.89, 153.68, 139.60, 133.99, 130.93, 128.95, 128.89, 124.23, 66.24, 62.02, 29.57, 24.15, 21.35, 21.03. HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{17}NNaO_3^+$: 270.1101; Found: 270.1105.

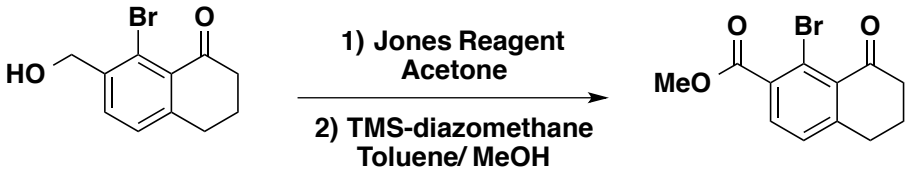


To a solution 7-CH_2OAc tetalone methyl oxime (3.3298 g, 13.46 mmol) in acetic acid (65.0 mL) and acetic anhydride (3.0 mL) were added NBS (2.6352 g, 14.81 mmol) and palladium diacetate (241.8mg, 1.08 mmol).[3] The solution was heated to 80 °C for 1 hr, and the acetic acid was removed by azeotropic distillation with toluene under reduced pressure. The resultant suspension was filtered through celite and the residue was washed with ethyl acetate. The solution was concentrated and purified with column chromatography (n-hexane : ethyl acetate = 15 : 1) to afford the 7-CH_2OAc-8-Br tetalone methyl oxime (yellow oil, 2.7221g, 62%).

^{1}H NMR ($CDCl_3$): 7.263 (1H, d, J=8.0), 7.095 (1H, d, J=7.6), 5.232 (2H, s), 4.031 (3H, s), 2.771 (2H, t, J=6.8), 2.608 (2H, t, J=6.0), 2.136 (3H, s), 1.774-1.709 (2H, m).
^{13}C NMR ($CDCl_3$): 170.80, 153.43, 143.93, 135.50, 132.10, 129.32, 126.79, 121.67, 67.02, 62.35, 30.88, 24.88, 21.14, 21.09.
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{16}BrNNaO_3^+$: 348.0206; Found 348.0185.



7-CH_2OAc-8-Br tetalone methyl oxime (2.7221 g, 8.35 mmol) was dissolved in dioxane at room temperature. 4 M sulfuric acid was added and stirred for 30 min. The whole was heated to reflux for 90 min and the solution was allowed to cool to room temperature. The whole was neutralized with 10% aqueous solution of NaOH. The whole was extracted with ethyl acetate, and combined organic phase was dried over anhydrous sodium sulfate. Solvent was evaporated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 2 : 1) to afford 7-CH_2OH-8-Br tetalone (1.4627g, 68%, colorless oil).
^{1}H NMR ($CDCl_3$): 7.585 (1H, d, J=7.6), 7.258 (1H, d, J=8.0) 4.830 (2H, s), 2.990 (2H, t, J=6.0), 2.738 (2H, t, J=6.8), 2.293 (1H, brs), 2.156-2.107 (2H, m).
^{13}C NMR ($CDCl_3$): 197.29, 146.15, 140.49, 132.02, 131.68, 128.09, 121.73, 65.43, 40.20, 30.64, 25.55. HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{11}BrNaO_2^+$, 276.9835. Found: 276.9995.



7-CH_2OH-8-Br tetalone (1.4000 g, 5.49 mmol) was dissolved in acetone (25.0 mL) and cooled to 0 °C. Jones reagent (2.67 M, 5.5 mL) was added dropwise, and the whole was stirred for 30 min at 0 °C. The solution was allowed to warm to room temperature and stirred for 1 hr. The reaction was quenched with 1.2 mL of isopropanol and the whole was stirred for 15 min. The solution was dispersed between water and dichloromethane.

The organic phase was washed with brine and dried over anhydrous sodium sulfate. The whole was concentrated to afford an off-white powder.

The powder was dissolved in a mixed solution of methanol and toluene (1:9, 30 mL). TMS-diazomethane (2 M in Et_2O, 2.8 mL) was added dropwise at 0 °C. The whole was stirred until gas generation stopped, and a minimum amount of acetic acid was added to stop the reaction. The whole was evaporated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 2 : 1) to afford the 7-COOMe-8-Br tetralone (1.4929 g, white solid, 96%).

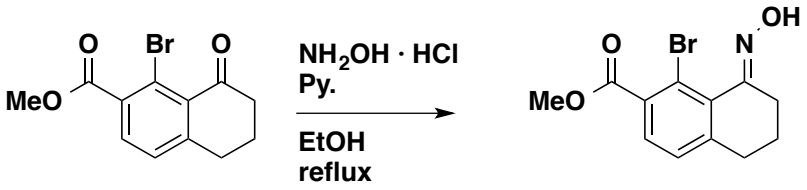
^{1}H NMR ($CDCl_3$): 7.503 (1H, d, J=8.0), 7.250 (1H, d, J=8.0), 3.935 (3H, s), 2.981 (2H, t, J=6.0), 2.726 (2H, t, J=6.4), 2.143-2.085 (2H, m).

^{13}C NMR ($CDCl_3$): 196.55, 167.79, 148.86, 136.08, 132.50, 132.05, 127.95, 119.54, 52.74, 39.98, 30.78, 22.24.

Anal. Calcd. for $C_{12}H_{11}BrO_3$: C 50.91, H 3.92, N 0.00; Found C 50.62, H 3.97, N 0.00.

Mp.: 56.5-57.0 ºC (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{11}BrNaO_3^+$: 304.9784; Found: 304.9784.



7-COOMe-8-Br tetralone (576.1 mg, 2.04 mmol) and hydroxyl ammonium chloride (282.8 mg, 4.08 mmol) were dissolved in ethanol (5.0 mL), and pyridine (0.4 mL) was added to the mixture. The whole was heated to reflux for 1 hr and the solvent was evaporated. The residue was diluted with ethyl acetate and washed with 2 M HCl and brine. The organic layer was dried over Na_2SO_4 and concentrated in vacuo. The residue was purified with column chromatography (n-hexane : ethyl acetate = 2 :1) to afford 7-COOMe-8-Br tetralone oxime (583.4 mg, white solid, 96%).

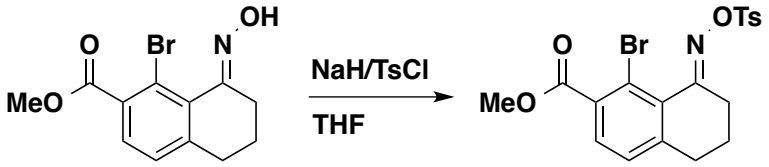
^{1}H NMR ($CDCl_3$): 9.162 (1H, brs), 7.433 (1H, d, J=8.0), 7.177 (1H, d, J=7.6), 3.953 (3H, s), 2.902 (2H, t, J=6.8), 2.669 (2H, t, J=6.0), 1.841-1.776 (2H, m).

^{13}C NMR ($CDCl_3$): 168.06, 154.59, 146.40, 135.12, 132.54, 129.26, 126.72, 118.11, 52.62, 31.03, 24.33, 20.77.

Anal. Calcd. for $C_{12}H_{12}BrNO_3$: C 48.34, H 4.06, N 4.74; found C 48.64, H 4.22, N 4.69.

Mp.: 175.0-175.5 ºC (recrystallized from dichloromethane).

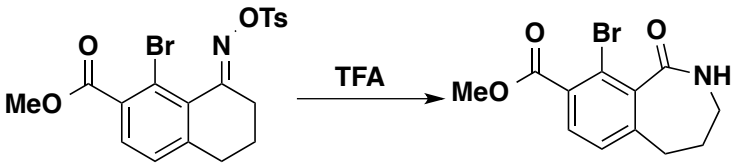
HRMS (ESI-TOF, $[M+H]^+$): Calcd. for $C_{12}H_{13}BrNO_3^+$: 298.0073; Found: 298.0067.



7-COOMe-8-Br tetralone oxime (579.1 mg, 1.94 mmol) was dissolved in THF (3 mL) and cooled to 0 °C. NaH (93.2 mg, 2.0 equiv.) was added portionwise at 0 °C and then the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (407.3 mg, 2.13 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The whole was diluted with Et_2O and quenched by slow addition of water. The organic phase was separated and the water phase was extracted with ethyl acetate. The combined organic layer was washed with brine, dried over anhydrous sodium sulfate and concentrated. The mixture was filtered and the residue was washed with water and hexane. The residue was purified with column chromatography (n-hexane : ethyl acetate = 2 :1) to afford the bromide oxime tosylate **3b** (780.8 mg, 89%, white solid).

^{1}H NMR ($CDCl_3$): 7.980 (2H, d, J=8.0), 7.465 (1H, d, J=8.0), 7.361 (2H, d, J=8.0), 7.182 (1H, d, J=8.0), 3.940 (3H, s), 2.954 (2H, t, J=6.8), 2.685 (2H, t, J=6.0), 2.457 (3H, s), 1.817-1.752 (2H, m). ^{13}C NMR ($CDCl_3$): 167.64, 161.11, 147.05, 145.11, 135.26, 132.82, 130.57, 130.41, 129.53, 129.42, 126.96, 119.03, 52.71, 30.66, 26.03, 21.73, 20.17.

Anal. Calcd. for $C_{19}H_{18}BrNO_5S$: C 50.45, H 4.01, N 3.10; Found: C 50.35, H 4.18, N 2.91. Dec.: 104.5 ºC (recrystallized from n-Hex/dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{19}H_{18}BrNNaO_5S^+$: 473.9981. Found: 473.9990.



To 7-COOMe-8-Br tosylated oxime **3b** (200.0 mg, 0.44 mmol) was added TFA (4.4 mL) at 0 °C and the whole was stirred at 20 °C for 1 hr. The whole was poured onto crushed ice and extracted with chloroform. The combined organic phase was washed with brine, dried over anhydrous sodium sulfate and concentrated. The residue was purified with

column chromatography to afford the desired alkyl migration product **4b** (128.1 mg, 96%, white solid).

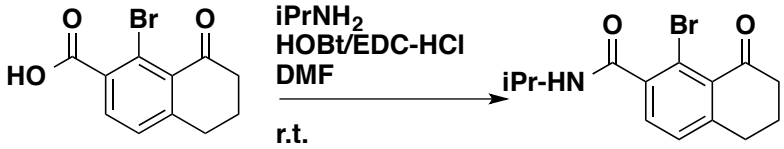
^{1}H NMR ($CDCl_3$): 7.727 (1H, d, J=7.7), 7.260 (1H, brs), 7.144 (1H, d, J=8.0), 3.920 (3H, s), 3.210 (1H, brs), 2.866-2.796 (3H, br), 2.154 (1H, brs), 1.742 (1H, brs).

^{13}C NMR ($CDCl_3$): 169.35, 166.36, 142.59, 135.14, 132.40, 131.47, 130.80, 126.79, 52.74, 38.94, 30.41, 29.87.

Anal. Calcd. For $C_{12}H_{12}BrNO_3$: C 48.34, H 4.06, N 4.74. Found: C 48.39, H 4.15, N 4.65. Mp.: 137.5-138.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+H]^+$): Calcd. for $C_{12}H_{13}BrNO_3^+$: 298.0073. Found: 298.0098.

Synthesis of 3c

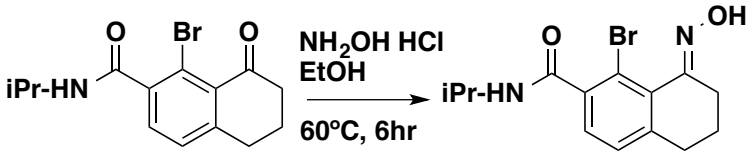


7-COOH-8-Br-tetralone (99.7 mg, 0.372 mmol) was dissolved in DMF (2.5 mL) and to this solution was added EDC-HCl (78.4 mg, 0.409 mmol) and HOBt (61.8 mg, 0.409 mmol) at 0ºC. The mixture was stirred at ambient temperature for 30 min, and isopropyl amine (100.0 mg, 4.55 equiv.) was added. The whole was stirred for 2 hr and the solution was diluted with 10mL of ethyl acetate. The whole was washed with water, 1 M aqueous solution of HCl and brine, and dried over anhydrous sodium sulfate. The concentrated residue was purified with column chromatography (n-hexane : ethyl acetate = 1 : 1) to afford 7-CONH^{i}Pr-8-Br tetralone (85.9 mg, 75%, white solid).

^{1}H NMR ($CDCl_3$): 7.417 (1H, d, J=8.0), 7.230 (1H, d, J=7.6) 5.611-5.594 (1H, br), 4.334-4.248 (1H, m) 2.956 (2H, t, J=6.0), 2.712 (2H, t, J=6.8), 2.128-2.064 (2H, m), 1.268 (6H, d, J=6.4). ^{13}C NMR ($CDCl_3$): 196.82, 167.17, 147.91, 140.40, 132.09, 131.69, 128.25, 118.25, 42.30, 39.99, 30.70, 22.56, 22.39.

Anal. Calcd. for $C_{14}H_{16}BrNO_2$: C 54.21, H 5.20, N 4.52. Found: C 54.17, H 5.28, N 4.49. Mp.: 149.5-151.0 ºC (recrystallized from ethyl acetate).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{16}BrNNaO_2^+$: 332.0257. Found: 332.0244.



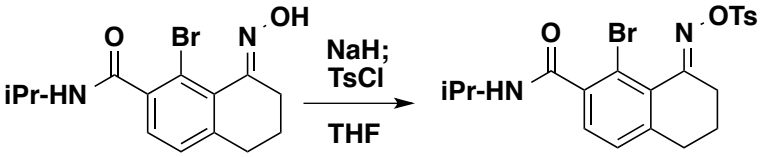
7-CONH^{i}Pr-8-Br tetralone (67.8 mg, 0.219 mmol) was dissolved in ethanol (2.0 mL) and $NH_2OH \cdot HCl$ (16.7 mg, 1.1 equiv.) was added to this solution. The mixture was stirred for 15 min and heated to reflux for 1 hr. An additional portion of $NH_2OH \cdot HCl$ (16.7 mg) was added and the whole was heated at reflux for further 30 min. The resulting solution was diluted with 20 mL of ethyl acetate and dried over Na_2SO_4. The solution was concentrated and recrystallized from ethanol to afford 7-CONH^{i}Pr-8-Br tetralone oxime (64.8 mg, 91%, white solid).

^{1}H NMR (Acetone-d_6): 10.546 (1H, s), 7.227-7.158 (3H, m), 4.227-4.141 (1H, m), 2.827-2.789 (2H, m), 2.653 (2H, t, J=6.0), 1.795-1.730 (2H, m), 1.248 (6H, d, J=6.4).

^{13}C NMR (Acetone-d_6): 167.15, 152.74, 144.01, 141.15, 132.39, 127.29, 126.58, 116.73, 41.34, 30.52, 23.96, 21.71, 21.08.

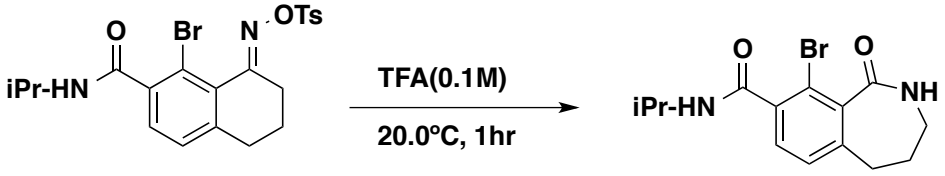
Anal. Calcd. for $C_{14}H_{17}BrN_2O_2 \cdot 0.1C_2H_5OH$: C 51.71, H 5.38, N 8.49. Found: C 51.94, H 5.51, N 8.10. Dec.: 205.5 ºC (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{14}H_{17}BrN_2NaO_2^+$: 347.0366. Found: 347.0346.



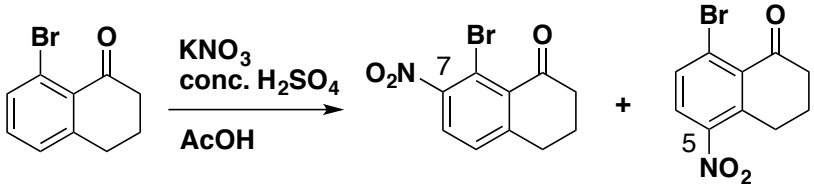
To a solution of 7-CONH^{i}Pr-8-Br tetralone oxime (49.2 mg, 0.151 mmol) in 1 mL of THF was added a suspension of NaH (24.0 mg, 6 eq.) in 0.5 mL of THF dropwise at 0 °C and the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (31.5 mg, 0.165 mmol) was added at 0 °C and the whole was stirred at 0 °C for 1hr. The whole was diluted with Et_2O and quenched by slow addition of water. The organic phase was separated and the water phase was extracted with ethyl acetate. The combined organic layer was washed with brine, dried over anhydrous sodium sulfate and concentrated. The mixture was filtered and the residue was washed with water and hexane. The residue was purified with column chromatography (n-hexane : ethyl acetate = 2 :1) to afford 7-CONH^{i}Pr-8-Br tetralone tosyl oxime **3c** (52.9 mg, 78%, white solid).

^{1}H NMR ($CDCl_3$): 7.902 (2H, d, J=8.4), 7.362 (2H, d, J=8.0), 7.265 (1H, d, J=7.6), 7.172 (1H, d, J=7.6), 5.595 (1H, d, J=7.6), 4.228-4.142 (1H, m) 2.901 (2H, t, J=6.8), 2.646 (2H, m, J=6.0) 2.429 (3H, s), 1.771-1.707 (2H, m), 1.240 (6H, d, J=6.8).
^{13}C NMR ($CDCl_3$): 167.03, 161.60, 145.99, 145.44, 140.40, 132.87, 129.58, 129.41, 129.10, 127.44, 120.26, 117.23, 42.13, 30.48, 26.11, 22.19, 21.41, 20.24.
Dec: 42 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{21}H_{23}BrN_2NaO_4S^+$: 501.0454. Found: 501.0456.



To **3c** (102.8 mg, 0.11 mmol) was added TFA (1.1 mL) at 0 °C. The whole was stirred at 20 °C for 1 hr and the whole was poured onto crushed ice. The reaction mixture was extracted with chloroform, and the organic layer was washed with brine, dried over sodium sulfate, and concentrated. The residue was purified with column chromatography to afford the desired alkyl migration product **4c** (72.5 mg, white solid, 92%).
^{1}H NMR ($CDCl_3$): 7.430 (1H, d, J=7.6), 7.163 (1H, d, J=7.6), 6.660 (1H, t, J=6.0), 5.810 (1H, d, J=8.0), 4.320-4.234 (1H, m), 3.188-2.769 (4H, br), 2.163-2.068 (1H, br), 1.716 (1H, brs), 1.240 (6H, br). ^{13}C NMR ($CDCl_3$): 169.91, 166.94, 140.40, 139.01, 136.22, 130.50, 127.76, 117.45, 42.33, 38.88, 30.23, 29.83, 22.54.
Mp.: 98.0-102.0 ºC (recrystallized from dichloromethane).
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{17}BrN_2NaO_2^+$: 347.0366. Found: 347.0356.

Synthesis of 3d and 3f



To potassium nitrate (0.75 g, 1.2 equiv.) was added concentrated sulfuric acid (7.0 mL) slowly at 0 °C. The whole was stirred for 30 min and cooled to -15 °C. A solution of 8-Br tetralone (1.50 g, 6.70 mmol) in acetic acid (7.0 mL) was added to the solution

dropwise. After addition, the reaction was quenched by slow addition of the solution onto crushed ice, and the solution was neutralized with 50% aqueous solution of NaOH. The mixture was extracted with CH_2Cl_2, and the organic phase was washed with brine. The combined organic layer was dried over anhydrous sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =4:1) to afford 7-nitro-8-Br tetralone (latter fractions, yellow solid, 0.741g, 41%) and 5-nitro-8-Br tetralone (earlier fractions, yellow solid, 0.7973g, 44%).

7-nitro-8-Br tetralone

^{1}H NMR ($CDCl_3$): 7.593 (1H, d, J=8.4), 7.348 (1H, d, J=8.0), 3.038 (2H, t, J=6.0), 2.764 (2H, t, J=6.4), 2.186-2.121 (2H, m). ^{13}C NMR ($CDCl_3$): 195.51, 149.47, 132.98, 128.86, 126.54, 113.12, 104.32, 39.73, 30.77, 22.08.

Anal. Calcd. for $C_{10}H_8BrNO_3$: C 44.47, H 2.99, N 5.19. Found: C 44.22, H 3.04, N 5.15.

Mp.: 118.0-120.5 °C (recrystallized from ethanol).

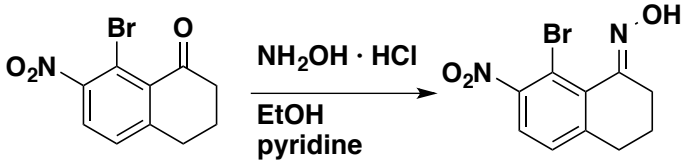
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_8BrNNaO_3^+$: 291.9580. Found: 291.9567.

5-nitro-8-Br tetralone

^{1}H NMR ($CDCl_3$): 7.793-7.730 (2H, m), 3.174 (2H, t, J=6.0), 2.769 (2H, t, J=6.4), 2.174-2.109 (2H, m). ^{13}C NMR ($CDCl_3$): 195.05, 148.63, 140.52, 134.45, 133.19, 127.50, 127.33, 39.09, 26.88, 21.70. Mp.: 104.5-107.5 °C (recrystallized from dichloromethane/ethanol). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for. $C_{10}H_8BrNNaO_3^+$:291.9580. Found: 291.9598.

Anal. Calcd. for $C_{10}H_8BrNO_3$: C 44.20, H 2.99, N 5.19. Found: C 44.27, H 3.09, N 5.15.

Synthesis of 3d



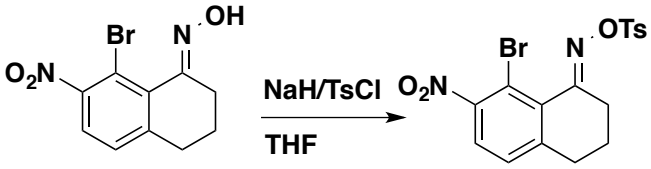
To a solution of 7-nitro-8-Br tetralone (1.5433 g, 5.71 mmol) in 18 mL of ethanol and 2.0 mL of pyridine was added hydroxylamine hydrochloride (800.0 mg, 11.5 mmol). The whole was stirred at room temperature for 12 hr. The whole was diluted with ethyl acetate and washed with water and brine. The concentrated residue was purified with

column chromatography (n-hexane : acetone = 4 : 1) to afford the desired oxime (1.1488 g, 71%, yellow solid).

^{1}H NMR (Acetone-d_6): 7.669 (1H, d, J=8.0), 7.473 (1H, d, J=8.0), 2.857 (2H, t, J=6.8), 2.777 (2H, t, J=6.0), 1.854-1.824 (2H, m).

^{13}C NMR (Acetone-d_6): 152.44, 152.34, 146.75, 134.02, 127.97, 122.86, 109.94, 30.57, 23.79, 20.66. Anal. Calcd. for $C_{10}H_9BrN_2O_3$: C 42.13, H 3.18, N 9.83. Found: C 42.30, H 3.30, N 9.63. Mp.: 213.0-215.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for. $C_{10}H_9BrN_2NaO_3^+$: 306.9689. Found: 306.9696.

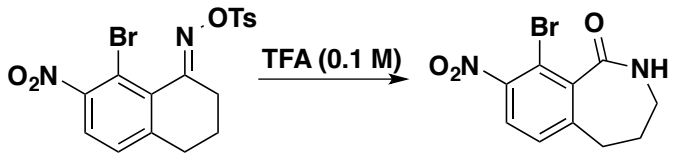


To a solution of 7-nitro-8-Br oxime (600.0 mg, 2.10 mmol) in 5.0 mL of THF were added tosyl chloride (421.3 mg, 2.21 mmol) and a suspension of NaH (101.0 mg, 2.0 eq.) in THF (2.0 mL). The whole was stirred for 5 min and diluted with Et_2O. Water was added to stop the reaction and the organic layer was separated. Aqueous phase was extracted with ethyl acetate. The combined organic phase was dried over sodium sulfate and evaporated. Recrystallization from dichloromethane/n-hexane afforded desired tosylated oxime **3d (**790.8 mg, 82%, yellow solid).

^{1}H NMR ($CDCl_3$): 7.926 (2H, d, J=8.4), 7.490 (1H, d, J=8.4), 7.337 (2H, d, J=8.0), 7.235 (1H, d, J=8.0), 2.936 (2H, t, J=7.2), 2.699 (2H, t, J=6.0), 2.426 (3H, s), 1.805-1.774 (2H, m). ^{13}C NMR ($CDCl_3$): 160.41, 151.92, 147.63, 145.43, 132.58, 131.31, 129.64, 129.43, 127.81, 125.00, 112.47, 30.62, 25.83, 21.74, 20.03.

Anal. Calcd. for $C_{17}H_{15}BrN_2O_5S$: C 46.48, H 3.44, N 6.38. Found: C 46.51, H 3.59, N 6.36. Dec.: 159.5 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{17}H_{15}BrN_2NaO_5S^+$: 460.9777. Found: 460.9798.



To 7-nitro-8-Br tetralone tosylated oxime **3d** (92.4 mg, 0.21 mmol) was added 2.1 mL of TFA at 0 °C. The whole was stirred at 20 °C for 1 hr and poured onto crushed ice. The whole was extracted with chloroform and the combined organic phase was washed with brine, dried over anhydrous sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : acetone = 1 : 1) to afford alkyl migration product **4d** (52.9 mg, white solid, 88%).

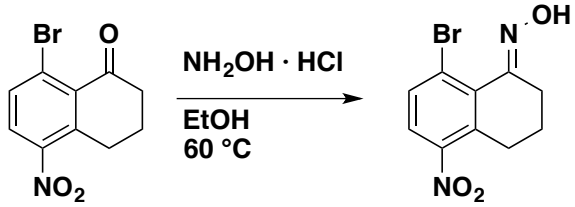
^{1}H NMR ($CDCl_3$): 7.688 (1H, d, J=8.0), 7.285-7.247 (2H, m), 3.247 (1H, brs), 2.874 (3H, br), 2.156 (1H, brs), 1.755 (1H, brs). ^{13}C NMR ($CDCl_3$): 168.75, 150.56, 142.93, 137.97, 128.31, 126.13, 112.89, 38.76, 30.38, 29.61.

Anal. Calcd. for $C_{10}H_9BrN_2O_3$: C 42.13, H 3.18, N 9.83. Found: C 42.21, H 3.25, N 9.43.

Mp.: 143.0-145.0 ºC (recrystallized from chloroform).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_9BrN_2NaO_3^+$: 306.9689. Found: 306.9695.

Synthesis of 3f

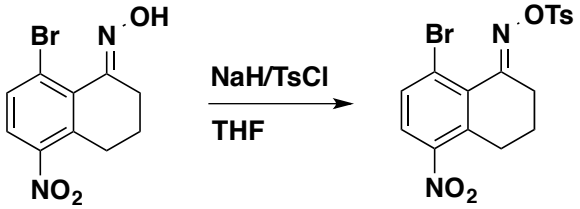


To a solution of 5-nitro-8-Br tetralone (916.8 mg, 3.40 mmol) in 14 mL of ethanol were added hydroxylamine hydrochloride (471.8 mg, 6.79 mmol) and pyridine (2.0 mL). The whole was heated to reflux and stirred for 1 hr. The solution was poured into water and the whole was stirred for 30 min. The resultant precipitate was filtered, and the solid was washed with water and n-hexane, and dried in vacuum to afford the desired oxime (1.1488 g, 82%, white solid).

^{1}H NMR ($CDCl_3$): 9.470 (1H, brs), 7.684 (1H, d, J=8.8), 7.620 (1H, d, J=8.8), 2.918-2.857 (4H, m), 1.835-1.770 (2H, m). ^{13}C NMR ($CDCl_3$): 153.70, 148.40, 138.34, 133.70, 133.31, 125.29, 124.25, 26.50, 24.24, 20.37.

Anal. Calcd. for $C_{10}H_9BrN_2O_3$: C 42.13, H 3.18, N 9.83. Found: C 42.49, H 3.25, N 9.83. Mp.: 153.5-155.5 °C (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+H]^+$): Calcd. for $C_{10}H_{10}BrN_2O_3^+$: 284.9869. Found: 284.9886.

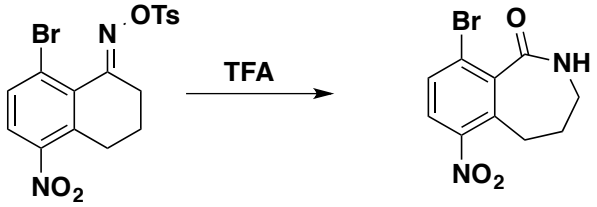


To a solution of 7-nitro-8-Br oxime (400.0 mg, 1.40 mmol) in 3.0 mL of THF were added tosyl chloride (280.8 mg, 1.47 mmol) and a suspension of NaH (67.3 mg, 2.0 eq.) in 1.0 mL of THF. The whole was stirred for 1 hr at room temperature and diluted with Et_2O. Water was added to stop the reaction and the organic layer was separated. Aqueous phase was extracted with ethyl acetate. The combined organic phase was dried over sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 3 : 2) to afford the desired tosylated oxime **3f** (486.0 mg, 79%, yellow solid).

^{1}H NMR ($CDCl_3$): 7.936 (2H, d, J=8.4), 7.664, (2H, s), 7.341 (2H, d, J=8.4), 2.948 (2H, t, J=7.2), 2.873 (2H, t, J=6.8), 2.437 (3H, s), 1.809-1.743 (2H, m). ^{13}C NMR ($CDCl_3$): 160.39, 148.31, 145.33, 139.04, 133.69, 132.59, 131.49, 129.58, 129.39, 126.34, 125.54, 26.27, 25.72, 21.71, 19.81.

Anal. Calcd. for $C_{17}H_{15}BrN_2O_5S$: C 46.48, H 3.44, N 6.38. Found: C 46.68, H 3.64, N 6.08. Dec.: 129.5 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{17}H_{15}BrN_2NaO_5S^+$: 460.9777. Found: 460.9799.

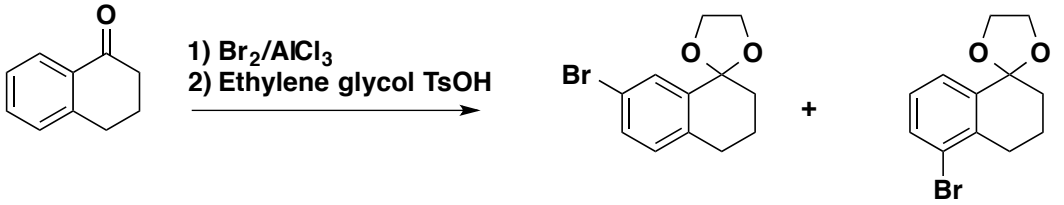


To 5-nitro-8-Br tetralone tosylated oxime **3f** (78.0 mg, 0.178 mmol) was added 1.8 mL of TFA at 0 °C. The whole was stirred at 20 °C for 8 hr and poured onto crushed ice. The whole was extracted with chloroform and the combined organic phase was washed with brine, dried over anhydrous sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 1 : 1) to afford alkyl migration product **4f** (46.6 mg, yellow solid, 92%).

^{1}H NMR ($CDCl_3$): 7.753-7.690 (2H, m), 7.303 (1H, brs), 3.309 (2H, brs), 2.985 (1H, brs), 2.715-2.636 (1H, br), 2.231 (1H, brs), 2.090-2.041 (1H, br). ^{13}C NMR ($CDCl_3$): 168.56, 148.49, 138.04, 133.57, 132.90, 126.21, 125.69, 39.04, 29.76, 25.69.

Mp.:124.0-126.0ºC (recrystallized from dichloromethane). Anal. Calcd. for $C_{10}H_9BrN_2O_3$: C 42.13, H 3.18, N 9.80. Found: C 42.19, H 3.41, N 9.51. HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_9BrN_2NaO_3^+$: 306.9689. Found: 306.9690.

Synthesis of 3e



To $AlCl_3$ (9.12 g, 2.5 equiv.) was added tetralone (4.0 g, 27.4 mmol) dropwise to afford a slurry mixture. The mixture was heated to 80 ºC and then bromine (4.8 g, 1.1 equiv.) was added for over 30 min using a dropping funnel. The resultant red solution was further stirred at 80 ºC for 30 min and the reaction mixture was poured onto crushed ice and acidified with concentrated hydrochloric acid. The mixture was extracted with Et_2O, and the combined organic phase was washed with saturated aqueous solution of $NaHCO_3$ and brine and dried over anhydrous sodium sulfate. The solvent was evaporated and the resultant orange oil was filtered over a pad of silica gel (Et_2O as eluent) to afford a mixture of 7-Br and 5-Br tetralone (7.39g, yellow oil, 7-Br-tetralone : 5-Br-tetralone = 56 : 44).

The above mixture was dissolved in 32.5 mL of toluene to afford a yellow solution. Ethylene glycol (7.5 mL) and $TsOH{\cdot}H_2O$ (31.2 mg, 0.5%) was added to this solution at ambient temperature. The whole was heated at reflux for 14 hr and water was removed with a dean-stark apparatus. The solution was cooled to room temperature and sequentially washed with water, saturated aqueous solution of sodium bicarbonate and brine. The organic layer was dried over Na_2SO_4, and concentrated product was used in the further step without purification (yellow oil, 5.9511g).

The mixture of 5-Br and 7-Br 1-acetal (3.2781g, calcd. 12.18 mmol) was dissolved in 50.0 mL of Et_2O and cooled to -78 ºC. A solution of *tert*-butylithium in pentane (16.0 mL, 1.57 M, 2.06 equiv.) was added dropwise and stirred for 5 min. DMF (3.5609 g, 4.0 equiv.) was added and the whole was stirred at -78 ºC for 30 min. The whole was warmed to 0 ºC and diluted with Et_2O (100 mL). The reaction was quenched with a minimum amount of water, and the mixture was washed with brine and dried over anhydrous sodium sulfate. The solvent was evaporated to afford a colorless oil.

The above mixture was dissolved in THF (50 mL) and 2 M aqueous solution of HCl (15.0 mL) was added at 0 ºC. The whole was stirred for 15 min and diluted with ethyl acetate. The organic phase was separated and the aqueous phase was extracted with ethyl acetate. A combined organic phase was washed with brine, dried over sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 9 : 1) to afford 5-CHO-tetralone (earlier fractions, 937.3 mg, colorless oil, 36% based on tetralone, 4 steps) and 7-CHO-tetralone (latter fractions, 971.2 mg, light yellow oil, 37% based on tetralone, 4 steps).

5-CHO-tetralone:

^{1}H NMR ($CDCl_3$): 10.30 (1H, s), 8.331 (1H, dd, J=8.0, 1.6), 8.007 (1H, dd, J=7.6, 1.6), 7.516 (1H, t, J=7.6), 3.448 (2H, t, J=6.4), 2.706 (2H, t, J=6.4), 2.223-2.158 (2H, m).

^{13}C NMR ($CDCl_3$): 197.20, 191.96, 145.96, 137.63, 133.98, 133.92, 132.83, 126.75, 38.53, 25.94, 22.47.

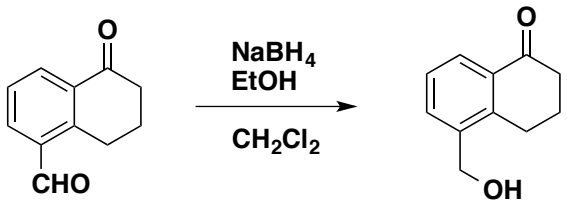
Anal. Calcd. for $C_{11}H_{10}O_2$: C 75.84, H 5.79, N 0.00. Found: C 75.70, H 6.05, N 0.00.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{10}NaO_2^+$: 197.0573. Found: 197.0582.

7-CHO-tetralone:

^{1}H NMR ($CDCl_3$): 10.05 (1H, s), 8.516 (1H, d, J=2.0), 8.022 (1H, dd, J=8.0, 2.0), 7.446 (1H, d, J=8.0), 3.075 (2H, t, J=6.0), 2.737 (2H, t, J=6.4), 2.239-2.176 (2H, m).

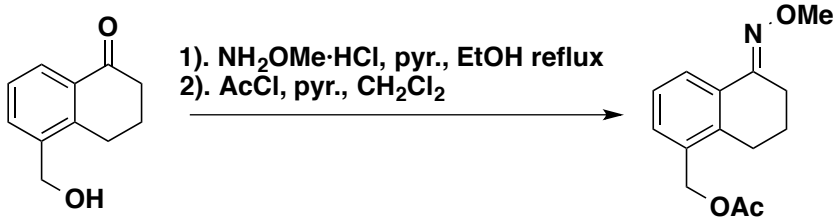
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{10}NaO_2^+$: 197.0573. Found: 197.0600.



5-CHO tetralone (1.0869 g, 6.23mmol) was dissolved in dichloromethane (30.0 mL) and ethanol (6.0 mL). The reaction mixture was cooled to -78 ºC and $NaBH_4$ (589.2mg, 2.5 equiv.) was added in portions. After addition, the whole was stirred for 5min and diluted with dichloromethane (50.0 mL). The whole was transferred slowly to an ice-cooled 2 M aqueous solution of HCl, and the organic phase was separated. The water phase was extracted with ethyl acetate, and the combined organic phase was washed with brine, dried over sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 3 : 2) to afford 5-CH_2OH tetralone (white solid, 1.0257 g, 93%).

^{1}H NMR ($CDCl_3$): 8.035 (1H, dd, J=8.0, 0.8), 7.590 (1H, d, J=7.2), 7.329 (1H, t, J=7.6), 4.765 (2H, s), 2.992 (2H, t, J=6.0), 2.662 (2H, t, J=6.0), 2.195-2.131 (2H, m), 1.813 (1H, brs). ^{13}C NMR ($CDCl_3$): 198.44, 142.61, 138.47, 133.14, 132.67, 126.96, 126.44, 63.05, 38.76, 25.53, 22.69.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}NaO_2^+$: 199.0730. Found: 199.0736.



5-CH_2OH-tetralone (1.1579 g, 6.57 mmol) and O-methyl hydroxylamine hydrochloride (1.0975 g, 13.14 mmol) were dissolved in 70.0 mL of ethanol, and 7.0 mL of pyridine was added to the mixture. The whole was heated to reflux and stirred for 1 hr. The whole was cooled to room temperature, concentrated and diluted with dichloromethane. The organic solution was washed with 2 M aqueous solution of HCl, brine and dried over anhydrous sodium sulfate. The solvent was evaporated to afford a yellow oil.

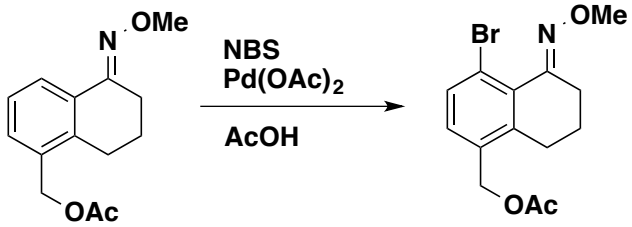
The oil was dissolved in dichloromethane (30.0 mL) and pyridine (3.0 mL) was added. 1.0 mL of acetyl chloride was added dropwise at 0 °C. The whole was stirred for 5 min and washed with water, brine, dried over sodium sulfate and concentrated. The residue

was purified with column chromatography (n-hexane: ethyl acetate = 8: 1) to afford 5-CH_2OAc tetralone methyl oxime (1.4961 g, white solid, 92%).

^1H NMR ($CDCl_3$): 7.994 (1H, dd, J=8.0, 1.2), 7.293 (1H, d, J=7.6, 1.2), 7.170 (1H, t, J=7.6), 5.102 (2H, s), 3.963 (3H, s), 2.727-2.687 (4H, m), 2.068 (3H, s), 1.867-1.803 (2H, m).^{13}C NMR ($CDCl_3$): 170.76, 153.96, 138.36, 133.25, 131.38, 130.18, 126.05, 124.88, 64.42, 61.98, 25.41, 23.72, 21.04, 20.91.

Mp.: 65.0-66.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{17}NNaO_3^+$: 270.1101. Found: 270.1103.

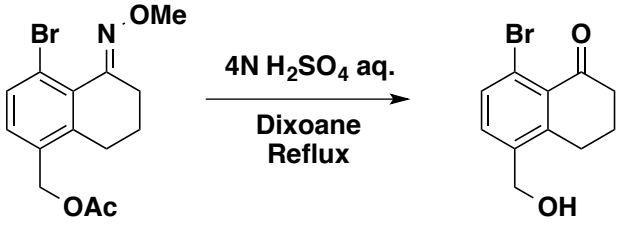


To a solution of 5-CH_2OAc tetralone O-methyl oxime (1.001 g, 4.044 mmol) in 20.0 mL of acetic acid were added NBS (863.7 mg, 4.85 mmol) and palladium diacetate (72.6 mg, 8% equiv.). The whole was heated at 90 °C for 45 min, and the acetic acid was removed by azeotropic distillation with toluene under reduced pressure. The resulted suspension was filtered through celite and the residue was extracted with ethyl acetate. The solution was concentrated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 9 : 1) to afford 5-CH_2OAc-8-Br tetralone methyl oxime (yellow oil, 1.1441g, 87%).

^1H NMR ($CDCl_3$): 7.545 (1H, d, J=8.4), 7.142 (1H, d, J=8.0), 5.103 (3H, s), 4.051 (2H, s), 2.789 (2H, t, J=6.8), 2.656 (2H, t, J=6.0), 2.095 (3H, s), 1.820-1.755 (2H, m).

^{13}C NMR ($CDCl_3$): 170.59, 153.19, 142.84, 132.77, 131.88, 131.73, 130.19, 120.95, 63.80, 62.20, 35.46, 26.21, 24.45, 20.84.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{16}BrNNaO_3^+$: 348.0206. Found: 348.0211.



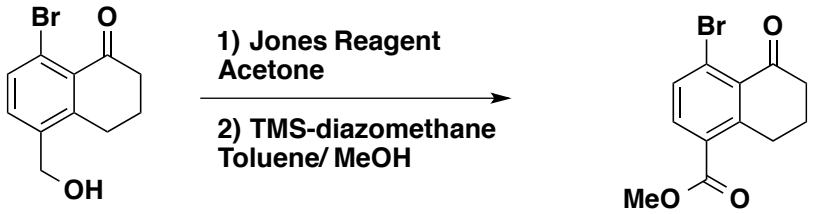
5-CH_2OAc-8-Br tetralone O-methyl oxime (1.1441 g, 3.50 mmol) was dissolved in dioxane (20.0 mL) at room temperature. 4N sulfuric acid (32.0 mL) was added and stirred for 30 min. The whole was heated to reflux for 90 min and the solution was allowed to cool to room temperature. The whole was neutralized with 10% aqueous solution of NaOH and saturated with NaCl. The whole was extracted with ethyl acetate, and the combined organic phase was dried over anhydrous sodium sulfate. Solvent was evaporated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 4 : 1) to afford 5-CH_2OH-8-Br tetralone (700.3 mg, off-white solid, 78%).

^{1}H NMR ($CDCl_3$): 7.560 (1H, d, J=8.0), 7.346 (1H, d, J=7.6) 4.685 (2H, d, J=3.6), 2.935 (2H, t, J=6.0), 2.677 (2H, t, J=6.4), 2.142-2.073 (2H, m), 1.686 (1H, s).

^{13}C NMR ($CDCl_3$): 196.97, 144.81, 137.82, 133.61, 131.90, 131.73, 121.19, 62.64, 39.68, 26.28, 22.08.

Mp.: 78.0-80.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{11}BrNaO_2^+$: 276.9835. Found: 276.9826.



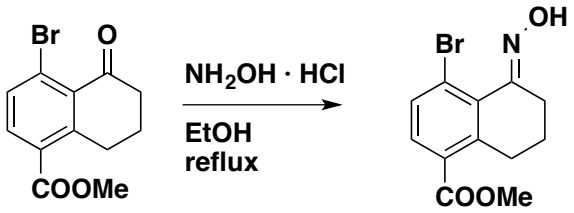
5-CH_2OH-8-Br tetralone (697.2 mg, 2.46 mmol) was dissolved in acetone (10.0 mL) and cooled to 0 °C. Jones reagent (2.67 M, 3.0 mL) was added dropwise, and the whole was stirred for 30 min. The solution was allowed to warm to room temperature and stirred for 1 hr. The reaction was quenched with 1.0 mL of isopropanol and the whole was stirred for 15 min. The solution was dispersed between water and dichloromethane. The organic phase was washed with brine and dried over anhydrous sodium sulfate. The whole was concentrated to afford an off-white powder.

The powder was dissolved in a mixture of methanol and toluene (1:9, 20 mL). TMS-diazomethane solution (2 M in Et_2O, 1.3 mL) was added dropwise at 0 °C. The whole was stirred till gas generation stopped, and a minimum amount of acetic acid was added to stop the reaction. The whole was evaporated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 4 :1) to afford 5-COOMe-8-Br tetralone (642.7 mg, white solid, 92%).

^{1}H NMR ($CDCl_3$): 7.748 (1H, d, J=8.4), 7.622 (1H, d, J=8.4), 3.900 (3H, s), 3.280 (2H, t, J=6.0), 2.707 (2H, t, J=6.4), 2.110-2.045 (2H, m). ^{13}C NMR ($CDCl_3$): 196.71, 166.93, 147.90, 133.97, 133.58, 132.76, 129.50, 126.33, 52.42, 39.42, 28.27, 22.03.

Anal. Calcd. for $C_{12}H_{11}BrO_3 \cdot 0.1H_2O$: C 50.59, H 3.96, N 0.00. Found: C 50.49, H 3.91, N 0.00. Mp.: 88.0-90.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{11}BrNaO_3^+$: 304.9780. Found: 304.9769.



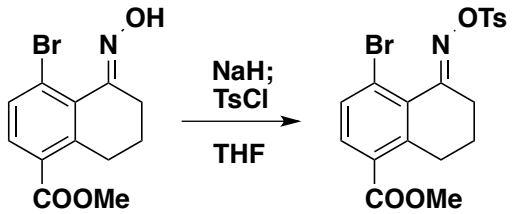
5-COOMe-8-Br tetralone (200.2 mg, 0.71mmol) and hydroxyl ammonium chloride (58.9 mg, 0.847 mmol) were dissolved in ethanol (3.5 mL). The whole was heated at reflux for 1 hr and the solvent was evaporated. The residue was diluted with ethyl acetate and washed with 2 M aqueous solution of HCl and brine. The organic layer was dried over Na_2SO_4 and concentrated in vacuo. The residue was purified with column chromatography (CH_2Cl_2 : hexane =1 :1 to acetone : hexane = 1 :1) to afford 5-COOMe-8-Br tetralone oxime (106.3 mg, white solid, 50%).

^{1}H NMR ($CDCl_3$): 8.927 (1H, brs), 7.599 (1H, d, J=8.4), 7.572 (1H, d, J=7.6), 3.844 (3H, s), 2.993 (2H, t, J=6.0), 2.854 (2H, t, J=6.8), 1.776-1.711 (2H, m).

^{13}C NMR ($CDCl_3$): 167.39, 154.72, 145.56, 132.64, 132.52, 130.67, 128.69, 124.66, 52.29, 27.60, 24.28, 20.67.

Anal. Calcd. for $C_{12}H_{12}BrNO_3$: C 48.34, H 4.06, N 4.70. Found: C 48.30, H 4.12, N 4.60. Mp.: 152.5-154.0 ºC (recrystallized from dichloromethane).

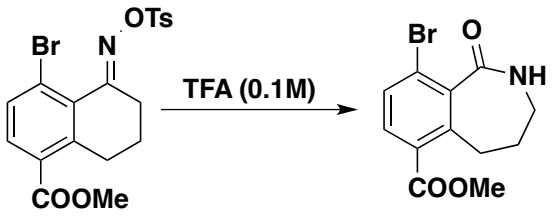
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}BrNNaO_3^+$: 319.9893. Found: 319.9876.



5-COOMe-8-Br tetralone oxime (136.8 mg, 0.46 mmol) was dissolved in THF (1.5 mL) and cooled to 0 °C. A suspension of NaH (30.0 mg in 1 mL of THF) was added dropwise and the reaction mixture was stirred at room temperature for 1 hr. Tosyl chloride (96.2 mg, 0.49 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The whole was diluted with Et_2O and quenched by slow addition of water. The organic phase was separated and the water phase was extracted with ethyl acetate. The combined organic layer was washed with brine, dried over anhydrous sodium sulfate and concentrated. The mixture was filtered and the residue was washed with water and hexane. The residue was purified with column chromatography (n-hexane : ethyl acetate = 4 :1) to afford **3e** (189.9 mg, 91%, white solid).

^{1}H NMR ($CDCl_3$): 7.948 (2H, d, J=8.4), 7.637 (1H, d, J=8.4), 7.534 (1H, d, J=8.8), 7.331 (2H, d, J=8.0), 3.878 (3H, s), 2.913 (2H, t, J=6.4), 2.443 (3H, s), 1.775-1.690 (2H, m). ^{13}C NMR ($CDCl_3$): 166.93, 161.49, 146.25, 145.07, 132.83, 132.03, 130.40, 129.50, 129.39, 128.87, 125.46, 119.14, 52.38, 27.36, 25.92, 21.70, 20.07. Dec.: 132.5 ºC (recrystallized from n-hexane/dichloromethane). Anal. Calcd. for $C_{19}H_{18}BrNO_5S$: C 50.45, H 4.01, N 3.10. Found: C 50.53, H 4.10, N 3.11.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{19}H_{18}BrNNaO_5S^+$: 473.9981. Found 473.9999.



5-COOMe-8-Br tosylated oxime **3e** (73.3 mg, 0.16 mmol) was added TFA (1.6 mL) at 0 °C and the whole was stirred at 20 °C for 1 hr. The whole was poured onto crushed ice and extracted with chloroform. The combined organic phase was washed with brine, dried over anhydrous sodium sulfate and concentrated. The residue was purified with column chromatography to afford the desired alkyl migration product **4e** (46.0 mg, 96%, white solid).

^{1}H NMR ($CDCl_3$): 7.717 (1H, d, J=8.4), 7.590 (1H, d, J=8.4), 6.948 (1H, brs), 3.897 (3H, s), 3.710-3.661 (1H, br), 3.243-3.207 (1H, br), 2.936-2.908 (1H, br), 2.644 (1H,

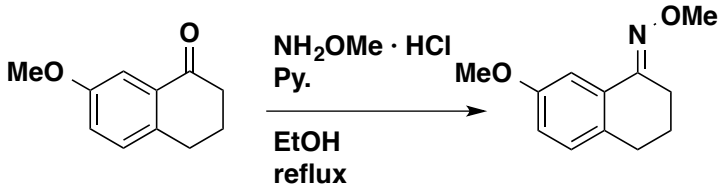
brs), 2.164-2.134 (1H, br), 1.946-1.917 (1H, br). ^{13}C NMR ($CDCl_3$): 169.86, 167.19, 140.44, 137.29, 132.47, 131.83, 128.96, 124.74, 52.41, 39.13, 30.18, 26.74.

Anal. Calcd. For $C_{12}H_{12}BrNO_3$: C 48.34, H 4.06, N4.70. Found: C 48.41, H 4.17, N 4.62.

Mp.: 137.5-138.0 ºC (recrystallized from n-hexane/ ethyl acetate).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}BrNNaO_3^+$: 319.9893. Found: 319.9895.

Synthesis of 3g

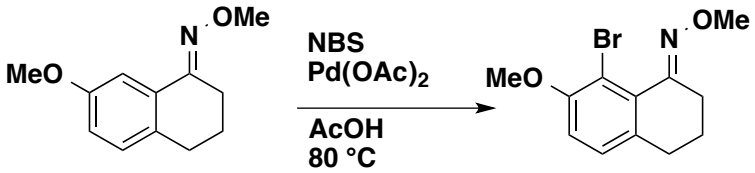


7-OMe-tetralone (1.7622 g, 10.0 mmol) and O-Methyl hydroxylammonium hydrochloride (1.6703 g, 20.0 mmol) were dissolved in ethanol (20 mL), and pyridine (2.0 mL) was added to the mixture. The whole was heated at reflux and stirred for 1 hr, and the solvent was evaporated. The residue was diluted with dichloromethane and acidified with 2 M aqueous solution of HCl. The organic layer was separated, washed with saturated sodium bicarbonate and brine, dried over Na_2SO_4 and concentrated in vacuo to afford 7-OMe tetalone methyl oxime (1.8358 g, 96%, yellow oil).

^{1}H NMR ($CDCl_3$): 7.497 (1H, d, J=2.8), 7.022 (1H, d, J=8.4), 6.841-6.814 (1H, m), 3.983 (3H, s), 3.813 (3H, s), 2.707-2.644 (4H, m), 1.835-1.771 (2H, m).

^{13}C NMR($CDCl_3$): 158.03, 154.01, 132.13, 131.44, 129.56, 116.64, 107.46, 61.97, 55.38, 28.95, 24.10, 21.71.

HRMS (ESI-TOF $[M+H]^+$): Calcd. for $C_{12}H_{16}NO_2^+$: 206.1176. Found: 206.1166.



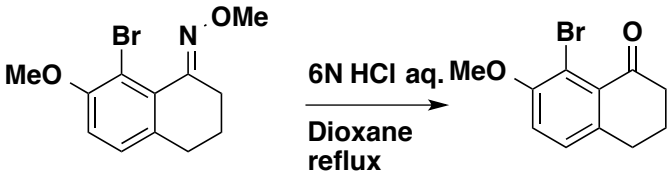
To the solution 7-OMe tetralone methyl oxime (1.8358 g, 9.6 mmol) in 40 mL of AcOH were added NBS (2.0 g, 11.2 mmol) and palladium diacetate (112.2 mg, 0.05 mmol). The solution was heated at 80 °C with stirring for 30 min and the solvent was

evaporated. The residue was filtered through celite and the filtrate was purified with column chromatography (n-hexane : ethyl acetate =15 : 1) to yield 7-OMe-8-Br methyl oxime (2.0682 g, 73%, colorless oil).

^{1}H NMR ($CDCl_3$): 7.050 (1H, d, J=8.4), 6.814 (1H, d, J=8.4), 4.038 (3H, s), 3.884 (3H, s), 2.755 (2H, t, J=6.8), 2.568 (2H, t, J=6.0), 1.744-1.714 (2H, m). ^{13}C NMR ($CDCl_3$): 155.60, 153.44, 135.86, 132.33, 127.04, 112.11, 110.70, 62.23, 56.75, 30.19, 24.75, 21.33.

Anal. Calcd. for $C_{12}H_{14}BrNO_2$: C 50.72, H 4.97, N 4.93. Found: C 50.68, H 5.01, N 4.83.

HRMS (ESI-TOF $[M+H]^+$): Calcd for $C_{12}H_{15}BrNO_2^+$: 284.0281. Found: 284.0283.



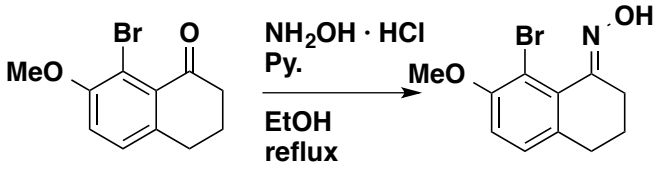
7-OMe-8-Br methyl oxime (2.0470 g, 7.2mmol) was dissolved in 32 mL of dioxane and 48 mL of 6 M aqueous HCl was added to the solution. The whole was heated at reflux for 1 hr. The whole was extracted with ethyl acetate and the combined organic phase was washed sequentially with water, 10% aqueous solution of NaOH and brine. The organic phase was dried over anhydrous sodium sulfate and concentrated. The residue was purified by column chromatography (n-hexane: ethyl acetate =4:1) to afford 7-OMe-8-Br tetralone (1.3954 g, 76%, yellow solid).

^{1}H NMR ($CDCl_3$): 7.190-7.165 (1H, m), 7.011 (1H, d, J=8.8), 3.906 (3H, s), 2.909 (2H, t, J=6.0), 2.694 (2H, t, J=6.8), 2.109-2.045 (2H, m). ^{13}C NMR($CDCl_3$): 197.29, 155.52, 138.70, 132.52, 128.41, 115.92, 111.69, 56.84, 40.12, 30.07, 22.77.

Anal. Calcd. for $C_{11}H_{11}BrO_2$: C 51.79, H 4.35, N 0.00. Found: C 51.77, H 4.44, N 0.00.

Mp.: 96.5-98.0 (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd $C_{11}H_{11}NaBrO_2^+$: 276.9835. Found: 276.9855.



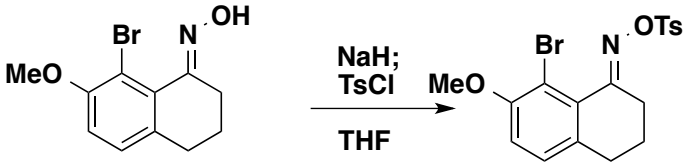
7-OMe-8-Br tetralone (1.3364 g, 5.24 mmol) and hydroxyl ammonium chloride (728.1 mg, 10.48 mmol) were dissolved in ethanol (18.0 mL), and pyridine (2.0 mL) was added to the mixture. The whole was heated at reflux for 1 hr and the solvent was evaporated. The residue was diluted with ethyl acetate and washed with 2 M aqueous solution of HCl and brine. The organic layer was dried over Na_2SO_4 and concentrated in vacuo. Recrsytallization of the residue from ethyl acetate afforded 7-OMe-8-Br tetralone oxime (846.4 mg, 60%, white solid).

^{1}H NMR ($CDCl_3$): 9.073 (1H, brs), 7.072 (1H, d, J=8.0), 6.833 (1H, d, J=8.4), 3.891 (3H, s), 2.853 (2H, t, J=6.8), 2.580 (2H, t, J=6.0), 1.791-1.726 (2H, m). ^{13}C NMR($CDCl_3$): 155.45, 154.87, 135.96, 132.35, 127.16, 112.17, 110.39, 56.70, 30.24, 24.46, 21.26.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91, H 4.48, N 5.19. Found: C 49.12, H 4.47, N 5.20.

Mp.: 203.0-205.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}BrNNaO_2^+$: 291.9945. Found: 291.9938.



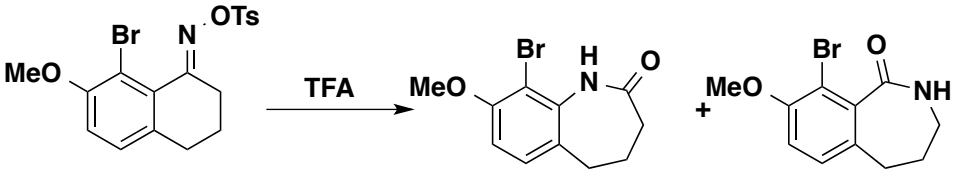
7-OMe-8-Br tetralone Oxime (400.0 mg, 1.48mmol) was dissolved in 4 mL of THF and the solution was cooled to 0 °C. A suspension of NaH (71.1 mg in 3.0 mL of THF, 2.0 eq.) was added dropwise and the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (296.4 mg, 1.55 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The reaction was quenched by slow addition of water, and additional water was added to afford a white precipitate. The mixture was filtered and the residue was washed with water and hexane to afford 7-OMe-8-Br tetralone tosyl oxime **3g** (327.5 mg, off-white solid, 94%).

^{1}H NMR ($CDCl_3$): 7.966 (2H, d, J=8.4), 7.328 (2H, d, J=8.0), 7.071 (1H, d, J=8.4), 6.862 (1H, d, J=8.4), 3.867 (3H, s), 2.901 (2H, t, J=6.8), 2.589 (2H, t, J=6.0), 2.424 (3H,s); 1.730 (2H, quint, J=6.8).

^{13}C NMR($CDCl_3$): 161.56, 155.52, 144.96, 136.58, 132.90, 130.00, 129.52, 129.47, 127.50, 113.59, 111.11, 56.72, 29.81, 26.01, 21.71, 20.64.

Anal. Calcd. for $C_{18}H_{18}BrNO_4S$: C 50.95, H 4.28, N 3.30. Found: C 51.10, H 4.20, N 3.50. Dec.: 113.5 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF $[M+Na]^+$): Calcd $C_{18}H_{18}BrNNaO_4S^+$: 446.0032. Found: 446.0037.



To **3g** (212.3 mg, 0.5 mmol) was added 5.0 mL of TFA at 0 °C. The whole was stirred at 20 °C for 1 hr and poured onto crushed ice. The mixture was extracted with chloroform and washed with brine. The combined organic phase was dried over anhydrous sodium sulfate and concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate =2:1) to afford and alkyl migration product **4g** (115.4 mg, 87%, white solid) and benzene migration product **5g** (8.9 mg, 6.6%, white solid).

Alkyl migration **4g**

^{1}H NMR ($CDCl_3$): 7.597 (1H, brs), 7.066 (1H, d, J=8.0), 6.876 (1H, d, J=8.4), 3.872 (3H, s), 3.172-2.679 (4H, br), 2.074 (1H, brs), 1.667 (1H, brs). ^{13}C NMR($CDCl_3$): 170.65, 155.33, 136.64, 131.03, 128.12, 113.33, 110.53, 56.61, 38.99, 30.15, 29.49.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91, H, 4.48, N 5.19. Found: C 48.57, H 4.47, N 5.01.

Mp.: 128.0-130.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF $[M+H]^+$): Calcd for $C_{11}H_{13}BrNO_2^+$: 270.0124. Found: 270.0140.

Benzene migration **5g**

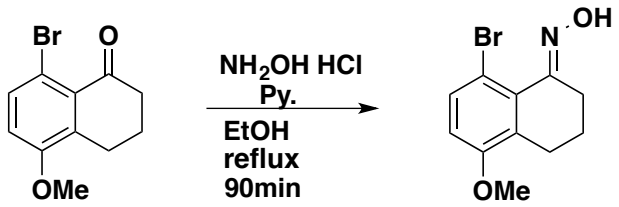
^{1}H NMR (CD_2Cl_2): 7.153 (1H, d, J=8.4), 6.723 (1H, d, J=8.4), 3.888 (3H, s), 2.776 (2H, t, J=7.2), 2.299 (2H, t, J=7.2), 2.215-2.123 (2H, m).

^{13}C NMR ($CDCl_3$): 173.94, 155.35, 137.40, 128.75, 127.70, 108.33, 105.90, 56.52, 32.91, 30.30, 28.44.

Mp.: 134.5-136.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF $[M+H]^+$): Calcd. for $C_{11}H_{13}BrNO_2^+$: 270.0124. Found: 270.0135.

Synthesis of 3h



5-MeO-8-Br-ketone[4] (538.3 mg, 2.11 mmol) and hydroxyl ammonium chloride (293.3 g, 2 equiv.) were dissolved in ethanol (5 mL), and pyridine (0.5 mL) was added to the solution. The whole was heated at reflux and stirred for 90 min. The whole was cooled an ice bath and white solid was precipitated. The solid was separated with a suction filter and the crop was washed with water and dried in vaccum to afford 5-MeO-8-Br tetralone Oxime (383.5 mg, 71%, white solid).

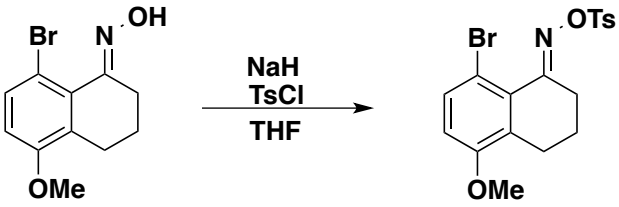
^{1}H NMR ($CDCl_3$): 9.069 (1H, brs), 7.464 (1H, d, J=8.8), 6.684 (1H, d, J=8.8), 3.812 (3H, s), 2.840 (2H, t, J=6.8), 2.661 (2H, t, J=6.4), 1.788-1.723 (2H. m) .

^{13}C NMR ($CDCl_3$): 165.57, 155.32, 155.16, 132.67, 131.63, 111.56, 110.52, 55.80, 24.28, 22.67, 20.73.

Anal. Calcd. For $C_{11}H_{12}BrNO_2$: C 48.91, H 4.48, N 5.19. Found: C 49.07, H 4.48, N 5.22.

Mp.: 185.5-187.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}BrNNaO_2^+$:291.9944. Found: 291.9972.



5-MeO-8-Br tetralone oxime (299.7mg, 1.11mmol) was dissolved in THF (3 mL) at 0 °C. NaH (53.3 mg, 2 equiv., in 1.0 mL THF) was added to it and the whole was stirred for 30 min. Tosyl chloride (222.2 mg, 1.1 mmol) was added to the mixture at 0°C and the solution was warmed to room temperature and stirred for 1 hr. The reaction was quenched by water (20 mL) and the resultant solid was collected. The solid was washed with water and n-hexane to afford tosylated compound **3h** as a white powder (393.1mg, 83%).

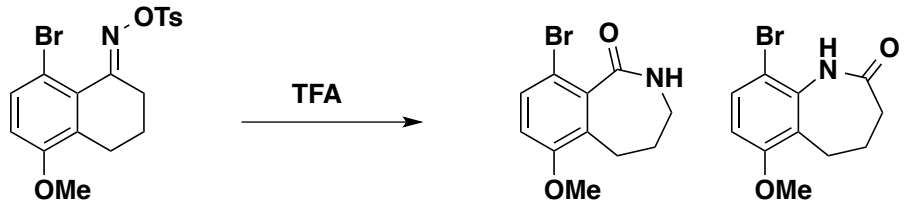
^{1}H NMR (CD_2Cl_2): 7.923 (2 H, d, J=8.4), 7.436 (1 H, d, J=8.4), 7.351 (2 H, d, J=8.0), 6.751 (1 H, d, J=8.8), 3.794 (3 H, s), 2.854 (2 H, t, J=6.8), 2.671-2.641 (2 H, m), 2.424 (3 H, s), 1.756 – 1.691 (2 H, m).

^{13}C NMR (CD_2Cl_2): 162.55, 156.01, 145.67, 134.25, 133.44, 133.34, 129.88, 129.58, 129.44, 113.33, 110.89, 56.23, 26.30, 22.92, 21.79, 20.59 .

Anal. Calcd. for $C_{18}H_{18}BrNO_4S$: C 50.95, H 4.28, N 3.30. Found: C 51.04, H 4.34, N 3.24.

Dec.: 115.5 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{18}H_{18}BrNNaO_4S^+$:446.0032. Found: 446.0062.



TFA (5mL) was added to 5-MeO-8-Br-tosylated oxime **3h** (183.0mg, 0.5 mmol) at 0°C and the whole was stirred at 20°C for 1 hour. The whole was poured onto crushed ice and extracted with chloroform (30 mL x3). The organic layers were combined, washed with brine, dried over Na_2SO_4 and concentrated. The product was purified with column chromatography (n-hexane : AcOEt =1:1) to afford alkyl-migrated lactam **4h** (99.5mg, white solid, 84%) and benzene-migrated lactam **5h** (7.4 mg, off-white sold, 6.2%).

Alkyl migration **4h**

^{1}H NMR ($CDCl_3$): 7.485 (1H, d, J=8.8), 6.832 (1H, d, J=8.8), 6.357 (1H, brs), 3.845 (3H, s), 3.099-2.674 (4H, br), 1.903 (2H, brs). ^{13}C NMR ($CDCl_3$): 170.08, 155.37, 136.16, 132.21, 127.88, 113.56, 110.82, 55.98, 39.29, 29.24, 21.41.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91, H 4.48, N 5.19. Found: C 49.02, H 5.04, N 4.63.

Mp.: 181.0-183.5 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}BrNNaO_2^+$: 291.9944. Found: 291.9935.

Benzene-migration **5h**

^{1}H NMR ($CDCl_3$): 7.379 (1H, d, J=9.2), 7.133 (1H, brs), 6.624 (1H, d, J= 8.8), 3.812 (3H, s), 2.884 (2H, t, J=6.4), 2.333 (2H, t, J=6.0), 2.212-2.140 (2H, m).

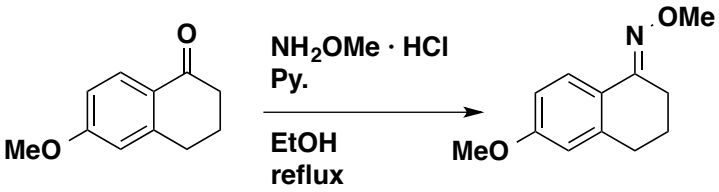
^{13}C NMR ($CDCl_3$): 174.06, 156.87, 137.07, 130.36, 124.57, 109.10, 107.00, 55.97, 33.25, 27.73, 22.80.

Anal. Calcd. For $C_{11}H_{12}BrNO_2$: C 48.91, H 4.48, N 5.19; Found C 48.69, H 4.54, N 5.01.

Mp.: 133.0-135.0 °C (recrystallized from chloroform).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}BrNNaO_2^+$:291.9944. Found: 291.9948.

Synthesis of 3i

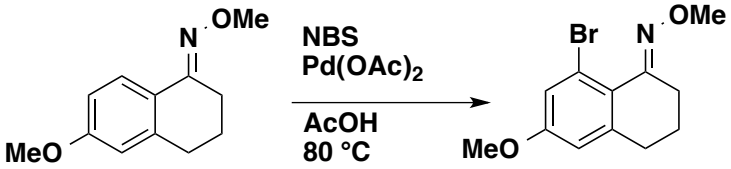


6-OMe tetralone (1.7622 g, 10.0 mmol) and O-methyl hydroxylammonium hydrochloride (1.6703 g, 20.0 mmol) were dissolved in ethanol (20 mL), and pyridine (2.0mL) was added to the mixture. The system was heated at reflux and stirred for 1 hr, and then the solvent was evaporated. The residue was diluted with dichloromethane and acidified with 2 M aqueous solution of HCl. The organic layer was separated, washed with saturated sodium bicarbonate and brine, dried over Na_2SO_4 and concentrated to afford 6-OMe tetraone methyl oxime (1.8358 g, 96%, yellow oil).

^{1}H NMR ($CDCl_3$): 7.909 (1H, d, J=8.8), 6.749 (1H, dd, J=2.8, 8.8), 6.631 (1H, d, J=2.8), 3.957 (3H, s), 3.803 (3H, s), 2.721-2.688 (4H, m), 1.860-1.796 (2H, m).

^{13}C NMR($CDCl_3$): 160.20, 153.89, 141.26, 125.84, 123.53, 112.91, 112.79, 61.79, 55.23, 30.10, 24.17, 21.55.

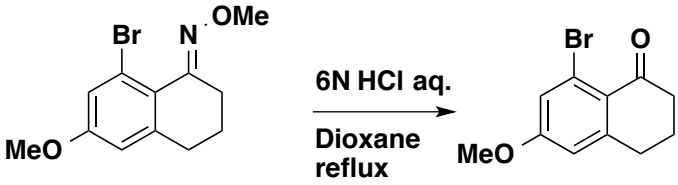
HRMS (ESI-TOF $[M+H]^+$): Calcd for $C_{12}H_{16}NO_2^+$: 206.1176. Found: 206.1177.



To a solution of 6-OMe tetralone methyl oxime (1.8358 g, 9.6 mmol) in AcOH (40 mL) were added NBS (2.0g, 11.2 mmol) and palladium diacetate (112.2 mg, 0.05 mmol). The solution was heated at 80 °C with stirring for 30 min and filtered through a pad of celite. The concentrated filtrate was purified with column chromatography (n-hexane : Ethyl acetate =15 : 1) to yield 6-OMe-8-Br methyl oxime (2.0682 g, 73%, colorless oil).

^{1}H NMR ($CDCl_3$): 7.080 (1H, d, J=2.8), 6.644 (1H, d, J=2.4), 4.014 (3H, s), 3.790 (3H, s), 2.736 (2H, t, J=6.8), 2.591 (2H, t, J=6.0), 1.768-1.704 (2H, m). ^{13}C NMR($CDCl_3$): 159.08, 152.84, 144.78, 123.58, 120.98, 118.68, 112.98, 62.07, 55.49, 31.37, 24.90, 21.04.

HRMS (ESI-TOF $[M+H]^+$): Calcd for $C_{12}H_{15}BrNO_2^+$: 284.0281. Found: 284.0263.



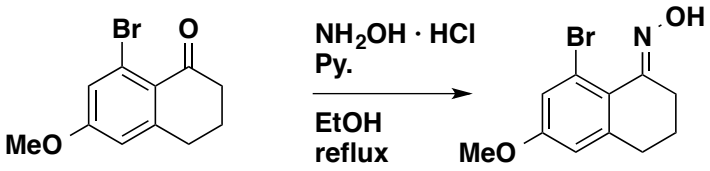
6-OMe-8-Br tetraone methyl oxime (2.0470 g, 7.2mmol) was dissolved in dioxane (32 mL) and 6N aqueous HCl (48 mL) was added. The whole was heated to reflux for 1 hr. The whole was extracted with ethyl acetate and organic phases were combined, washed sequentially with water, 10% aqueous solution of NaOH and brine. The organic phase was dired over anhydrous sodium sulfate and concentrated. The residue was purified by column chromatography (n-hexane: Ethyl acetate =4:1) to afford 6-OMe-8-Br tetralone (1.3954 g, 76%, yellow solid).

^{1}H NMR ($CDCl_3$): 7.102 (1H, d, J=2.8), 6.697-6.691 (1H, m), 3.840 (3H, s), 2.935 (2H, t, J=6.0), 2.647 (2H, t, J=6.8), 2.099-2.035 (2H, m). ^{13}C NMR($CDCl_3$): 195.41, 161.90, 148.76, 124.41, 123.72, 119.93, 113.13, 55.65, 39.94, 31.57, 22.52.

Anal. Calcd. for $C_{11}H_{11}BrO_2$: C 51.79, H 4.35, N 0.00. Found: C 51.92, H 4.33, N 0.00.

Mp.: 85.0-87.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{11}BrNNaO_2^+$: 276.9835. Found: 276.9828.



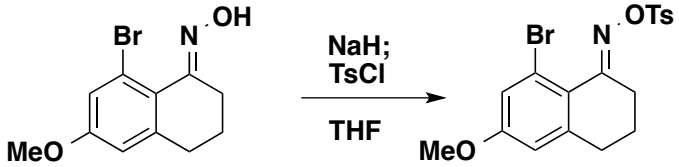
6-OMe-8-Br tetralone (1.3364 g, 5.24 mmol) and hydroxyl ammonium chloride (728.1 mg, 10.48 mmol) were dissolved in ethanol (18.0 mL), and pyridine (2.0 mL) was added to the mixture. The whole was heated at reflux for 1 hr and the solvent was evaporated. The residue was diluted with ethyl acetate and washed with 2 M aqueous solution of HCl and brine. The organic layer was dried over Na_2SO_4 and concentrated in vacuo. Recrsytallization of the residue from ethyl acetate afforded 6-OMe-8-Br tetralone oxime (846.4 mg, 60%, white solid).

^{1}H NMR ($CDCl_3$): 8.350 (1H, s), 7.081 (1H, d, J=2.8), 6.666 (1H, d, J=2.4), 3.801 (3H, s), 2.835 (2H, t, J=6.8), 2.610 (2H, t, J=6.0), 1.277-1.241 (2H, m).

^{13}C NMR ($CDCl_3$): 159.04, 154.27, 144.79, 123.34, 120.52, 118.35, 112.85, 55.30, 31.21, 24.36, 20.74.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91; H, 4.48; N 5.19. Found: C 49.05; H, 4.48; N 5.01. Mp.: 208.0-210.5 °C(recrystallized from ethylacetate).

HRMS (ESI-TOF, $[M+H]^+$): Calcd for $C_{11}H_{13}BrNO_2^+$: 270.0124. Found: 270.0123.



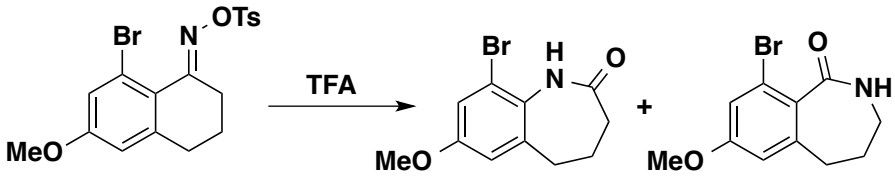
6-OMe-8-Br tetralone Oxime (400.0 mg, 1.48mmol) was dissolved in THF (4 mL) and cooled to 0 °C. A suspension of NaH (71.1 mg, 2.0 eq.) in 3.0 mL THF was added dropwise and the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (296.4 mg, 1.55 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The reaction was quenched with water to afford a white precipitate. The mixture was filtered and the residue was washed with water and hexane to afford 6-OMe-8-Br tetralone tosyl oxime **3i** (327.5 mg, off-white solid, 94%).

^{1}H NMR ($CDCl_3$): 7.960 (2H, d, J=8.4), 7.318 (2H, d, J=8.0), 7.017 (1H, d, J=2.8), 6.326 (1H, d, J=2.4), 3.775 (3H, s), 2.864 (2H, t, J=6.8), 2.598 (2H, t, J=6.0), 2.422 (3H, s), 1.739-1.708 (2H, m). ^{13}C NMR($CDCl_3$): 161.05, 160.37, 145.99, 144.85, 133.01, 129.41, 121.87, 121.04, 119.22, 119.11 113.02, 55.55, 31.08, 26.27, 21.71, 20.35.

Anal. Calcd. for $C_{18}H_{18}BrNO_4S$ + 0.1H_2O: C 50.74, H 4.31, N 3.29. Found: C 50.38, H 4.33, N 3.10.

Dec.: 104.5ºC (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{18}H_{18}BrNNaO_4S^+$: 446.0032. Found: 446.0040.



To 6-OMe-8-Br tetralone tosyl oxime **3i** (127.3 mg, 0.3 mmol) was added TFA (3.0 mL) at 0 °C. The whole was stirred at 20 °C for 1 hr and poured onto crushed ice. The mixture was extracted with chloroform and washed with brine. The combined organic phase was dried over anhydrous sodium sulfate and concentrated. The residue was

purified by column chromatography (n-hexane : ethyl acetate =2:1) to afford alkyl migration product **4i** (37.3 mg, 46%, white solid) and benzene migration product **5i** (39.0 mg, 48%, white solid).

Alkyl migration **4i**

^{1}H NMR ($CDCl_3$): 7.081 (1H, d, J=2.8), 6.669 (1H, d, J=2.4), 6.324 (1H, brs), 3.824 (3H, s), 3.115-3.009 (2H, m), 2.797 (2H, brs), 1.934 (2H, brs). ^{13}C NMR ($CDCl_3$): 170.27, 160.93, 140.91, 127.31, 122.02, 117.10, 113.78, 55.58, 39.10, 30.86, 30.03.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91; H, 4.48; N 5.19. Found: C 49.07; H, 4.48; N 5.01. Mp.: 111.0-111.5 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}BrNNaO_2^+$: 291.9944. Found: 291.9934.

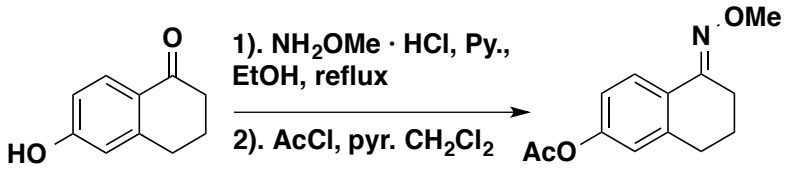
Benzene migration **5i**

^{1}H NMR ($CDCl_3$): 7.046 (1H, d, J=2.4), 6.997 (1H, brs), 6.777 (1H, d, J=2.8) 3.820 (3H, s), 2.817 (2H, t, J=7.2), 2.355 (2H, t, J=7.6), 2.277-2.196 (2H, m). ^{13}C NMR ($CDCl_3$): 173.83, 157.50, 137.18, 129.29, 116.90, 115.68, 115.18, 55.72, 32.50, 31.26, 28.03.

Anal. Calcd. for $C_{11}H_{12}BrNO_2$: C 48.91; H, 4.48; N 5.19. Found: C 48.91; H, 4.52; N 5.10. Mp.: 141.0-142.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_{12}BrNNaO_2^+$: 291.9944. Found: 291.9948.

Synthesis of 3j



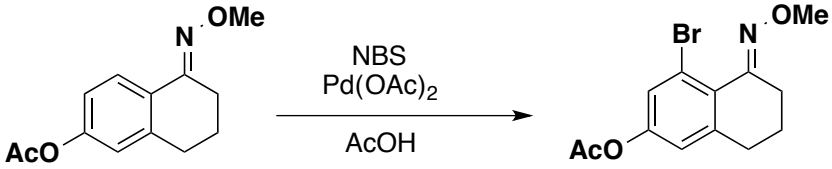
A mixture of 6-OH tetralone (800 mg, 4.93 mmol) and methoxyl ammonium chloride (620.0 mg, 2 equiv.) in ethanol (20 mL) and pyridine (2.0 mL) was heated at reflux for 1 hr. The solvent was removed and the residue was diluted with ethyl acetate, washed with 2 M aqueous solution of HCl and brine and dried over anhydrous sodium sulfate. The solvent was removed to afford desired methylated oxime (822.4 mg, light- yellow oil).

The above oil (765.1 mg, 4 mmol) was dissolved in dichloromethane (8 mL) and pyridine (2 mL) at 0 °C. Acetyl chloride (342 μl, 1.2 equiv.) was added and the reaction mixture was stirred for 5 min. The reaction was quenched with water and extracted with dichloromethane. The residue was purified with column chromatography (n-hexane :

ethyl acetate =4:1) to afford 6-OAc tetralone methyl oxime (877.6 mg, two step yield: 79%, white solid).

^{1}H NMR ($CDCl_3$) 7.988 (1H, d, J=8.0), 6.918-6.870 (2H, m), 3.971 (3H, s), 2.740-2.693 (4H, m), 2.285 (3H, s), 1.870-1.806 (2H, m). ^{13}C NMR (CDCl3) 169.47, 153.40, 151.13, 141.04, 128.63, 125.78 , 121.33, 119.82, 62.09, 29.87, 24.15, 21.36, 21.25.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{13}H_{15}NNaO_3^+$: 256.0944. Found: 256.0946.

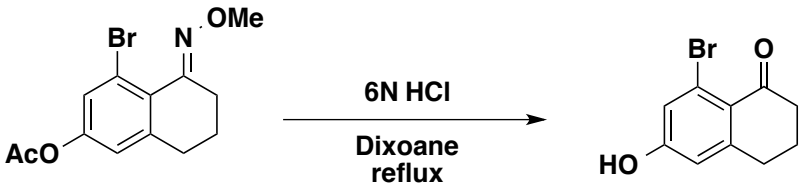


A mixture of 6-OAc tetralone oxime (350.0 mg, 1.5 mmol), NBS (320.4 mg, 1.2 eq.) and palladium acetate (34.0 mg, 10%) in acetic acid (7.7 mL) was heated to 90°C for 45 min. The reaction mixture was poured onto crushed ice and extracted with ethyl acetate. The solvent was removed and the residue was purified by column chromatography (n-hexane : ethyl acetate =4:1) to afford 6-OAc-8-Br tetralone methyl oxime (345.2 mg, 74%, sticky oil).

^{1}H NMR ($CDCl_3$): 7.298 (1H, d, J=2.4), 6.888 (1H, d, J=2.4), 4.024 (3H, s), 2.765 (2H, t, J=6.8), 2.618 (2H, t, J=6.0), 2.280 (3H, s), 1.792-1.727 (2H, m).

^{13}C NMR ($CDCl_3$): 169.01, 152.61, 149.87, 144.65, 128.75, 126.45, 120.48, 62.37 , 31.22, 24.85, 21.18 , 21.18, 20.99.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{13}H_{14}BrNNaO_3^+$: 334.0049. Found: 334.0027.

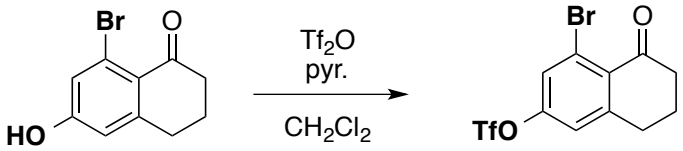


6-OAc-8-Br tetarlone methyl oxime (332.4 mg, 1.06 mmol) was dissolved in dixoane (8 mL) and 2 M aqueous solution of HCl (12 mL). The whole was heated to reflux for 1 hr. The whole was poured onto crushed ice and extracted with ethyl acetate. The solvent was evaporated and the residue was purified by column chromatography (n-hexane : ethyl acetate =4:1) to afford 6-OH-8-Br tetralone (224.2 mg, yellow solid, 87%).

^{1}H NMR (CD_3OD): 7.170 (1H, d, J=2.0), 6.849 (1H, d, J=2.4), 3.094 (2H, t, J=6.0), 2.768 (2H, t, J=6.4), 2.236-2.186 (2H, m). ^{13}C NMR (CD_3OD): 199.17, 164.07, 152.68, 125.98, 125.41, 123.82, 116.96, 42.27 , 33.64, 25.07.

Mp.: 128.0-131.0 ºC (recrystallized from ethanol).

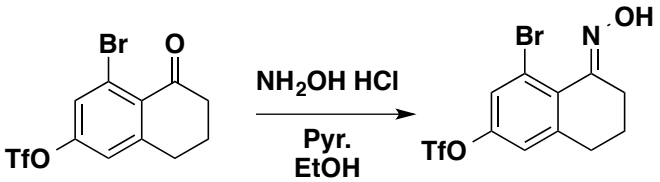
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_9BrNaO_2^+$: 262.9678. Found: 262.9686.



A solution of 6-OH-8-Br tetralone (497.0 mg, 2.06 mmol), pyridine (2.9 mL, 1.4 equiv.) in dichloromethane (7 mL) was cooled to 0 °C and Tf_2O (394 μl, 1.2 equiv.) was added. The reaction was stirred at the same temperature for 30 min and was quenched with saturated aqueous solution of $NaHCO_3$ (15 mL). The whole was extracted with dichloromethane. The solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate =4:1) to afford 6-TfO-8-Br tetralone (630.8 mg, 82%, yellow oil).

^{1}H NMR ($CDCl_3$): 7.490 (1H, d, J=2.4), 7.183 (1H, d, J=2.4), 3.043 (2H, t, J=6.4), 2.729 (2H, t, J=6.8), 2.189-2.113 (2H, m). ^{13}C NMR ($CDCl_3$): 195.01, 150.21, 149.12, 130.97, 126.56, 123.45, 120.69, 118.60 (J= 319), 39.66, 31.06, 22.15.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_8BrF_3NaO_4S^+$:394.9171. Found: 394.9180.

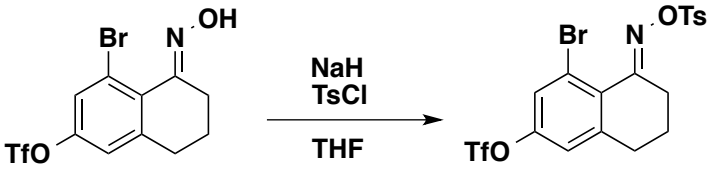


6-OTf-8-Br tetralone (570.3 mg, 1.53 mmol) and hydroxyl ammonium chloride (159.9 mg, 1.5 equiv.) were dissolved in ethanol (5 mL) and pyridine (0.5 mL) was added to this solution. The whole was heated at reflux for 4 hr. The solvent was removed by evaporation and the residue was purified by column chromatography (n-hexane: etyl acetate= 4:1) to afford the 6-OTf-8-Br tetralone oxime (492.6 mg, 83%, white solid).

^{1}H NMR ($CDCl_3$): 9.714 (1H, s), 7.479 (1H, d, J=2.8), 7.088 (1H, d, J=2.8), 2.890 (2H, t, J=6.8), 2.688 (2H, t, J=6.0), 1.860-1.796 (2H, m). ^{13}C NMR ($CDCl_3$): 153.61, 148.12, 146.00, 131.52, 125.84, 120.91, 119.99, 118.79 (J= 318), 31.33, 24.56, 20.77.

Anal. Calcd. for $C_{11}H_9BrF_3NO_4S$: C 34.04, H 2.34, N 3.61. Found: C 34.16, H 2.44, N 3.65. Mp.: 104.5-106.0 °C (recrystallized from dichloromethane).

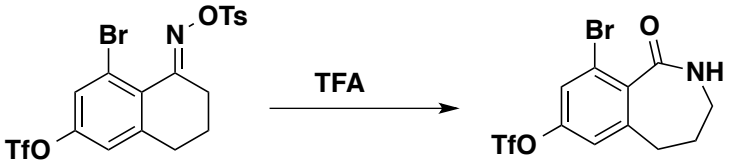
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_9BrF_3NNaO_4S^+$: 409.9280. Found: 409.9287.



6-OTf-8-Br-oxime (249.3 mg, 0.64 mmol) was dissolved in THF (1.5 mL) at 0 °C. Tosyl chloride (127.1 mg, 1.05 mmol) was added to the mixture, followed by the addition of a suspension of NaH (31.2 mg, 2.0 equiv.) in 1 mL of THF. The solution was warmed to room temperature and stirred for 1hr. The whole was poured onto crushed ice and extracted with Et_2O. The solvent was removed and the residue was purified with column chromatography (n-hexane: ethyl acetate= 3: 7) to afford **3j** (790.7 mg, 88%, sticky oil).

^{1}H NMR ($CDCl_3$): 7.951 (2H, d, J=8.0), 7.427 (1H, d, J=2.4), 7.346 (2H, d, J=8.4), 7.077 (1H, d, J=2.8), 2.926 (2H, t, J=6.8), 2.698 (2H, t, J=6.0), 2.441 (3H, s), 1.833-1.768 (2H, m). ^{13}C NMR ($CDCl_3$): 160.23, 149.00, 146.82, 145.40, 132.74, 129.67, 129.50, 129.30, 126.26, 122.15, 120.16, 118.72 (J= 319), 30.90, 25.98, 21.81, 20.19.

Anal. Calcd. for $C_{18}H_{15}BrF_3NO_6S_2$: C 39.86, H 2.79, N 2.58. Found: C 40.21, H 3.05, N 2.49. HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{15}BrF_3NNaO_6S_2^+$: 563.9369. Found: 563.9394.



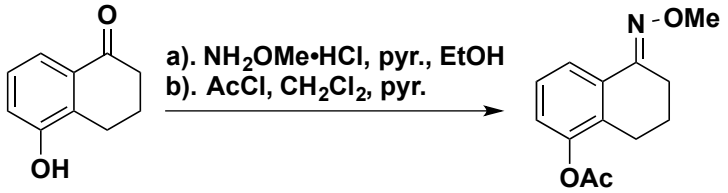
TFA (3.0 mL) was added to 6-OTf-8-Br tetralone tosyla oxime **3j** (163.2 mg, 0.3 mmol) at 0°C. The whole was stirred at 20 °C for 4 hrs and poured onto crushed ice. The mixtrure was extracted with chloroform, and the combined organic layer was washed with brine, dried over Na_2SO_4 and concentrated. The residue was purified with column

chromatography (n-hexane : AcOEt =2:1) to afford alkyl-migrated lactam **4j** (98.8 mg, white solid, 85%) as a sole product.

^{1}H NMR ($CDCl_3$): 7.496 (1H, d, J=2.4), 7.104 (1H, d, J=2.0), 6.971 (1H, brs), 3.125 (2H, brs), 2.873 (2H, brs), 1.994 (2H, brs). ^{13}C NMR ($CDCl_3$) 168.87, 149.58, 141.78, 135.44, 125.04, 122.10, 120.40, 118.64 (J= 318), 38.80, 30.57, 29.71.

Anal. Calcd. for $C_{11}H_9BrF_3NO_4S$: C 34.04, H 2.34, N 3.61. Found: C 34.07, H 2.46, N 3.62. Mp.: 129.0-131.5 °C (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_9BrF_3NNaO_4S^+$: 409.9280. Found: 409.9289.

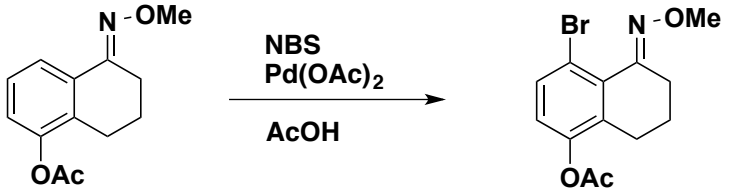
Synthesis of 3k



A mixture of 5-OH tetralone (1700.0 mg, 10.5 mmol) and methoxyl ammonium chloride (1252.8 mg, 1.5 equiv.) in ethanol (20 mL) and pyridine (2 mL) was heated at reflux for 1 hr. The solvent was removed and the residue was washed by 2 M aqueous solution of HCl (30 mL) to afford the 5-hydroxyl O-methyl tetralone oxime as a white solid. The above solid was dissolved in dichloromethane (8 mL) and pyridine (2 mL) was added to the mixture at 0 °C. Acetyl chloride (1.4 mL, 1.5 equiv.) was added and the reaction mixture was stirred for 10 min. The reaction was diluted with dichloromethane and washed with water and brine. The solvent was removed and the residue was purified with column chromatography (n-hexane: ethyl acetate= 8: 1) to afford 5-AcO tetralone O-methyl oxime (2.8969 mg, quantitative, stickyl oil).

^{1} H NMR ($CDCl_3$): 7.904 (1H, d, J=8.0), 7.211 (1H, t, J=8.0), 6.695 (1H, d, J=8.0), 3.980 (3H, s), 2.717 (2H, t, J=6.8), 2.569 (2H, t, J=6.0), 2.316 (3H, s), 1.833-1.775 (2H, m). ^{13}C NMR ($CDCl_3$) 169.10, 153.32, 148.32, 132.50, 131.66, 126.57, 122.22, 122.08, 62.05, 23.63, 22.96, 20.76, 20.62.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{13}H_{15}NNaO_3^+$: 256.0944. Found: 256.0944.

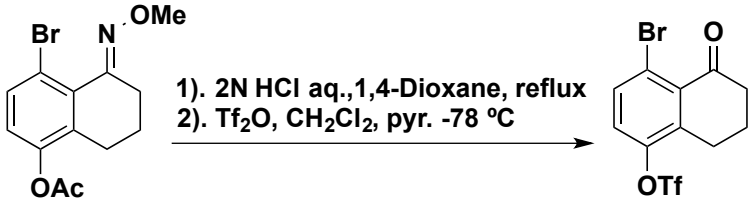


A mixture of of 5-OAc tetralone methyl oxime (2.4599 mg, 5.24mmol), NBS (2.2500 g, 1.2 eq.) and palladium acetate (118.0 mg, 5% equiv.) in 40 mL of acetic acid was heated at 80°C for 45 min. The reaction mixture was poured onto crushed ice and neutralized with 15% aqueous solution of NaOH. The whole was extracted with ethyl acetate and the solvent was evaporated. The residue was purified by column chromatography (n-hexane: ethyl acetate= 92: 8) to afford 5-OAc-8-Br methyl oxime tetralone (2.7789 g, 85%, yellow oil).

^{1}H NMR ($CDCl_3$): 7.531 (1H, d, J=8.8), 6.917 (1H, d, J=8.8), 4.076 (3H, s), 2.750 (2H, t, J=7.2), 2.483 (2H, t, J=6.4), 2.320 (3H, s), 1.764-1.717 (2H, m).

^{13}C NMR ($CDCl_3$): 168.80, 152.70, 146.75, 135.69, 133.26, 132.37, 122.70, 117.31, 62.29, 24.47, 23.80, 20.74, 20.45.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{13}H_{14}BrNNaO_3^+$: 334.0049. Found: 334.0029.

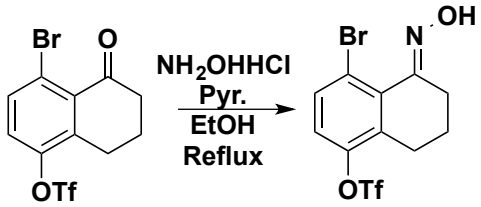


5-OAc-8-Br tetralone O-methyl oxime (2.7261g, 8.7mmol) was dissolved in 40 mL of 1,4-dixoane and 60 mL of 2 M aqueous solution of HCl. The whole was heated at reflux for 1 hr and poured onto crushed ice. The reaction mixture was extracted with ethyl acetate and the solvent was evaporated to afford 5-OH-8-Br-tetralone as a brown solid (1.6471g, 78%).

A solution of the above solid (1.3503 g, 5.6 mmol) and pyridine (1.2 mL) in dichloromethane (15 mL) was cooled to 0 °C and Tf_2O (394 µl, 1.2 equiv.) was added. The reaction was stirred for 10 min and diluted with dichloromethane. The solvent was removed and the residue was purified with column chromatography (n-hexane: ethyl acetate= 88: 12) to afford 5-OTf-8-Br tetralone (1.1983g, 57% yellow oil). Contained impurity was separated in the later steps.

^{1}H NMR ($CDCl_3$): 7.678 (1H, d, J=8.8), 7.258 (1H, d, J=8.8), 3.037 (2H, t, J=6.0), 2.758 (2H, t, J=6.0), 2.195-2.130 (2H, m). ^{13}C NMR ($CDCl_3$): 195.01, 146.13, 139.53, 134.80, 133.09, 125.51, 121.78, 121.62 (J= 300), 39.35, 24.51, 21.58.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_8BrF_3NaO_4S^+$: 394.9171. Found: 394.9167.

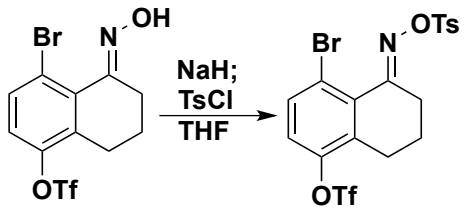


5-OTf-8-Br tetralone (570.3 mg, 1.53 mmol) and hydroxyl ammonium chloride (159.9 mg, 1.5 equiv.) were dissolved in ethanol (5 mL), and pyridine (1 mL) was added to the mixture. The whole was heated at reflux for 4 hr. The solvent was removed and the residue was purified by column chromatography (n-hexane : ethyl acetate =4:1) to afford the 5-OTf-8-Br tetralone oxime (2094.6 mg, 83%.) as a white solid.

^{1}H NMR ($CDCl_3$): 7.658 (1H, brs), 7.616 (1H, d, J=8.8), 7.081 (1H, d, J=8.8), 2.869 (2H, t, J=6.8), 2.737 (2H, t, J=6.0), 1.855-1.790 (2 H, m). ^{13}C NMR ($CDCl_3$): 154.45, 146.27, 137.23, 134.49, 134.27, 122.60, 120.47, 119.03 (J= 318), 24.76, 24.62, 20.83.

Anal. Calcd. for $C_{11}H_9BrF_3NO_4S$: C 34.04, H 2.34, N 3.61. Found: C 34.19, H 2.45, N 3.64. Mp.: 135.0-136.0 °C (recrystallized from methanol).

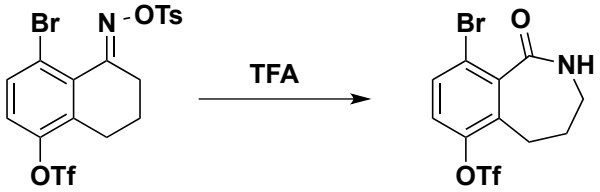
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{11}H_9BrF_3NNaO_4S^+$: 409.9280. Found: 409.9271.



5-OTf-8-Br tetralone oxime (249.3 mg, 0.64 mmol) was dissolved in THF (1.5 mL) at 0 °C. Tosyl chloride (127.1 mg, 1.05 mmol) was added, followed by the addition of a suspension of NaH (31.2 mg, 2 equiv.) in 0.5 mL THF. The whole was stirred for 1 hr at room temperature. The whole was poured onto crushed ice and extracted with Et_2O. The solvent was removed and the residue was purified with column chromatography (n-hexane: ethyl acetate = 3: 7) to afford **3k** (white solid, 790.7 mg, 88%).

^{1}H NMR ($CDCl_3$) 7.947 (2H, d, J=8.4), 7.572 (1H, d, J=8.8), 7.336 (2H, d, J=8.0), 7.109 (1H, d, J=8.4), 2.924 (2H, t, J=6.8), 2.721 (2H, t, J=6.4), 2.420 (3H, s), 1.820-1.755 (2H, m). ^{13}C NMR ($CDCl_3$) 160.28, 145.59, 145.32, 137.50, 134.27, 132.56, 131.39, 129.58, 129.42, 123.49, 120.84, 118.52 (J= 319), 25.76, 25.69, 23.93, 21.71.

Mp.: 110.0-112.5 °C (recrystallized from n-hexane/ dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{15}BrF_3NNaO_6S_2^+$: 563.9369. Found: 563.9368.



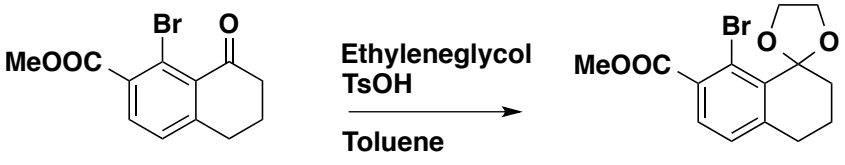
TFA (2.66 mL) was added to 5-OTf-8-Br tetralone tosyl oxime **3k** (144.1 mg, 0.27 mmol) at 0°C and stirred at 20 ºC for further 2 hours. The whole was poured onto crushed ice and extracted with chloroform. The combined organic layers was washed with brine, dried over Na_2SO_4 and concentrated. The residue was purified with column chromatography (n-hexane: AcOEt =2: 1) to afford alkyl-migrated lactam **4k** (96.2 mg, white solid, 83%) as the sole product.

^{1}H NMR ($CDCl_3$): 7.657 (1H, d, J=8.8), 7.228 (1H, d, J=8.8), 7.200 (1H, brs), 3.178-2.754 (4H, br), 2.193 (1H, brs), 1.916 (1H, brs). ^{13}C NMR ($CDCl_3$): 168.63, 145.52, 137.96, 133.60, 132.53, 124.18, 120.65, 118.49 (J= 319), 38.90, 29.11, 23.35.

Mp.: 68.0-70.0 ºC (recrystallized from dichloromethane).

Anal. Calcd. for $C_{11}H_9BrF_3NO_4S$: C 34.04, H 2.34, N 3.61. Found: C 34.05, H 2.47, N 3.68. HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_9BrF_3NNaO_4S^+$: 409.9280. Found: 409.9279.

Synthesis of 7

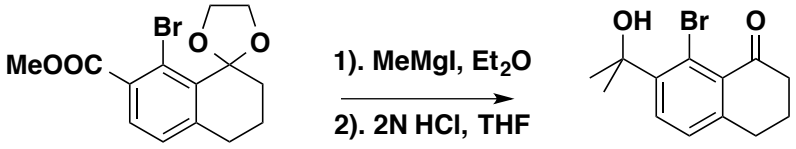


To a solution of 7-COOMe-8-Br tetralone (373.6 mg, 1.32 mmol) in toluene (4 mL) were added 1.0 mL of ethylene glycol and 2.5 mg of $TsOH·H_2O$. The whole was heated at reflux for 16 hr and water was removed with a dean-stark apparatus. The solution was cooled to room temperature and washed with saturated aqueous solution of sodium

bicarbonate. The organic layer was dried over Na_2SO_4, concentrated and purified with column chromatography (n-hexane: ethyl acetate= 4: 1) to afford 7-COOMe tetralone acetal as a colorless oil (401.4 mg, 93%).

^{1}H NMR ($CDCl_3$): 7.312 (1H, d, J=7.6), 7.100 (1H, d, J=8.0), 4.380-4.346 (2H, m), 4.166-4.132 (2H, m), 3.897 (3H, s), 2.853 (2H, t, J=6.4), 2.005-1.975 (2H, m), 1.884-1.823 (2H, m).

^{13}C NMR ($CDCl_3$): 168.41, 144.55, 135.72, 134.43, 128.68, 128.27, 120.19, 107.51, 64.74, 52.46, 34.88, 31.33, 22.64.



A solution of 7-COOMe-8-Br tetralone acetal (100.0 mg, 0.36 mmol) in 1.0 mL of Et_2O was cooled to 0 ºC. The solution of MeMgI in Et_2O (prepared from 710.0 mg MeI and 144.0 mg Mg turnings in 5.0 mL Et_2O) was added over 30 min. After addition, the solution was stirred at the same temperature for 30 min and warm to room temperature for 1 hr. The solution was diluted with Et_2O and quenched with crushed ice. The mixture was extracted with ethyl acetate and the solvent was removed to afford a yellow oil.

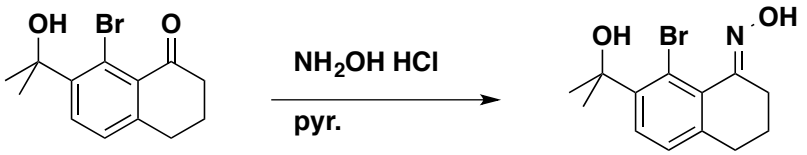
The dimethyl alcohol obtained above was dissolved in 2.0 mL of THF, and 2.0 mL of 2 M aqueous solution of HCl was added at 0 ºC. The reaction mixture was stirred for 20 min and neutralized with a saturated aqueous solution of sodium bicarbonate. The whole was extracted with ethyl acetate and concentrated. The residue was purified with column chromatography (n-hexane: ethyl acetate= 4: 1) to afford 7-(2-OH-propanyl)-8-Br tetralone as white solid (72.5 mg, 83%).

^{1}H NMR ($CDCl_3$): 7.749 (1H, d, J=8.0), 7.174 (1H, d, J=7.6), 3.174 (1H, brs). 2.903 (2H, t, J=6.4), 2.742-2.700 (2H, m), 2.115-2.050 (2H, m), 1.790 (6H, s). ^{13}C NMR ($CDCl_3$): 198.29, 146.35, 145.52, 134.27, 130.62, 127.83, 119.61, 74.34, 40.19, 30.18, 29.87, 22.38.

Anal. Calcd. for $C_{13}H_{15}BrO_2$: C 55.14, H 5.34, N 0.00. Found: C 54.93, H 5.24, N 0.00.

Mp.: 122.5-123.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{13}H_{15}BrNaO_2^+$: 305.0148. Found: 305.0119.



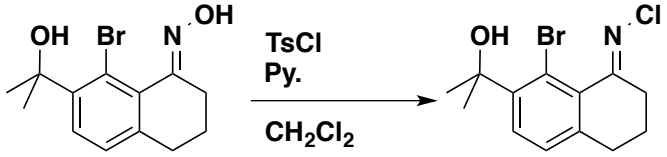
To a solution of 7-(2-OH-propanyl)-8-Br tetralone (210.4 mg, 0.745 mmol) in 4.0 mL of pyridine was added $NH_2OH \cdot HCl$ (200.0 mg, 4 eq.) at 0 ºC. The whole was stirred at room temperature for 8 hr. The mixture was purified with column chromatography (n-hexane : ethyl acetate = 4:1) to afford 7-(2-OH-propanyl)-8-Br tetralone oxime **11** as a white solid (177.2 mg, 80%).

^{1}H NMR ($CDCl_3$): 7.580 (1H, d, J=8.0), 7.095 (1H, d, J=8.0), 3.266 (1H, brs), 2.877 (2H, t, J=7.2), 2.587 (2H, t, J=5.6), 1.800-1.770 (8H, m).

^{13}C NMR ($CDCl_3$): 155.36, 145.67, 143.14, 133.51, 127.37, 126.63, 118.69, 74.33, 30.51, 30.02, 34.23, 20.95.

Anal. Calcd $C_{13}H_{16}BrNO_2 \cdot 0.5H_2O$: C 50.83, H 5.41, N 4.56. Found: C 50.44, H 5.31, N 4.36. Mp.: 145.0-147.0ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{13}H_{16}BrNNaO_2^+$: 320.0257. Found: 320.0264.



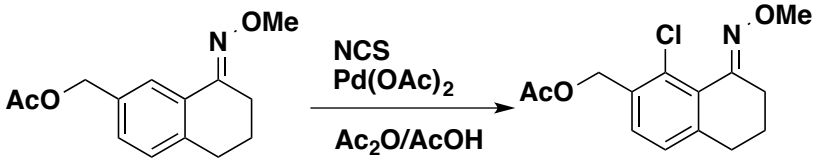
7-(2-OH-propanyl)-8-Br tetralone **7** (150.4 mg, 0.504 mmol) was dissolved in 2.0 mL of dichloromethane. 0.2 mL of pyridine was added at 0 ºC, followed by the addition of tosyl chloride (110.0 mg, 1.14 equiv.) and the whole was stirred for 15 min. The whole was purified with column chromatography (n-hexane/ ethylacetate= 4: 1) to afford the chloride imine **8** as a white solid.

^{1}H NMR ($CDCl_3$): 7.708 (1H, d, J=8.0), 7.161 (1H, d, J=8.0), 3.079-3.045 (3H, m), 2.669 (2H, t, J=5.6), 1.916-1.851 (2H, m), 1.819 (6H, s). ^{13}C NMR ($CDCl_3$): 155.36, 145.67, 143.14, 133.51, 127.37, 126.63, 118.69, 74.33, 30.51, 30.02, 24.23, 20.95. Dec.: 115.5 ºC (recrystallized from acetone/benzene/carbon tetrachloride).

Anal. Calcd. for $C_{13}H_{15}BrClNO$: C 49.32, H 4.78, N 4.42. Found: C 49.23, H 4.77, N 4.37. HRMS (ESI-TOF $[M+H]^+$): Calcd. for $C_{13}H_{16}BrClNO^+$: 316.0098. Found: 316.0092.

Synthesis of substituted *peri*-Cl compounds

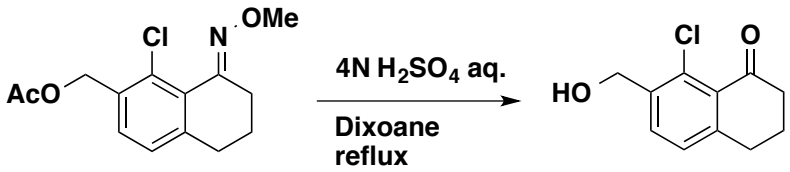
Synthesis of 10b



To a solution of 7-CH_2OAc teralone methyl oxime (989.2 mg, 4.0 mmol) in 16.0 mL of acetic acid and 2.0 mL of acetic anhydride were added N-chlorosuccinimide (587.5 mg, 4.8 mmol) and palladium diacetate (72.8 mg, 0.32 mmol). The solution was heated at 80 °C for 1 hr, and the acetic acid was removed by azeotropic distillation with toluene under reduced pressure. Ethyl acetate (30 mL) was added and the resulted suspension was filtered through Celite. The filtrate was concentrated and purified with column chromatography (n-hexane : ethyl acetate = 15 : 1) to afford 7-CH_2OAc-8-Cl tetralone O-methyl oxime (yellow oil, 870.2 mg, 79%).

^1H NMR ($CDCl_3$): 7.277 (1H, d, J=8.0), 7.060 (1H, d, J=7.6), 5.235 (2H, s), 4.025 (3H, s), 2.769 (2H, t, J=6.8), 2.617 (2H, t, J=6.0), 2.127 (3H, s), 1.775-1.710 (2H, m).

^{13}C NMR ($CDCl_3$): 170.75, 152.77, 143.79, 133.58, 131.27, 129.97, 129.12, 126.07, 64.42, 62.24, 30.81, 25.00, 21.03, 20.95. HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{16}ClNNaO_3^+$ 304.0711. Found: 304.0710.

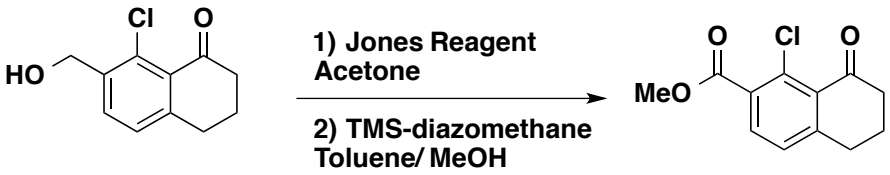


7-CH_2OAc-8-Cl tetralone methyl oxime (393.1 mg, 1.27 mmol) was dissolved in 8 mL of dioxane at room temperature. 4 M H_2SO_4 (12.0 mL) was added and stirred for 30 min. The whole was heated at reflux for 90 min and the solution was allowed to cool to room temperature. The whole was neutralized with 10% aqueous solution of NaOH and diluted with Et_2O. The whole was extracted with Et_2O and the solvent was evaporated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 3 : 2) to afford 7-CH_2OH-8-Cl tetralone (207.5 mg, 71%, white solid).

^{1}H NMR ($CDCl_3$): 7.591 (1H, d, J=8.0), 7.196 (1H, d, J=8.0), 4.814 (2H, s), 2.958 (2H, t, J=6.0), 2.695 (2H, t, J=6.4), 2.129-2.065 (3H, m). ^{13}C NMR ($CDCl_3$): 197.04, 146.04, 138.77, 132.29, 131.84, 130.18, 127.33, 62.82, 40.54, 30.62, 22.63.

Mp.: 175.0-179.0 ºC (recrystallized from ethyl acetate).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}ClNaO_2^+$ 233.0340. Found: 233.0343.



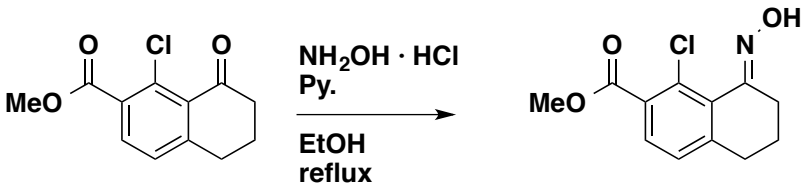
7-CH_2OH-8-Cl tetralone (196.3 mg, 0.93 mmol) was dissolved in 4.0 mL of acetone and cooled to 0 °C. Jones reagent (2.67 M, 1.0 mL) was added dropwise, and the whole was stirred for further 30 min. The solution was allowed to warm to room temperature and stirred for 1 hr. The reaction was quenched with 1.2 mL of isopropanol and the mixture was dispersed between water and dichloromethane. The organic phase was separated, washed with brine and dried over anhydrous sodium sulfate. The whole was concentrated to afford an off-white powder.

The above powder was dissolved in a mixed solution of methanol and toluene (1:9, 4.5 mL). TMS-diazomethane solution (2 M in Et_2O, 0.5 mL) was added dropwise at 0 °C. The whole was stirred for 5 min and the reaction was quenched with a minimum amount of acetic acid. The whole was evaporated and the residue was purified with column chromatography (n-hexane : ethyl acetate = 2 :1) to afford 7-COOMe-8-Cl tetralone (196.2 mg, white solid, 89%, 2 steps).

^{1}H NMR ($CDCl_3$): 7.627 (1H, d, J=8.0), 7.196 (1H, d, J=7.6), 3.921 (3H, s), 2.966 (2H, t, J=6.4), 2.702 (2H, t, J=6.8), 2.163-2.069 (2H, m). ^{13}C NMR ($CDCl_3$): 196.15, 166.67, 149.32, 132.77, 132.71. 132.56, 131.24, 127.14, 52.65, 40.36, 30.78, 22.28.

Mp.: 54.5-56.0 ºC (recrystallized from n-hexane/dichloromethane).

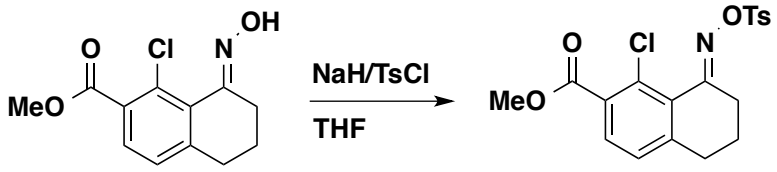
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{11}ClNaO_3^+$ 261.0289. Found: 261.0282.



7-COOMe-8-Cl tetralone (183.0 mg, 0.70 mmol) and hydroxyl ammonium chloride (97.3 mg, 1.4 mmol) were dissolved in ethanol (3.5 mL), and pyridine (0.2 mL) was added to the mixture. The whole was heated at reflux for 1 hr and the solvent was evaporated. The residue was purified with column chromatography (n-hexane : acetone = 1 :1) to afford 7-COOMe-8-Cl tetralone oxime (170.2 mg, white solid, 88%).

^{1}H NMR ($CDCl_3$): 8.806 (1H, brs), 7.538 (1H, d, J=8.0), 7.144 (1H, d, J=7.6), 3.951 (3H, s), 2.900 (2H, t, J=6.8), 2.686 (2H, t, J=6.0), 1.846-1.781 (2H, m). ^{13}C NMR ($CDCl_3$): 167.12, 153.58, 146.72, 132.04, 130.72, 129.97, 129.67, 126.10, 52.54, 31.11, 24.61, 20.77. Mp.: 173.5-176 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}ClNNaO_3^+$:276.0398. Found: 276.0398.



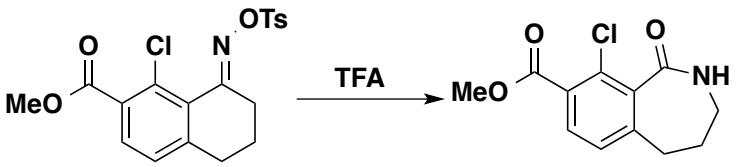
7-COOMe-8-Cl tetralone oxime (100.0 mg, 0.394 mmol) was dissolved in 1 mL of THF and cooled to 0 °C. A suspension of NaH (18.9 mg) in 1 mL THF was added dropwise and the reaction mixture was the whole was stirred at room temperature for 30 min. Tosyl chloride (78.3 mg, 0.411 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The whole was diluted with Et_2O and quenched by slow addition of water. The reaction was extracted with ethyl acetate. The solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate = 2 :1) to afford **10b** (130.4 mg, 81%, white solid).

^{1}H NMR ($CDCl_3$): 7.941 (2H, d, J=8.0), 7.551 (1H, d, J=8.0), 7.335 (2H, d, J=8.4), 7.115(1H, d, J=8.0), 3.913 (3H, s), 2.914 (2H, t, J=6.8), 2.668 (2H, t, J=6.4), 2.434 (3H, s) 1.786-1.722 (2H, m). ^{13}C NMR ($CDCl_3$): 166.63, 160.44, 147.40, 145.12, 132.72, 132.12, 131.20, 131.12, 129.50, 129.30, 128.53, 126.33, 52.62, 30.68, 26.17, 21.71, 20.16.

Anal. Calcd. for $C_{19}H_{18}ClNO_5S$: C 55.95, H 4.45, N 3.43. Found: C 55.55, H 4.51, N 3.41.

Mp.: 138.0-140.0 ºC (recrystallized from n-hexane/dichloromethane).

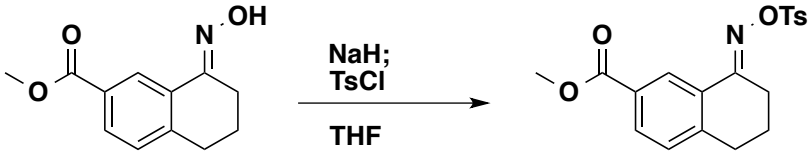
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{19}H_{18}ClNNaO_5S^+$ 430.0486. Found: 430.0498.



To 7-COOMe-8-Cl tetralone tosylated oxime **10b** (110.0 mg, 0.27 mmol) was added 2.7 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 1 hr and then poured onto crushed ice. The mixtrure was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =1:2) to afford alkyl-migrated lactam **11b** (66.4 mg, sticky oil, 97%) as the only migration product.

^{1}H NMR ($CDCl_3$): 7.722 (1H, d, J=8.0), 7.361 (1H, brs), 7.140 (1H, d, J=8.0), 3.915 (3H, s), 3.208-2.792 (4H, br), 2.149 (1H, brs), 1.732 (1H, brs). ^{13}C NMR ($CDCl_3$): 169.26, 166.21, 142.47, 135.02, 132.25, 131.31, 130.66, 126.66, 52.59, 38.79, 30.27, 29.68. Anal. Calcd. for $C_{12}H_{12}ClNO_3$: C 56.82, H 4.77, N 5.52. Found: C 56.88, H 4.94, N 5.36. HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}ClNNaO_3^+$ 276.0398. Found: 276.0399.

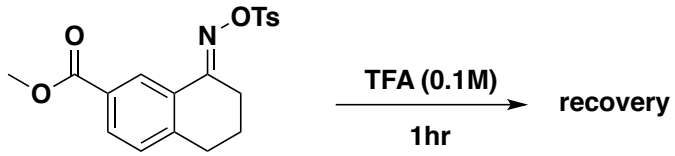
Synthesis of 10b-H



To a solution of 7-COOMe-tetralone oxime[28] (301.2 mg, 1.374 mmol) in 4.0 mL of THF was added a suspension of NaH (60.0 mg, 2.5 mmol) in 1 mL of THF at 0 ºC. The whole was stirred at ambient temperature for 1 hr and added tosyl chloride (286.1 mg, 1.5 mmol) in one portion. The whole was stirred for 5 min at room temperature and quenched with water. The whole was extracted with ethyl acetate and the solvent was concetrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 1: 1) to afford 7-COOMe tetralone tosyl oxime **10b-H** (460.5 mg, white solid, 90%).

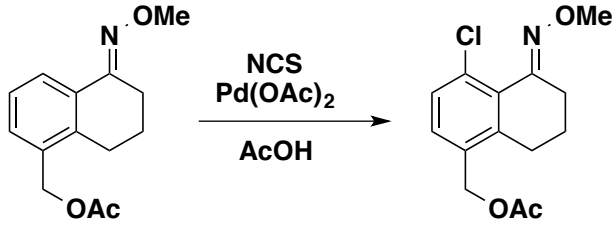
^{1}H NMR ($CDCl_3$): 8.506 (1H, d, J=1.6), 7.980-7.946 (3H, m), 7.367 (2H, d, J=8.0), 7.218 (1H, d, J=8.0), 3.932 (3H, s), 2.844 (2H, t, J=6.4), 2.779 (2H, t, J=6.4), 2.442 (3H, s), 1.880-1.816 (2H, quintet, J=6.4). ^{13}C NMR ($CDCl_3$): 166.39, 161.45, 145.74, 145.12, 132.64, 131.52, 129.58, 129.09, 129.04, 128.78, 128.45, 126.92, 52.20, 29.53, 25.20,

21.70, 20.64. Mp.: 142.0-144.5ºC (recrystallized from ethanol). HRMS (ESI-TOF, $[M+H]^+$): Calcd. for $C_{19}H_{20}NO_5S^+$ 374.1057. Found: 374.1060.



To 7-COOMe tetralone oxime tosylate **10b-H** (200.7 mg, 0.537 mmol) was added 5.37 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 1 hr and then poured onto crushed ice. The mixture was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =1:1) to recover the starting tosylate oxime (188.2 mg, white solid, 94%).

Synthesis of 10c

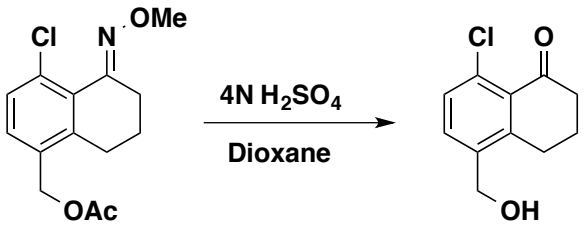


A mixture of 5-CH_2OAc tetralone methyl oxime (400.2 mg, 1.618 mmol), $Pd(OAc)_2$ (30.0 mg, 8% equiv.) and N-chlorosuccinimide (260.0 mg, 1.2 equiv.) in acetic acid (8.0 mL) was heated at 90 ºC with stirring for 30 min and the whole was cooled to room temperature. The whole was diluted with 50mL ethyl acetate and filtered through a pad of Celite. The filtrate was concentrated and purified with column chromatography (n-hexane: ethyl acetate =10: 1) to afford the desired chloride oxime (398.7 mg, colorless oil, 87%).

^{1}H NMR ($CDCl_3$): 7.334 (1H, d, J=8.0), 7.228 (1H, d, J=8.0), 5.116 (2H, s), 4.046 (3H, s), 2.796 (2H, t, J=7.2), 2.660 (2H, t, J=6.0), 2.101 (3H, s), 1.822-1.757 (2H, m).

^{13}C NMR ($CDCl_3$): 170.65, 166.53, 152.78, 142.80, 132.37, 131.21, 130.00, 129.28, 63.86, 62.21, 26.25, 24.67, 20.88, 20.81.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{14}H_{16}ClNNaO_3^+$: 304.0711. Found: 304.0705.



To a solution of 5-CH_2OAc-8-Cl tetralone methyl oxime (379.0 mg, 1.345 mmol) in dioxane (6.0 mL) was added 4 M H_2SO_4 (11.0 mL). The mixture was heated to reflux and stirred for 1 hr, and the reaction mixture was cooled to ambient temperature. The whole was diluted with ethyl acetate and concentrated. The residue was purified with column chromatography (n-hexane: ethyl acetate= 7: 3) to afford the 5-CH_2OH-8-Cl tetralone (225.3 mg, white solid, 80%).

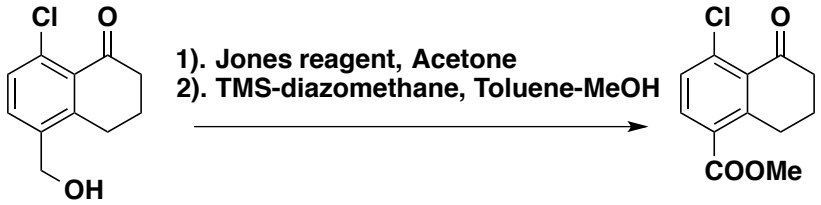
^{1}H NMR ($CDCl_3$): 7.486 (1H, d, J=8.4), 7.360 (1H, d, J=8.4), 4.740 (2H, d, J=5.2), 2.973 (2H, t, J=6.0), 2.710 (2H, t, J=6.4), 2.191-2.117 (2H, m), 1.788 (1H, t, J=1.6).

^{13}C NMR ($CDCl_3$): 196.92, 144.72, 137.12, 133.63, 131.82, 130.51, 129.97, 62.65, 40.07, 26.26, 22.14.

Anal. Calcd. for $C_{11}H_{11}ClO_2$: C 62.72, H 5.26, N 0.00. Found: C 62.36, H 5.28, N 0.00.

Mp.: 103.0-107.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}ClNaO_2^+$: 233.0340. Found: 233.0329.



5-CH_2OH-8-Cl tetralone (231.7 mg, 1.10 mmol) was dissolved in 5.0 mL of acetone and the solution was cooled to 0 ºC. The Jones reagent (2.67 M, 1.1 mL, 2.67 equiv.) was added dropwise at the same temperature and the whole was stirred at ambient temperature for 30 min. i-PrOH (0.7 mL) was added to quench the reaction, and the reaction mixture was dispersed between $CHCl_3$ and water. The organic phase was separated and concentrated to afford 5-COOH-8-Cl- tetralone as a white powder.

The above powder was dissolved in a mixed solvent of toluene (9.0 mL) and methanol (1.0 mL) at 0 ºC. A solution of TMS-diazomethane in Et_2O (2.0 M, 0.6 mL) was added dropwise, and the whole was diluted with 20 mL of toluene. The reaction was quenched with a minimum amount of acetic acid and the solvent was evaporated. The residue was

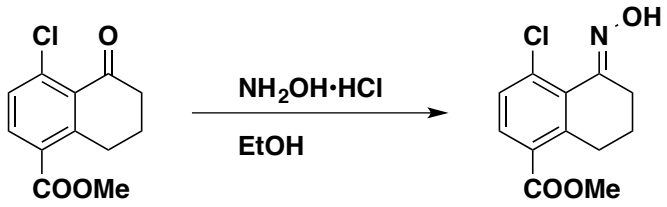
purified with column chromatography (n-hexane: ethyl acetate= 4: 1) to afford the desired 5-COOMe-8-Cl tetralone (228.1 mg, white solid, 87%).

^{1}H NMR ($CDCl_3$): 7.875 (1H, d, J=8.4), 7.390 (1H, d, J=8.4), 3.913 (3H, s), 3.291 (2H, t, J=6.0), 2.706 (2H, t, J=6.4), 2.123-2.058 (2H, m). ^{13}C NMR ($CDCl_3$): 196.44, 166.83, 148.01, 138.34, 134.04, 131.52, 129.95, 128.80, 52.36, 39.81, 28.27, 22.11.

Anal. Calcd. for $C_{12}H_{11}ClO_3$: C 60.39, H 4.65, N 0.00. Found: C 60.17, H 4.72, N 0.00.

Mp.: (recrystallized from dichloromethane) 101.0-102.5 ºC.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{11}ClNaO_3^+$: 261.0289. Found: 261.0307.



5-COOMe-8-Cl tetralone (154.8 mg, 0.649 mmol) was dissolved in 5.0 mL of ethanol and then NH_2OH•HCl (60.0 mg, 1.33 equiv.) was added to this solution. The whole was heated at reflux with stirring for 7 hr. The mixture was concentrated and purified with column chromatography (n-hexane : ethyl acetate = 10 : 1) to afford 5-COOMe-8-Cl tetralone oxime (148.5 mg, white solid, 90%).

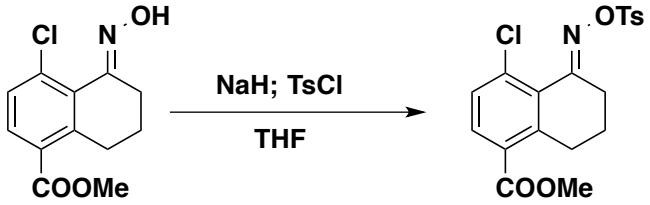
^{1}H NMR ($CDCl_3$): 8.512 (1H, s), 7.700 (1H, d, J=8.4), 7.371 (1H, d, J=8.8), 3.897 (3H, s), 3.018 (2H, t, J=6.0), 2.863 (2H, t, J=6.8), 1.792-1.726 (2H, m).

^{13}C NMR ($CDCl_3$): 167.31, 154.12, 145.56, 135.68, 130.80, 130.53, 129.07, 128.16, 52.23, 27.64, 24.37, 20.66.

Anal. Calcd. for $C_{12}H_{12}ClNO_3$: C 56.82, H 4.77, N 5.52. Found: C 56.72, H 4.90, N 5.26.

Mp.: 130.0-131.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}ClNNaO_3^+$: 276.0398. Found: 276.0401.



5-COOMe-8-Cl tetralone oxime (140.9 mg, 0.555 mmol) was dissolved in 3.0 mL of THF and the solution was cooled to 0 ºC. A suspension of NaH (50.0 mg, 2.08 mmol) in

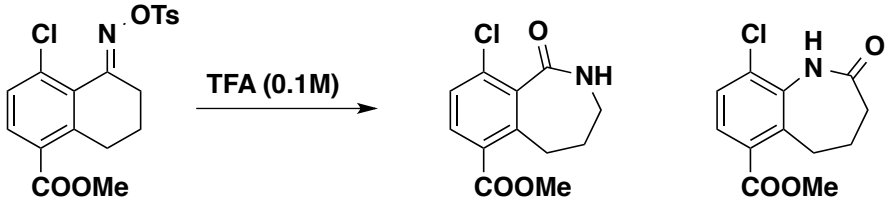
2.0 mL of THF was added dropwise at the same temperature, and the whole was warmed to room temperature and the whole was stirred for 30 min. Tosyl chloride (116.4 mg, 1.1 equiv.) was added in one portion at 0 ºC, and the whole was stirred for 30 min. The whole was diluted with Et_2O and quenched with water. The organic phase was separated and concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 6 : 1) to afford **10c** (179.9 mg, white solid, 80%).

^{1}H NMR ($CDCl_3$): 7.938 (2H, d, J=8.4), 7.740 (1H, d, J=7.6), 7.342-7.309 (3H, m), 3.881 (3H, s), 3.016 (2H, t, J=6.0), 2.903 (2H, t, J=6.8), 2.438 (3H, s), 1.754-1.690 (2H, m). ^{13}C NMR ($CDCl_3$): 166.83, 160.80, 146.29, 145.05, 140.07, 136.70, 132.78, 132.03, 129.45, 129.31, 128.52, 128.31, 52.35, 27.38, 26.01, 21.69, 20.08.

Anal. Calcd. for $C_{19}H_{18}ClNO_5S$ + 0.2 C_3H_6O: C 56.12, H 4.61, N 3.34. Found: C 55.90, H 4.61, N 2.96.

Mp.: 112.5-115.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{19}H_{18}ClNNaO_5S^+$: 430.0486. Found: 430.0485.



TFA (1.89 mL) was added to 5-COOMe-8-Cl tetralone tosyl oxime **10c** (77.0 mg, 0.189 mmol) at 0 ºC, and the whole was stirred at 20 ºC for 3 hr. The reaction was quenched with ice and the whole was extracted with chloroform. The combined organic phase was washed with brine, dried over sodium sulfate and concentrated. The residue was purified with column chromatography (n-hexane: ethyl acetate= 4: 1 to 1: 1) to afford the alkyl migration product **11c** (30.4 mg, white solid, 63%) and benzene migration product **12c** (15.1 mg, light-yellow solid, 32%).

Alkyl migration prouct **11c**

^{1}H NMR ($CDCl_3$): 7.829 (1H, d, J=8.8), 7.406 (1H, d, J=8.4), 6.668 (1H, br), 3.911 (3H, s), 3.724-3.680 (1H, br), 3.248-3.212 (1H, br), 2.950 (1H, brs), 2.646- 2.632 (1H, br), 2.176-2.130 (1H, br), 1.954-1.940 (1H, br).^{13}C NMR ($CDCl_3$): 168.98, 167.07, 140.60, 135.98, 135.23, 132.52, 128.56, 128.36, 52.42, 39.14, 30.13, 26.63.

Anal. Calcd. for $C_{12}H_{12}ClNO_3$: C 56.82, H 4.77, N 5.52. Found: C 56.61, H 4.89, N 5.50.

Mp.: 134.0-135.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}ClNNaO_3^+$: 276.0398. Found: 276.0406.

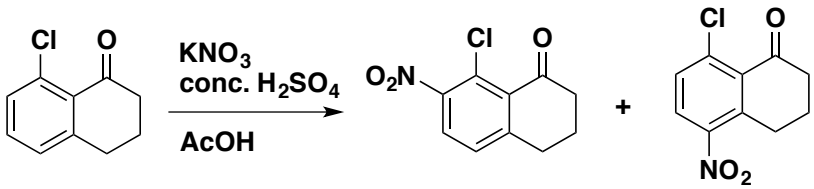
Benzene migration product **12c**

^{1}H NMR ($CDCl_3$): 7.568 (1H, d, J=8.4), 7.290-7.279 (2H, m), 3.844 (3H, s), 3.037 (2H, t, J=2.8), 2.302-2.267 (4H, m). ^{13}C NMR ($CDCl_3$): 173.83, 167.07, 137.38, 136.48, 130.23, 129.65, 127.79, 127.28, 52.44, 32.90, 28.22, 28.03.

Mp.: 110.0-111.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{12}ClNNaO_3^+$: 276.0398. Found: 276.0414.

Synthesis of 10d and 10e



To potassium nitrate (2.00 g, 19.8 mmol) was slowly added concentrated sulfuric acid (80.0 mL) at 0 °C. The whole was stirred for 30 min and cooled to -15 °C. A solution of 8-Cl tetralone (3.00 g, 16.6 mmol) in acetic acid (20 mL) was added to the solution dropwise. After addition, the reaction was quenched by slow transfer of the mixture to crushed ice, and neutralized with 50% aqueous solution of NaOH. The mixture was extracted with dichloromethane and concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =1:1) to afford 7-nitro-8-Cl tetralone (latter fraction, 1.3553g, yellow solid, 36%) and 5-nitro-8-Cl tetralone (earlier fraction, 1.1158 g, yellow sticky oil, 30%).

7-nitro-8-Cl tetralone:

$^{1-}$H NMR ($CDCl_3$): 7.695 (1H, d, J=8.0), 7.312 (1H, d, J=8.0), 3.036 (2H, d, J=6.0), 2.751 (2H, t, J=6.8), 2.189-2.124 (2H, m).

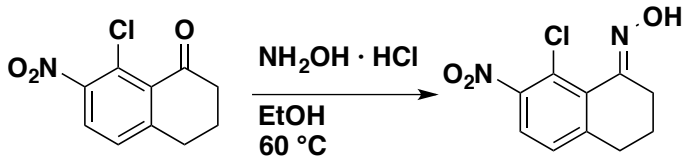
$^{13-}$C NMR ($CDCl_3$): 195.08, 149.84, 143.54, 131.55, 127.90, 126.89, 126.34, 40.08, 30.77, 20.10.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_8ClNNaO_3^+$: 248.0085. Found: 248.0077.

5-nitro-8-Cl tetralone:

^{1}H NMR ($CDCl_3$): 7.893 (1H, d, J=8.4), 7.495 (1H, d, J=8.4), 3.172 (2H, t, J=6.0), 2.757 (2H, t, J=6.8), 2.183-2.119 (2H, m).

^{13}C NMR ($CDCl_3$): 194.87, 147.96, 140.79, 139.44, 131.88, 130.89, 127.74, 39.52, 26.98, 21.84. HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_8ClNNaO_3^+$: 248.0085. Found: 248.0117.

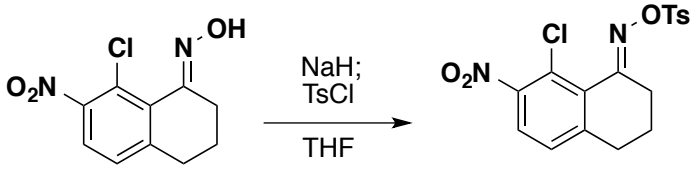


To a solution of 7-nitro-8-Cl tetralone (899.9 mg, 3.99 mmol) in 10.0 mL of ethanol was added hydroxylamine hydrochloride (554.4 mg, 7.8 mmol). The whole was heated at 60 °C with stirring for 1 hr. The solution was cooled to 0 °C and the resultant precipitate was filtered, and the solid was washed with water and hexane to afford 7-NO_2-8-Cl tetralone oxime (433.0 mg, 45%, white solid).

^{1}H NMR (CD_3OD): 7.617 (1H, d, J=8.0), 7.332 (1H, d, J=8.0), 2.844 (2H, t, J=6.8), 2.739 (2H, t, J=6.0), 1.848-1.783 (2H, m).

^{13}C NMR (CD_3OD): 151.81, 146.94, 146.15, 132.00, 126.67, 122.86, 122.36, 29.42, 23.75, 20.59.

Anal. Calcd. for $C_{10}H_9ClN_2O_3$: C 49.91, H 3.77, N 11.64. Found: C 49.90, H 3.88, N 11.57. Mp.: 203.0-205.0 °C (recrystallized from ethanol). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_9ClN_2NaO_3^+$: 263.0194. Found: 263.0193.



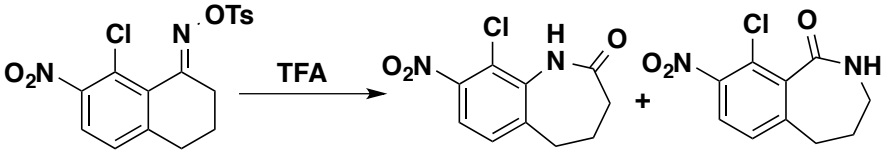
To a solution of 7-nitro-8-Cl oxime (350.0 mg, 1.45 mmol) in 5.0 mL of THF was added tosyl chloride (292.0 mg, 1.53 mmol), followed by the addition of a suspension of NaH (70.0 mg, 2.92 mmol) in 2.0 mL of THF. The whole was stirred for 15 min and diluted with Et_2O. Water was added and the organic layer was separated. The solvent

was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate =6 : 1) to afford **10d** (452.9 mg, 79%, yellow solid).

^{1}H NMR (CD_3CN): 7.900-7.870 (2H, m), 7.692 (1H, d, J=8.4), 7.437-7.415 (2H, m, J=8.0), 7.346 (1H, d, J=8.4), 2.892 (2H, t, J=6.8), 2.722 (2H, t, J=6.4), 2.422 (3H, s), 1.776-1.712 (2H, m). ^{13}C NMR (CD_3CN): 162.08, 150.48, 149.97, 147.06, 133.48, 130.82, 129.97, 129.82, 129.00, 126.33, 124.12, 31.07, 26.72, 21.70, 20.56. Anal. Calcd. for $C_{17}H_{15}ClN_2O_5S$: C 51.72, H 3.83, N 7.10. Found: C 51.42, H 3.94, N 6.97.

Dec.: 151.0 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{17}H_{15}ClN_2NaO_5S^+$: 417.0282. Found: 417.0282.



To 7-nitro-8-Cl tetralone tosyl oxime **10d** (117.6 mg, 0.3 mmol) was added 3.0 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 17 hr and then poured onto crushed ice. The mixture was diluted with chloroform, and the combined organic layer was washed with brine, dried over Na_2SO_4 and concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =2:1) to afford alkyl-migrated lactam **11d** (64.5 mg, white solid, 90%) and benzene migration lactam **12d** (2.4 mg, off-white solid, 3.3%)

Alkyl migration **11d**

^{1}H NMR ($CDCl_3$): 7.791 (1H, d, J=8.0), 7.442 (1H, brs), 7.267 (1H, d, J=8.0), 3.234-2.903 (4H, br), 2.181-1.862 (2H, br).

^{13}C NMR ($CDCl_3$): 167.98, 148.30, 143.42, 135.82, 127.55, 126.34, 125.16, 38.72, 30.315, 29.58.

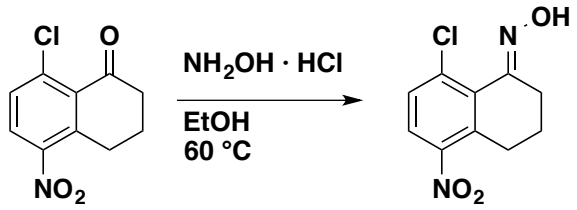
Anal. Calcd. for $C_{10}H_9ClN_2O_3$: C 49.91, H 3.77, N 11.64. Found: C 49.89, H 3.92, N 11.47. Mp.: 161.0-163.5 °C (recrystallized from n-hexane/dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_9ClN_2NaO_3^+$ 263.0194. Found: 263.0195.

Benzene migration **12d**

^{1}H NMR ($CDCl_3$): 7.661 (1H, d, J=8.4), 7.358 (1H, brs), 7.295 (1H, d, J=8.4), 2.909 (2H, t, J=7.2), 2.404 (2H, t, J=7.6), 2.339-2.267 (2H, m). ^{13}C NMR ($CDCl_3$): 173.05,

153.16, 148.47, 140.38, 137.22, 128.28, 121.69, 32.71, 31.22, 37.87. Mp.: 182.0-184.5 (recrystallized from chloroform).

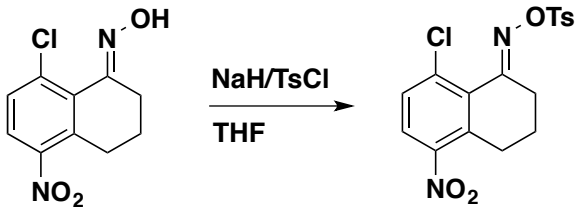
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_9ClN_2NaO_3^+$ 263.0194. Found: 263.0206.



To a solution of 5-nitro-8-Cl tetralone (693.1 mg, 3.07 mmol) in 10 mL of ethanol was added hydroxylamine hydrochloride (430.0 mg, 6.19 mmol). The whole was heated at reflux with stirring for 1 hr. The solution was concentrated and purified with column chromatography (n-hexane : ethyl acetate = 4 : 1) to afford 5-NO_2-8-Cl tetralone oxime (499.7 mg, 68%, white solid).

^{1}H NMR ($CDCl_3$): 9.379 (1H, s), 7.719 (1H, d, J=8.8), 7.466 (1H, d, J=8.8), 2.919-2.873 (4H, m), 1.841-1.776 (2H, m).^{13}C NMR ($CDCl_3$): 152.98, 147.87, 138.42, 136.50, 131.76, 129.88, 124.20, 26.57, 24.37, 20.34. Mp.: 160.0-162.0 °C (recrystallized from ethanol).

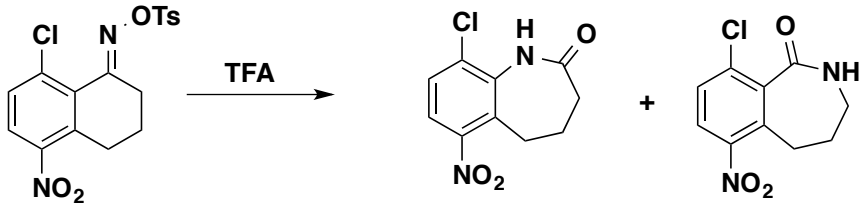
Anal. Calcd. for $C_{10}H_9ClN_2O_3$: C 49.91, H 3.77, N 11.64. Found: C 49.97, H 3.82, N 11.66.



To a solution of 5-nitro-8-Cl tetralone oxime (200.0 mg, 0.93 mmol) in 3.0 mL of THF was added tosyl chloride (174. 4 mg, 0.91 mmol), followed by the addition of a suspension of NaH (40.0 mg, 1.67mmol) in 1.0 mL of THF. The whole was stirred for 1 hr at room temperature and diluted with Et_2O. The reaction was quenched with water and extracted with ethyl acetate. The solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate = 4 : 1) to afford **10e** (305.6 mg, 93%, yellow solid).

^{1}H NMR ($CDCl_3$): 7.931 (2H, d, J=7.6), 7.762, (1H, d, J=8.8), 7.425 (1H, d, J=8.8), 7.345 (2H, d, J=8.0), 2.943 (2H, t, J=6.8), 2.891 (2H, t, J=6.4), 2.447 (3H, s), 1.810-1.745 (2H, m). ^{13}C NMR ($CDCl_3$): 159.68, 147.74, 145.34, 139.17,137.75, 132.49, 130.86, 130.16, 129.54, 129.32, 125.63, 26.33, 25.81, 21.71, 19.80.

Anal. Calcd. for $C_{17}H_{15}ClN_2O_5S$: C 51.72, H 3.83, N 7.10. Found: C 51.39, H 3.87, N 6.78. Dec.: 110.0 °C (recrystallized from n-hexane/dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{17}H_{15}ClN_2NaO_5S^+$: 417.0282. Found 417.0261.



To 5-nitro-8-Cl tetralone O-tosyl oxime **10e** (115.9 mg, 0.29 mmol) was added 2.9 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 48 hr and poured onto crushed ice. The mixtrure was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =2:1) to afford alkyl-migrated lactam **11e** (57.9 mg, white solid, 78%) and benzene migration lactam **12e** (9.2 mg, yellow solid, 12%).

Alkyl migration **11e**

^{1}H NMR ($CDCl_3$): 7.845 (1H, d, J=8.8), 7.546 (1H, brs), 7.511 (1H, d, J=8.8), 3.323 (2H, brs), 2.994 (1H, brs), 2.713 (1H, brs), 2.242 (1H, brs), 2.059 (1H, brs). ^{13}C NMR ($CDCl_3$): 167.90, 147.88, 136.99, 136.01, 133.82, 129.60, 126.30, 39.00, 29.74, 25.90.

Anal. Calcd. for $C_{10}H_9ClN_2O_3$: C 49.91, H 3.77, N 11.64. Found: C 49.69, H 3.91, N 11.49. Mp.: 140.0-142.0 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_9ClN_2NaO_3^+$:263.0194. Found: 263.0182.

Benzene migration **12e**

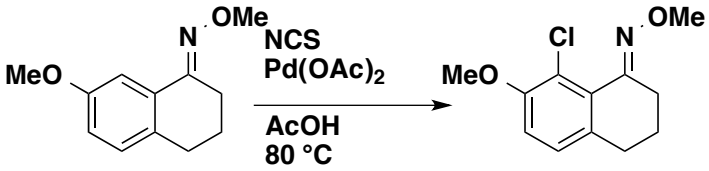
^{1}H NMR ($CDCl_3$): 7.695 (1H, d, J=8.4), 7.491-7.469 (2H, m), 3.012-2.977 (2H, m), 2.482-2.454 (4H, m). ^{13}C NMR ($CDCl_3$): 173.19, 149.37, 137.44, 130.79, 130.37, 127.95, 121.44, 32.96, 27.71, 27.66.

Mp.: 151.0-153.0 ºC (recrystallized from chloroform).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_9ClN_2NaO_3^+$: 263.0194. Found: 263.0184.

.

Synthesis of 10f

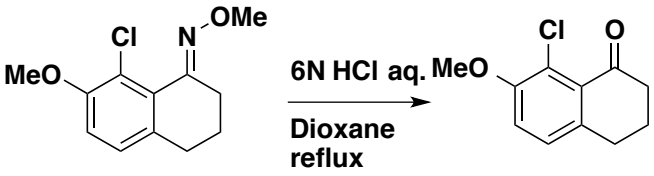


A mixture of 7-OMe tetralone methyl oxime (1.2964 g, 6.316 mmol), N-chlorosuccinimide (930.0 mg, 7.6 mmol) and palladium diacetate (113.5 mg, 0.5 mmol) in 35 mL of AcOH was heated at 80 °C with stirring for 3 hr and the solvent was evaporated. The residue was filtered through celite and the filtrate was purified with column chromatography (n-hexane : ethyl acetate =15 : 1) to yield 7-OMe-8-Cl tetralone methyl oxime (1.1991 g, 91%, colorless oil)

^{1}H NMR ($CDCl_3$): 7.010 (1H, d, J=8.4); 6.841 (1H, d, J=8.4); 4.032 (3H, s), 3.888 (3H, s); 2.753 (2H, t, J=6.8); 2.570 (2H, t, J=6.0); 1.760-1.696 (2H, m).

^{13}C NMR ($CDCl_3$): 154.68, 153.02, 135.48, 130.38, 126.14, 120.67, 112.09, 62.22, 56.60, 30.23, 24.96, 21.32.

HRMS (ESI-TOF $[M+Na]^+$): Calcd. for $C_{12}H_{14}ClNNaO_2^+$: 262.0605. Found: 262.0598.



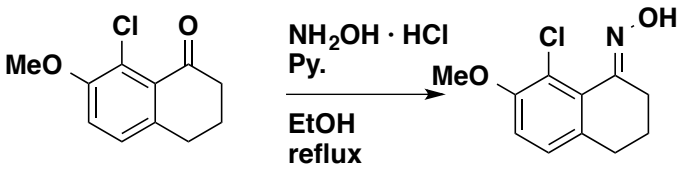
7-OMe-8-Cl-Tetralone O-methyl oxime (1.1778 g, 5.591 mmol) was dissolved in 30 mL of dioxane and to this solution was added 45 mL of 6 M aqueous solution of HCl. The whole was heated at reflux for 1 hr. The whole was extracted with ethyl acetate and the organic layer was concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate=6:1) to afford 7-OMe-8-Cl tetralone (1.0071g, 86%, white solid).

^{1}H NMR ($CDCl_3$): 7.135 (1H, d, J=8.8), 7.050 (1H, d, J=8.4), 3.908 (3H, s), 2.900 (2H, t, J=6.4), 2.676 (2H, t, J=6.4), 2.108-2.043 (2H, m). ^{13}C NMR($CDCl_3$): 196.81, 154.50, 138.11, 130.77, 127.17, 122.45, 115.85, 56.50, 40.29, 29.87, 22.64.

Anal. Calcd. for $C_{11}H_{11}ClO_2$: C 62.72, H 5.26, N 0.00. Found: C 62.56, H 5.41, N 0.00.

Mp.: 67.5-68.0 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}ClNaO_2^+$: 233.0340. Found: 233.0346.

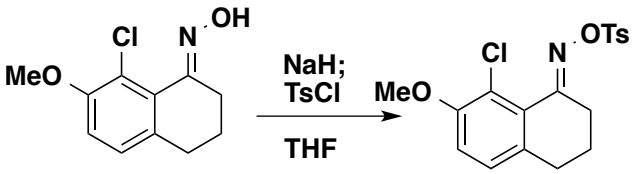


7-OMe-8-Cl-Tetralone (842.6 mg, 4.0 mmol) and hydroxyl ammonium chloride (556.0 mg, 8.0 mmol) was dissolved in ethanol (20.0 mL), and pyridine (2.0 mL) was added to the solution. The whole was heated at reflux for 1 hr and the solution was concentrated. The residue was washed with water, dried and recrystallized from n-hexane/dichloromethane to afford the 7-OMe-8-Cl tetralone oxime (799.2 mg, 86%, white solid).

^{1}H NMR ($CDCl_3$): 8.963 (1H, brs), 7.060 (1H, d, J=8.4), 6.886 (1H, d, J=8.0), 3.927 (3H, s), 2.873 (2H, t, J=6.8), 2.615 (2H, t, J=6.4), 1.801-1.771 (2H, m).

^{13}C NMR($CDCl_3$): 154.57, 154.37, 135.54, 130.28, 126.35, 120.38, 112.19, 56.57, 30.30, 24.64, 21.23. Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.55, H 5.36, N 6.21. Found: C 58.52, H 5.44, N 6.21. Mp.: 209.5-210.5ºC (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0454.



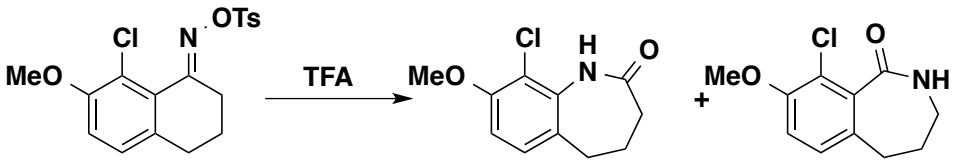
7-OMe-8-Cl-Tetralone oxime (203.0 mg, 0.90 mmol) was dissolved in 3 mL of THF and the solution was cooled to 0 °C. A suspension of NaH (43.2 mg, 1.8 mmol) in 3.0 mL of THF was added dropwise and the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (188.7 mg, 0.99 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The reaction was quenched by slow addition of water, and additional water was added to afford a white precipitate. The solid was collected, washed with water and n-hexane, and dried to afford 7-OMe-8-Cl tetralone tosyl oxime **10f** (313.5 mg, off-white solid, 92%).

^{1}H NMR ($CDCl_3$): 7.977-7.951 (2H, m), 7.338 (2H, d, J=8.0), 7.040 (1H, d, J=8.4), 6.905 (1H, d, J=8.4), 3.883 (3H, s), 2.892 (2H, t, J=5.2), 2.599 (2H, t, J=6.0), 2.433(3H,

s), 1.765-1.717 (2H, m). ^{13}C NMR($CDCl_3$): 161.03, 154.59, 144.99, 136.16, 132.76, 129.87, 129.43, 127.96, 126.67, 121.30. 113.67, 56.59, 29.85, 26.20, 21.72, 20.65.

Anal. Calcd. for $C_{18}H_{18}ClNO_4S$: C 56.91, H 4.78, N 3.69. Found: C 56.93, H 4.80, N 3.57. Dec.: 131.5 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}ClNNaO_4S^+$: 402.0537. Found: 402.0550.



To 7-OMe-8-Cl tetralone tosyl oxime **10f** (186.0 mg, 0.5 mmol) was added 5.0 mL of TFA at 0 °C. The whole was stirred at 20 °C for 1 hr and poured onto crushed ice. The mixture was extracted with chloroform and the solvent was concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate =1:1) to afford alkyl migration product **11f** (76.9 mg, 68%, white solid) and benzene migration product **12f** (26.0 mg, 23%, white solid).

Alkyl migration **11f**

^{1}H NMR ($CDCl_3$): 7.029 (1H, d, J=8.0), 6.923 (1H, d, J=8.4), 6.545 (1H, brs), 3.897 (3H, s), 3.086-3.073 (2H, br), 2.760 (2H, brs), 1.892 (2H, brs).

^{13}C NMR ($CDCl_3$): 169.48, 154.41, 134.26, 130.60, 127.06, 120.99, 113.39, 56.38, 38.94, 29.99, 29.30. Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.54, H 5.36, N 6.21. Found: C 58.33, H 5.38, N 6.09. Mp.: 151.0-154.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0455.

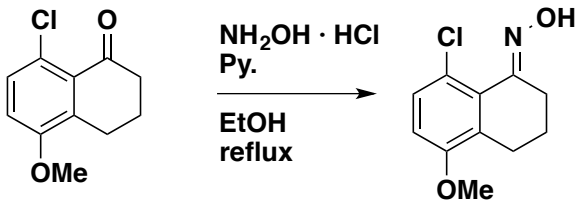
Benzene migration **12f**

^{1}H NMR (CD_2Cl_2): 7.244 (1H, brs), 7.081 (1H, d, J=8.4), 6.729 (1H, d, J=8.4), 3.905 (3H, s), 2.765 (2H, t, J=7.2), 2.366 (2H, t, J=7.2), 2.247-2.172 (2H, m).

^{13}C NMR (CD_2Cl_2): 173.99, 154.35, 136.04, 127.77, 127.46, 114.45, 108.33, 56.41, 32.98, 30.16, 28.40. Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.54, H 5.36, N 6.21. Found: C 58.20, H 5.37, N 6.16. Mp.: 155.5-160.5°C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0447.

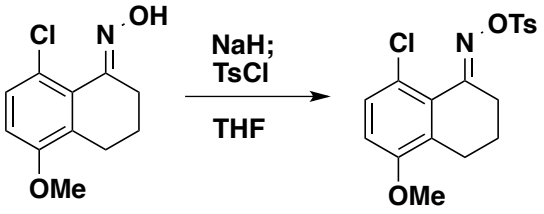
Synthesis of 10g



5-MeO-8-Cl-Ketone[5] (539.4 mg, 2.56 mmol) and hydroxyl ammonium chloride (311.3 mg, 4.48 mmol) were dissolved in ethanol (5 mL), and pyridine (0.5 mL) was added to this solution. The mixture was heated at reflux for 1 hr. The whole was cooled to 0 ºC and the resultant solid was collected, washed with water and cold ethanol to afford 5-MeO-8-Cl tetralone oxime (481.9 mg, 83%).

^{1}H NMR ($CDCl_3$): 7.284 (2H, m), 6.775 (1H, d, J=8.8), 3.841 (3H, s). 2.872 (2H, t, J=6.8), 2.689 (2H, t, J=6.0), 1.817-1.752 (2H, m). ^{13}C NMR ($CDCl_3$): 154.75, 154.37, 132.37, 129.84, 129.25, 122.82, 111.04, 55.82, 24.47, 22.74, 20.67. Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.55, H 5.36, N 6.21. Found: C 58.30, H 5.42, N 6.15. Mp.: 182.5-185.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$:248.0449. Found: 248.0443.

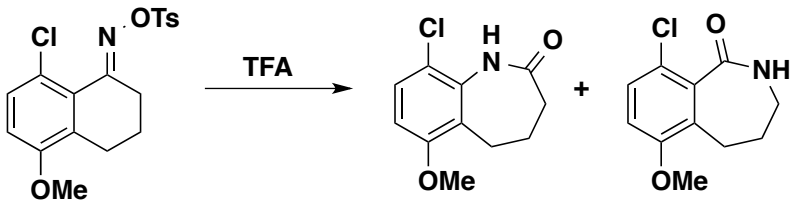


5-MeO-8-Cl-Tetralone oxime (200.0 mg, 0.89 mmol) was dissolved in THF (3 mL) at 0 °C. A suspension of NaH (42.5 mg, 1.8 mmol) in 1 mL of THF was added and the whole was stirred for 30 min at room temperature. Tosyl chloride (178.2mg, 0.94 mmol) was added at 0°C and the whole was stirred for 1 hr. The reaction was quenched by water (20 mL) and the resultant solid was collected. The solid was washed with water and n-hexane, and dried to afford 5-OMe 8-Cl tetralone O-tosyl oxime **10g** as a white powder (312.2 mg, 92%).

^{1}H NMR (CD_3OD): 7.908 (2H, d, J=8.4), 7.427 (2H, d, J=8.8), 7.268 (1H, d, J=8.8), 6.988 (1H, d, J=8.8), 3.841 (3H, s), 2.860 (2H, t, J=6.8), 2.694 (2H, t, J=6.4), 2.461 (3H, s), 1.779-1.714 (2H, m).

^{13}C NMR (CD_2Cl_2): 161.73, 155.01, 145.28, 133.48, 132.81, 129.49, 129.44, 129.12, 127.26, 122.20, 112.50, 55.84, 25.93, 22.55, 21.40, 20.14.

Anal. Calcd. for $C_{18}H_{18}ClNO_4S$: C 56.92, H 4.78, N 3.69. Found: C 57.15, H 4.90, N 3.75. Dec.: 146.5 °C (recrystallized from n-hexane/dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}ClNNaO_4S^+$: 402.0537. Found: 402.0521.



TFA (5 mL) was added to 5-MeO-8-Cl-O-tosyl oxime **10g** (174.9 mg, 0.5 mmol) at 0°C. The whole was stirred at 20 ºC for 1 hr. The whole was poured onto crushed ice and extracted with chloroform. The solvet was removed and the residue was purified with column chromatography (n-hexane : AcOEt =1:1) to afford alkyl-migrated lactam **11g** (66.3 mg, white solid, 64%) and benzene-migrated lactam **12g** (25.0 mg, off-white sold, 24%).

Alkyl-migrated lactam **11g**

^{1}H NMR ($CDCl_3$, 40 °C): 7.297 (1H, d, J=8.8), 6.890 (1H, d, J=8.8), 6.689 (1H, brs), 3.845 (3H, s), 3.085-2.915 (4H, br), 1.885 (2H, brs). ^{13}C NMR($CDCl_3$): 169.72, 154.76, 134.25, 128.95, 127.68, 123.24, 113.15, 56.01, 39.24, 29.26, 21.33.

Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.55, H 5.36, N 6.21. Found: C 58.44, H 5.38, N 6.22. Mp.: 158.5-160.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$:248.0449. Found: 248.0454.

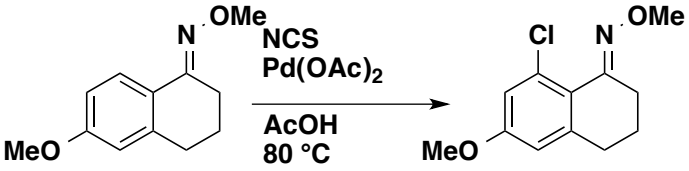
Benzene-migrated lactam **11g**

^{1}H NMR ($CDCl_3$): 7.263-7.217 (2H, m), 6.670 (1H, d, J=8.8), 3.827 (3H, s), 2.884 (2H, t, J=7.2), 2.358 (2H, t, J=7.6), 2.232-2.044 (2H, m). ^{13}C NMR ($CDCl_3$): 174.12, 156.21, 135.81, 127.25, 124.34, 117.59, 108.50, 55.97, 33.32, 27.72, 22.67.

Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.55, H 5.36, N 6.21. Found: C 58.58, H 5.44, N 6.07. Mp.: 159.5-162.0 °C (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0456.

Synthesis of 10h

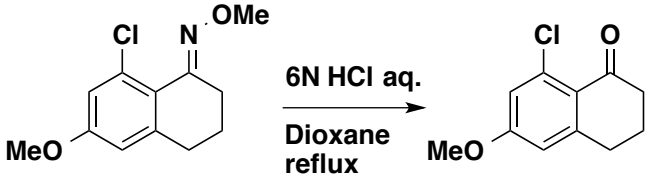


A mixture of 6-MeO-tetralone O-methyl oxime (1.5460g, 7.53 mmol), N-chlorosuccinimide (1.1060g, 9.04 mmol) and palladium diacetate (135.3 mg, 0.60 mmol) in 40 mL of AcOH was heated at 80 °C with stirring for 1 hr. The solvent was removed and the residue was diluted with ethyl acetate and filtered with celite. The filtrate was purified with column chromatography (n-hexane : ethyl acetate =15 : 1) to yield 6-OMe-8-Cl-tetralone O-methyl oxime (1.269 g, 73%, colorless oil).

^{1}H NMR ($CDCl_3$): 6.860 (1H, d, J=2.4), 6.602 (1H, d, J=2.8), 4.004 (3H, s), 3.789 (3H, s); 2.740 (2H, t, J=6.8), 2.597 (2H, t, J=6.0), 1.753-1.700 (2H, m).

^{13}C NMR ($CDCl_3$): 158.82, 152.41, 144.59, 132.57, 121.66, 114.95, 112.18, 61.84, 55.24, 31.15, 24.88, 20.83.

HRMS (ESI-TOF $[M+H]^+$): Calcd. for $C_{12}H_{14}ClNNaO_2^+$:262.0605. Found: 262.0610.



6-OMe-8-Cl Tetralone O-methyl oxime (1.1418 g, 4.76 mmol) was dissolved in 25 mL of dioxane and 40 mL of 6 M aqueous solution of HCl was added to this solution. The whole was heated at reflux for 1 hr and cooled to room temperature. The whole was extracted with ethyl acetate and concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate =4:1) to afford 6-OMe-8-Cl tetralone (895.3 mg, 89%, yellow solid).

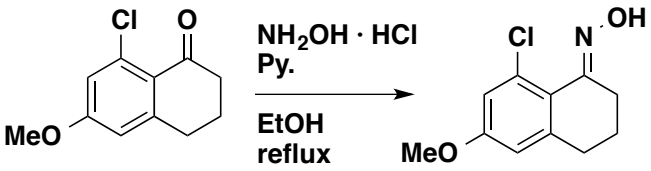
^{1}H NMR ($CDCl_3$): 6.851 (1H, d, J=2.8), 6.648 (1H, d, J=2.4), 3.838 (3H, s), 2.923 (2H, t, J=6.0), 2.635 (2H, t, J=6.8), 2.092-2.028 (2H, m).

^{13}C NMR($CDCl_3$): 195.51, 162.03, 148.88, 136.50, 123.44, 116.24, 112.60, 55.71, 40.39, 31.55, 22.65.

Anal. Calcd. for $C_{11}H_{11}ClO_2$: C 62.72, H 5.26, N 0.00. Found: C 62.51, H 5.18, N 0.00.

Mp.: 79.5-80.0 °C(recrystallized from n-Hex/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}ClNaO_2^+$: 233.0340. Found: 233.03343.



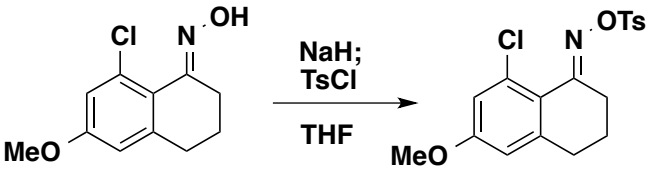
6-OMe-8-Cl-Tetralone (862.2 mg, 4.09 mmol) and hydroxyl ammonium chloride (570.0 mg, 8.20 mmol) were dissolved in ethanol (18.0 mL), and pyridine (2.0 mL) was added to this solution. The whole was heated at reflux for 1 hr and the whole was cooled to 0 °C. The resultant solid was filtered, washed with water, n-hexane and cold ethanol, and dried to give 6-OMe-8-Cl tetralone oxime(801.7 mg, 87%, white solid).

^{1}H NMR ($CDCl_3$): 8.425 (1H, brs), 6.869 (1H, d, J=2.8), 6.627 (1H, d, J=2.8), 3.803 (3H, s), 2.840 (2H, t, J=6.8), 2.624 (2H, t, J=6.0), 1.805-1.741 (2H, m).

^{13}C NMR($CDCl_3$): 159.20, 153.98, 144.97, 132.53, 121.76, 115.12, 112.54, 55.48, 31.43, 24.77, 20.93.

Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.55, H 5.36, N 6.21. Found: C 58.43, H 5.48, N 6.15. Mp.: 198.5-200.0 °C(recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0444.



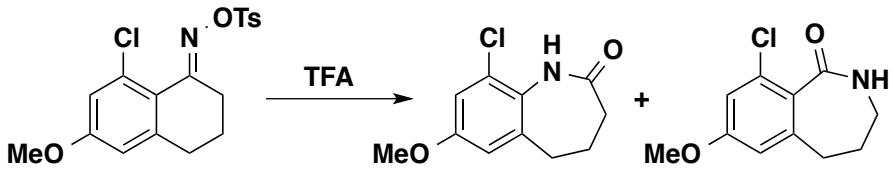
6-OMe-8-Cl-Tetralone Oxime (400.0 mg, 1.77 mmol) was dissolved in 4 mL of THF and the solution was cooled to 0 °C. A suspension of NaH (85.1 mg in 1.0 mL THF, 2.0 eq.) was added dropwise and the reaction mixture was stirred at room temperature for 30 min. Tosyl chloride (354.8 mg, 1.86 mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The reaction was quenched by slow addition of water, and additional water was added to afford a white precipitate. The mixture was filtered and the solid was washed with water and n-hexane, and dried to afford 6-OMe-8-Cl-tetralone tosyl oxime **10h** (513.2 mg, off-white solid, 76%).

^{1}H NMR ($CDCl_3$): 7.976 (2H, d, J=8.4), 7.348 (2H, d, J=8.4), 6.835 (1H, d, J=2.8), 6.619 (1H, d, 2.8), 3.809 (3H, s), 2.891 (2H, t, J=6.8), 2.640 (2H, t, 6.0), 2.455 (3H, s),

1.784-1.720 (2H, m). ^{13}C NMR($CDCl_3$): 160.72, 160.40, 145.93, 144.86, 134.01, 132.90, 129.36, 119.29. 118.37, 115.66, 112.50, 55.54, 31.06, 26.32, 21.71, 20.36.

Anal. Calcd. for $C_{18}H_{18}ClNO_4S$: C 56.91, H 4.78, N 3.69. Found: C 56.62, H 4.70, N 3.64.

Dec.:128.5°C (recrystallized from n-hexane/dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}ClNNaO_4S^+$: 402.0537. Found: 402.0540.



To 6-OMe-8-Cl-Tetralone O-tosyl oxime **10h** (114.0 mg, 0.3 mmol) was added 3.0 mL of TFA at 0 °C. The whole was stirred at 20 °C for 1 hr and poured onto crushed ice. The mixture was extracted with chloroform and washed with brine. The combined organic phase was dried over anhydrous sodium sulfate and concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate =2:1) to afford the alkyl migration product **11h** (5.2 mg, 7.7%, white solid) and the benzene migration product **12h** (59.5 mg, 88%, white solid).

Alkyl migration product **11h**

^{1}H NMR ($CDCl_3$): 6.912 (1H, d, J=2.4), 6.652 (1H, d, J=2.4), 6.210 (1H, brs), 3.848 (3H, s), 3.140-3.124 (2H, m), 2.815-2.799 (2H, m), 1.961 (2H, br). ^{13}C NMR ($CDCl_3$): 169.62, 161.00, 140.94, 133.93, 125.34, 113.88, 113.23, 55.57, 39.10, 30.72, 30.01.

Mp.: 108.0-110.0 ºC (recrystallized from n-hexane/dichloromethane). Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.54, H 5.36, N 6.21. Found: C 58.62, H 5.41, N 6.28.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449 ; Found: 248.0445.

Benzene migration product **12h**

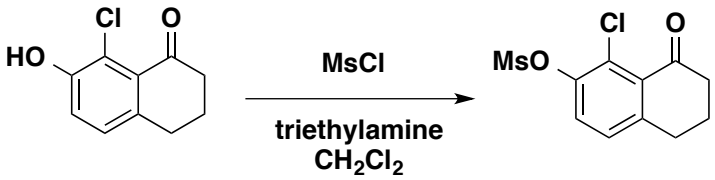
^{1}H NMR ($CDCl_3$): 7.166 (1H, brs), 6.857 (1H, d, J=2.8), 6.703 (1H, d, J=2.8), 3.798 (3H, s), 2.786 (2H, t, J=7.2), 2.341 (2H, t, J=7.6), 2.260-2.186 (2H, m).

^{13}C NMR ($CDCl_3$): 173.95, 157.32, 137.22, 127.96, 126.85, 114.42, 112.67, 55.69, 32.58, 31.03, 28.03. Anal. Calcd. for $C_{11}H_{12}ClNO_2$: C 58.54, H 5.36, N 6.21. Found: C 58.38, H 5.37, N 6.07.

Mp.: 152.0-154.0 ºC (recrystallized from n-hexane/ dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_2^+$: 248.0449. Found: 248.0466.

Synthesis of 10i

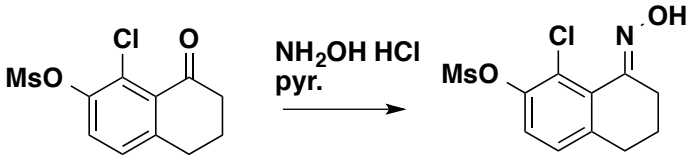


7-OH-8-Cl tetralone (600.0 mg, 3.05 mmol) was dissolved in dichloromethane and the solution was cooled to 0 ºC. Triethylamine (1.0 mL) was added and the whole was stirred for 10 min. Methanesulfonyl chloride (560 µl) was added in one portion and the whole was stirred at 0 ºC for 1 hr. The reaction mixture was quenched with 10% aqueous solution of $NaHCO_3$. The mixture was extracted with ethyl acetate and the organic layer was concetrated. The crude residue was purified by recrystallization (dichloromethane) to afford 7-OMs-8-Cl tetralone (747.9 mg, 88 %) as a white solid.

^{1}H NMR ($CDCl_3$): 7.522 (1H, d, J=8.4), 7.230 (1H, d, J=8.4), 3.270 (3H, s), 2.983 (2H, t, J=6.4), 2.706 (2H, t, J=6.4), 2.166-2.093 (2H, m). ^{13}C NMR ($CDCl_3$): 195.83, 145.53, 145.04, 131.38, 128.16, 127.86, 127.16, 40.11, 39.00, 30.44, 22.42.

Mp.: 149.5-152.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}ClNaO_4S^+$: 296.9959. Found: 296.9963.



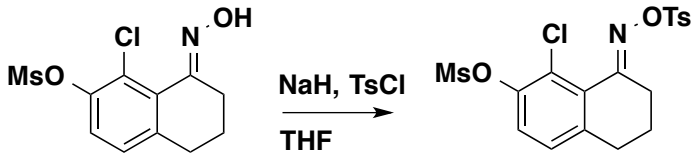
To a solution of 7-OMs-8-Cl-tetralone (300.0 mg, 1.09 mmol) in 3.0 mL of pyridine was added hydroxylamine hydrochloride (400.0 mg, 5.27 mmol) at 0 ºC. The mixture was stirred at room temperature for 4 hr and diluted with ethyl acetate. The solution was sequentially washed with 2 M aqueous solution of HCl, 10% aqueous solution of $NaHCO_3$, and brine. The organic phase was concentrated and recrystallized from dichloromethane to afford 7-OMs-8-Cl-tetralone oxime (307.4 mg, 97%) as a pale-yellow solid.

^{1}H NMR ($CDCl_3$): 8.551-8.531 (1H, br), 7.362 (1H, d, J=8.0), 7.134 (1H, d, J=8.4), 3.257 (3H, s), 2.858 (2H, t, J=6.8), 2.670 (2H, t, J=6.0), 1.842-1.777 (2H, m).

^{13}C NMR ($CDCl_3$): 154.01, 144.94, 142.45, 131.03, 127.15, 124.68, 124.04, 38.79, 30.66, 24.36, 20.75.

Mp.: 188.0-189.5 ºC (recrystallized from dichloromethane).

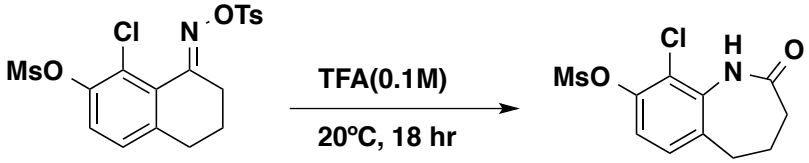
HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_4S^+$: 312.0068. Found: 312.0078.



To a solution of 7-OMs-8-Cl-tetralone oxime (72.0 mg, 0.249 mmol) in 0.6 mL or THF was added tosyl chloride (61.5 mg, 1.3 equiv.) at 0 ºC. A suspension of NaH (12.0 mg, 2.0 equiv.) in 1.0 mL of THF was added and the whole was stirred at 0 ºC for 1 hr. The reaction was quenched with water and extracted with ethyl acetate. The solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate = 2 : 1) to afford tosylate oxime **10i** (77.6 mg, 70%) as a white solid.

^{1}H NMR ($CDCl_3$): 7.933 (2H, d, J=8.0), 7.399 (1H, d, J=8.4), 7.338 (2H, d, J=8.0), 7.129 (1H, d, J=8.4), 3.231(3H, s), 2.904 (2H, t, J= 6.8), 2.672 (2H, t, J=6.4), 2.446 (3H, s), 1.775 (2H, m). ^{13}C NMR ($CDCl_3$): 160.46, 145.24, 145.01, 143.24, 132.63, 129.51, 129.28, 128.75, 127.45, 125.88, 125.52, 38.85, 30.27, 26.00, 21.73, 20.20.

Anal. Calcd. for $C_{18}H_{18}ClNO_6S_2$: C 48.70, H 4.09, N 3.16; Found: C 48.34, H 4.14, N 3.09. Mp.: 134.0-135.0 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}ClNNaO_6S_2^+$: 466.0156. Found: 466.0180.

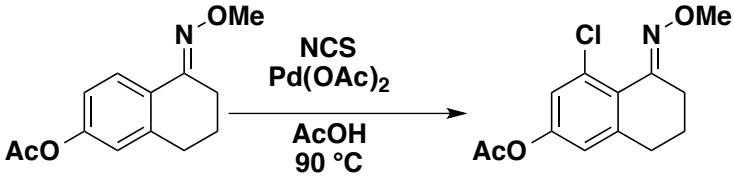


10i (88.0 mg, 0.2 mmol) was added TFA (2.0 mL) at 0 ºC. The whole was stirred at 20 ºC for 12 hr and poured onto crushed ice. The whole was extracted with dichloromethane and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 1 :1) to afford benzene migration product **12i** (22.3mg, 77%) as a white solid.

^{1}H NMR ($CDCl_3$): 7.276-7.174 (3H, m), 3.270 (3H, s), 2.832 (2H, t, J=6.8), 2.392 (2H, t, J=6.8), 2.294-2.162 (2H, m). ^{13}C NMR ($CDCl_3$): 173.49, 144.23, 136.73, 146.66, 128.44, 120.51, 119.16, 38.90, 32.84, 30.70, 28.13.

Anal. Calcd. for $C_{11}H_{12}ClNO_4S$+0.2H_2O: C 45.04, H 4.26, N 4.78. Found: C 44.79, H 4.18, N 4.66. Mp.: 198.0-200.0 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}ClNNaO_4S^+$:312.0068. Found: 312.0092.

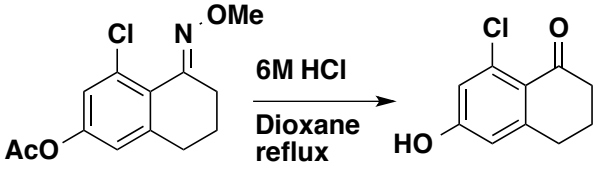
Synthesis of 10j



A mixture of 6-OAc-tetralone O-methyl oxime (600.0 mg, 2.6 mmol), N-chlorosuccinimide (412.2 mg, 3.1 mmol) and palladium acetate (46.0mg, 0.20 mmol) in 16 mL of acetic acid was heated to 90°C with stirring for 45 min. The reaction mixture was poured onto crushed ice and the whole was neutralized with 15% aqueous solution of NaOH. The whole was extracted with ethyl acetate and concentrated. The residue was purified by column chromatography (n-hexane : ethyl acetate =4:1) to afford 6-OAc-8-Cl-methoxyl oxime (617.3 mg, 90%, colorless oil).

^{1}H NMR ($CDCl_3$): 7.097 (1H, d, J=2.4), 6.845 (1H, d, J=2.4), 4.016 (3H, s), 2.754 (2H, t, J=6.4), 2.628 (2H, t, J=6.0), 2.294 (3H, s), 1.792-1.728 (2H, m).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{13}H_{14}ClNNaO_3^+$: 290.0554. Found: 290.0522.

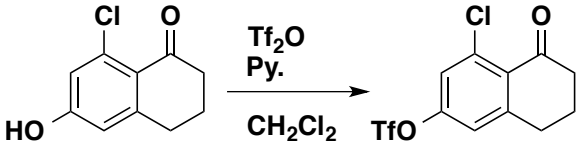


6-AcO-8-Cl tetralone O-methyl oxime (601.9 mg, 2.25 mmol) was dissolved in dioxane (16 mL) and to this solution 6 M aqueous solution of HCl (26 mL) was added. The whole was heated at reflux for 1 hr. The whole was poured onto crushed ice and extracted with ethyl acetate. The solvent was removed to affoard the desired ketone (494.1 mg, white solid, quant). The compound was used for further steps without further purification.

^{1}H NMR ($CDCl_3$): 6.820 (1H, d, J =2.4), 6.621 (1H, d J=2.4), 6.115 (1H, brs), 2.900 (2H, t, J=6.4), 2.637 (2H, t, J=6.4), 2.096-2.024 (2H, m).

Mp.: 202.5-203.5 ºC (recrystallized from ethyl acetate).

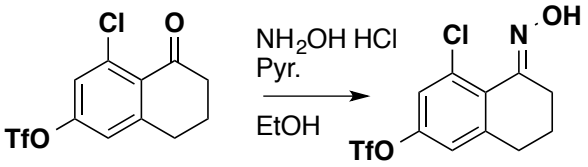
HRMS (ESI-TOF, $[M+Na]^+$): Calcd for $C_{10}H_9ClNaO_2^+$: 219.0183. Found: 219.0192.



A mixture of 6-hydroxyl-8-Cl-tetralone (316.3 mg, 1.61 mmol), pyridine (324 μl, 2.5 equiv.) in dichloromethane (8 mL) was cooled to 0 °C and Tf_2O (540.0 μl, 2.0 eq.) was added to this mixture. The mixture was stirred for 30 min and the reaction was quenched with 15 mL of saturated aqueous solution of $NaHCO_3$. The reaction mixture was extracted with dichloromethane and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate =4: 1) to afford 6-OTf-8-Cl-tetralone (372.5 mg, 70%, yellow oil).

^{1}H NMR ($CDCl_3$): 7.268 (1H, d, J=0.8), 7.124 (1H,d, J=1.6), 3.026 (2H, t, J=6.0), 2.719 (2H, t, J=6.0), 2.178-2.113 (2H, m). ^{13}C NMR ($CDCl_3$): 194.85, 150.31, 149.16, 136.61, 129.86, 123.11, 120.06, 118.61 (J=319), 40.06, 31.01, 22.21.

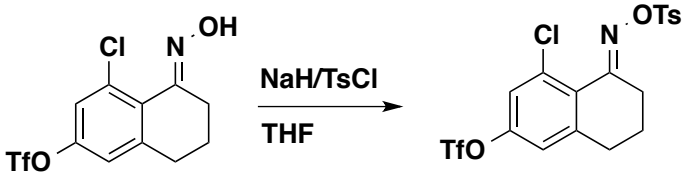
HRMS (ESI-TOF, $[M+H]^+$): Calcd. for $C_{11}H_9ClF_3O_4S^+$: 328.9857. Found: 328.9863.



6-OTf-8-Cl-Tetralone (372.5 mg, 1.13mmol) and hydroxyl ammonium chloride (157.5 mg, 2.3 mmol) were dissolved in ethanol (3 mL) and 0.3 mL of pyridine was added to the mixture. The whole was heated at reflux for 1 hr. The solution was diluted with ethyl acetate and washed sequentially with 2 M aqueous solution of HCl, water and brine to afford 6-OTf-8-Cl-tetralone oxime (282.1 mg, pale-yellow solid, 73%).

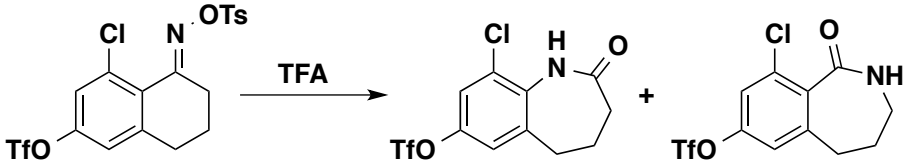
^{1}H NMR ($CDCl_3$): 9.591 (1H, brs), 7.276 (1H, d, J=2.4), 7.045 (1H, d, J=2.4), 2.886 (2H, t, J=6.8), 2.703 (2H, t, J=6.0), 1.863-1.804 (2H, m). ^{13}C NMR ($CDCl_3$): 152.93, 147.95, 145.84, 133.01, 129.56, 122.45, 119.40, 118.66 (J= 319), 31.22, 24.56, 20.60.

Mp.: 102.0-103.0 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_9ClF_3NNaO_4S^+$: 365.9785. Found: 365.9793.



6-OTf-8-Cl tetralone oxime (100.1 mg, 0.29 mmol) was dissolved in THF (1.0 mL) at 0 °C. Tosyl chloride (55.5 mg, 0.29 mmol) was added, followed by the addition of a suspension of NaH (14.0 mg, in 1 mL THF, 2.0 eq.). The solution was warmed to room temperature with stirring for 1 hr. The whole was poured onto crushed ice and extracted with Et_2O. Solvent was removed and the residue was purified with column chromatography (n-hexane : ethyl acetate =5 : 1) to afford 6-OTf-8-Cl tetraone tosyl oxime **10j** (101.0 mg, 70%, white solid).

^1H NMR ($CDCl_3$): 7.938 (2H, d, J=8.4), 7.345 (2H, d, J=8.4), 7.236 (1H, d, J=2.8), 7.032 (1H, d, J=2.4), 2.919 (2H, t, J=6.8), 2.711 (2H, d, J=5.6), 2.446 (3H, s), 1.833-1.768 (2H, m). ^{13}C NMR ($CDCl_3$): 159.59, 148.96, 146.67, 145.27, 134.53, 132.55, 129.50, 129.34, 127.40, 122.77, 119.53, 118.62 (J= 319), 31.58, 25.95, 21.70, 20.07.Anal. Calcd. for $C_{18}H_{15}ClF_3NO_6S_2$: C 43.42, H 3.04, N 2.81. Found: C 43.25, H 3.10, N 2.81. Mp.: 69.0-74.5 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{15}ClF_3NNaO_6S_2^+$: 519.9874. Found: 519.9858.



TFA (1.5 mL) was added to 6-OTf-8-Cl tetralone tosyl oxime **10j** (74.8 mg, 0.15 mmol) at 0ºC and the whole was stirred at 20 °C for 17 hr and then poured onto crushed ice. The mixture was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =2:1) to afford alkyl-migrated lactam **11j** (30.1 mg, white solid, 58%) and benzene-migrated lactam **12j** (17.8 mg, white solid, 35%).

Alkyl migration product **11j**

^{1}H NMR ($CDCl_3$): 7.326 (1H, d, J=2.4), 7.067-7.064 (2H, m), 3.132 (2H, brs), 2.875 (2H, m), 2.007 (2H, brs). ^{13}C NMR ($CDCl_3$): 168.33, 149.63, 141.89, 134.33, 133.51, 121.92, 119.89, 118.64 (J= 319), 38.77, 30.45, 29.69.

Anal. Calcd. for $C_{11}H_9ClF_3NO_4S$: C 38.44, H 2.64, N 4.08; Found: C 38.71, H 2.85, N 4.15. Mp.: 134.5-135.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_9ClF_3NNaO_4S^+$: 365.9785. Found: 365.9794.

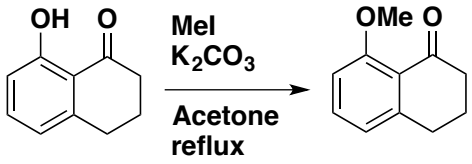
Benzene migration product **12j**

^{1}H NMR ($CDCl_3$): 7.458 (1H, brs), 7.296 (1H, d, J=2.4), 7.116 (1H, d, J=2.4), 2.871 (2H, t, J=7.2), 2.402 (2H, t, J=7.6), 2.326-2.170 (2H, m). ^{13}C NMR ($CDCl_3$): 173.36, 145.56, 137.82, 135.52, 126.84, 121.41, 121.04, 117.72, 32.73, 31.16, 27.95.

Mp.: 81.5-83.0 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_9ClF_3NNaO_4S^+$: 365.9785. Found: 365.9776.

Synthesis of substituted *peri*-OMe compounds

Synthesis of 13a

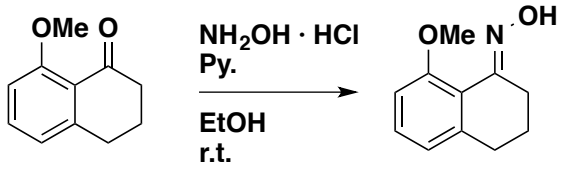


To a solution of 8-hydroxyl tetralone[6] (1.00 g, 6.17 mmol) in 20 mL of acetone was added potassium carbonate (3.4169g, 24.68 mmol) in one portion. The solution was stirred for 30 min and MeI (1.75g, 2.0 eq.) was added. The whole was heated at reflux for 8 hr. The reaction mixture was filtered through Celite and the filtrate was concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 8 : 1) to afford 8-OMe ketone (997.7 mg, 92%, red oil).

^{1}H NMR ($CDCl_3$): 7.399-7.359 (1H, m), 6.844-6.813 (2H, m), 3.902 (3H, s), 2.917 (2H, t, J=6.0), 2.632 (2H, t, J=6.4), 2.087-2.023 (2H, m).

^{13}C NMR ($CDCl_3$): 197.58, 160.39, 147.16, 133.93, 122.25, 120.74, 109.95, 55.99, 40.95, 30.84, 22.86.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}NaO_2^+$ 199.0730. Found: 199.0723.



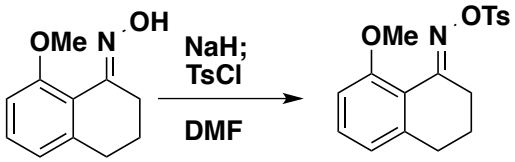
To a solution of 8-OMe-tetralone (730.4 mg, 4.15 mmol) in 20.0 mL of ethanol was added 2 mL of pyridine. Hydroxylamine hydrochloride (576.2mg, 8.3 mmol) was added to the solution and the whole was stirred for 15 min at room temperature. The resulted precipitate was filtered, the obtained solid was washed with water and Et_2O to afford the 8-OMe-tetralone oxime (796.1 mg, quantitative., white solid).

^{1}H NMR ($CDCl_3$): 10.902 (1H, brs), 7.195 (1H, t, J=8.0), 6.845 (1H, d, J=8.0), 6.791 (1H, d, J=7.6), 3.912 (3H, s), 2.922 (2H, t, J=6.8), 2.721 (2H, t, J=6.0), 1.848-1.785 (2H, m). ^{13}C NMR ($CDCl_3$): 157.96, 153.41, 142.91, 129.27, 121.13, 119.36, 109.73, 55.68, 31.30, 25.15, 21.24.

Anal. Calcd. for $C_{11}H_{13}NO_2$: C 69.09, H 6.85, N 7.32. Found: C 68.97, H 6.79, N 7.13.

Mp.: 193.5-195.0 °C (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{13}NNaO_2^+$ 214.0839. Found: 214.0832.



8-OMe-tetralone oxime (200.0 mg, 1.05 mmol) was dissolved in 4 mL of DMF and the whole was cooled to 0 °C. A suspension of NaH (50.0 mg, 2.08 mmol) in 1 mL of DMF was added dropwise and the reaction mixture was stirred at room temperature for 1 hr. Tosyl chloride (1.0g, 5.2mmol) was added at 0 °C and the whole was stirred at the same temperature for 30 min. The reaction was quenched by slow addition of water, and additional water was added to afford a white precipitate. The mixture was filtered and the solid was washed with water, ethanol and n-hexane to afford 8-OMe tetralone oxime tosylate **13a** (311.9 mg, white powder, 86%).

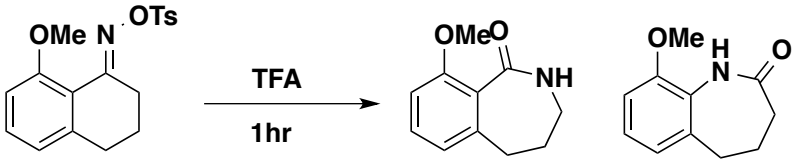
^{1}H NMR ($CDCl_3$): 7.991 (2H, d, J=8.0), 7.349 (2H, d, J=8.0), 7.231 (1H, d, J=8.0), 6.793-6.749 (2H, m), 3.774 (3H, s), 2.883 (2H, t, J=6.8), 2.655 (2H, t, J=6.4), 2.446 (3H, s), 1.758-1.624 (2H, m).

^{13}C NMR ($CDCl_3$): 161.69, 158.37, 144.42, 144.08, 133.10, 131.10, 129.04, 120.63, 117.06, 110.08, 106.70, 55.70, 30.37, 26.37, 21.51, 20.45.

Anal. Calcd. for $C_{18}H_{19}NO_4S$: C 62.59, H 5.54, N 4.06. Found: C 62.82, H 5.71, N 3.92.

Dec.: 88.0 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{19}NNaO_4S^+$: 368.0927. Found: 368.0952.



To 8-OMe-tetralone tosyl oxime **13a** (172.7mg, 0.5 mmol) was added TFA (5.0 mL) at 0 ºC and the whole was stirred at 20 ºC for 1 hr. The reaction was quenched with crushed ice and the whole was extracted with ethyl acetate. The solvent was removed and the residue was purified with column chromatography (n-hexane : acetone = 2: 1 to 1: 4) to afford alkyl migration product **14a** (76.6 mg, white solid, 80%) and benzene migration product **15a** (7.9 mg, yellow solid, 8.3%).

Alkyl migration product **14a**

^{1}H NMR ($CDCl_3$): 7.281-7.244 (2H, m), 6.834-6.715 (2H, m), 3.816 (3H, s), 3.025 (2H, brs), 2.715 (2H, brs), 1.862 (2H, brs).

^{13}C NMR ($CDCl_3$): 171.03, 157.58, 139.45, 131.45, 122.98, 120.67, 110.18, 56.05, 39.10, 30.29, 30.00.

Anal. Calcd. for $C_{11}H_{13}NO_2$: C 69.09, H 6.85, N 7.32. Found: C 68.82, H 6.97, N 7.25.

Mp.: 97.0-103.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{13}NNaO_2^+$ 214.0841. Found: 214.0827.

Benzene migration product **15a**

^{1}H NMR ($CDCl_3$): 7.100 (1H, brs), 7.080 (1H, t, J=8.0), 6.832-6.797 (2H, m), 3.843 (3H, s), 2.790 (2H, t, J=7.2), 2.386 (2H, t, J=7.2), 2.247 (2H, m).

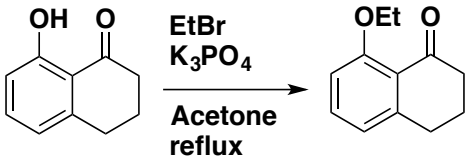
^{13}C NMR ($CDCl_3$): 174.45, 150.24, 134.97, 126.93, 125.61, 121.77, 109.18, 55.74, 33.41, 30.51, 28.64.

Anal. Calcd. for $C_{11}H_{13}NO_2$: C 69.09, H 6.85, N 7.32. Found: C 68.97, H 6.97, N 7.30.

Mp. 124.0-127.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{13}NNaO_2^+$ 214.0838. Found 214.0854.

Synthesis of 13b

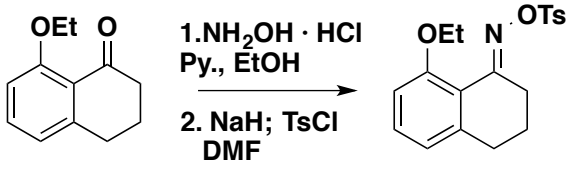


To a solution of 8-hydroxyl tetralone (650.0 g, 4.0 mmol) in 20 mL of acetone was added K_3PO_4 (1.70 g, 2.0 equiv.) in one portion. The solution was stirred for 30 min and EtBr (880.0 mg, 2.0 eq.) was added. The whole was heated at reflux for 24 hr. The reaction mixture was filtered through Celite and the filtrate was concentrated. The residue was purified with column chromatography (n-hexane : ethyl acetate = 6 : 1) to afford 8-OEt tetralone (630.2 mg, 57%, yellow oil). The starting phenol was recovered in 28% yield.

^{1}H NMR ($CDCl_3$): 7.338 (1H, t, J=7.6), 6.822-6.784 (2H, m), 4.001 (2H, q, J=6.8), 2.900 (2H, t, J=6.0), 2.615 (2H, t, J=6.4), 2.074-2.010 (2H, m), 1.486 (3H, t, J=6.8).

^{13}C NMR ($CDCl_3$): 197.34, 159.71, 146.99, 133.78, 122.41, 120.55, 111.17, 64.48, 40.97, 30.82, 22.86, 14.68.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{14}NaO_2^+$ 213.0892. Found 213.0920.



8-OEt-tetralone (600.4 mg, 3.15 mmol) was dissolved in 10.0 mL of ethanol, and 1.0 mL of pyridine was added to the solution. Hydroxylamine hydrochloride (420.0 mg, 6.30 mmol) was added at room temperature and the whole was stirred for 15 min. The resultant precipitate was filtered, the solid was washed with water and Et_2O and dried to afford 8-OEt tetralone oxime as a white solid. The compound was used in further steps without purification.

^{1}H NMR ($CDCl_3$): 7.161 (1H, t, J=7.6), 6.838 (1H, d, J=8.4), 6.769 (1H, d, J=8.0), 4.182 (2H, q, J=7.2), 2.895 (2H, t, J=6.8), 2.687 (2H, t, J=6.0), 1.837-1.773 (2H, m), 1.472 (3H, t, J=6.8). ^{13}C NMR ($CDCl_3$): 157.12, 152.47, 142.86, 129.16, 120.96, 119.56, 111.11, 64.78, 31.29, 25.31, 21.23, 14.71.

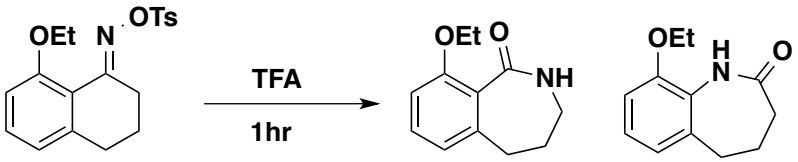
To a suspension of the above solid in 8 mL of DMF was added NaH (150.0 mg, 2.0 equiv.) at 0 ºC and the whole was stirred at room temperature for 3 hrs. Tosyl chloride (660.2 mg, 1.1 equiv.) was added and the mixture was stirred for further 1 hr. The reaction was diluted with Et_2O and quenched with water. The organic phase was separated and the aqueous phase was extracted with ethyl acetate. The combined organic phase was concentrated and the residue was purified with recrystallized from ethyl acetate to afford 8-OEt-tetralone tosyl oxime **13b** (879.3 mg, 78%, white solid).

^{1}H NMR (Acetone-d_6): 7.940 (2H, d, J=8.4), 7.469 (2H, d, J=8.0), 7.295 (1H, t, J=7.6), 6.933 (1H, d, J=8.0), 6.818 (1H, d, J=7.6), 4.048 (2H, q, J=6.8), 2.895-2.843 (2H, m), 2.685 (2H, t, J=7.2), 2.452 (3H, s), 1.782-1.719 (2H, m), 1.303 (3H, t, J=6.8). ^{13}C NMR (Acetone-d_6): 161.63, 157.85, 144.81, 144.41, 133.88, 131.43, 129.55, 128.67, 120.63, 117.22, 111.67, 64.42, 30.18, 26.30, 20.72, 20.63, 14.24.

Anal. Calcd. for $C_{19}H_{21}NO_4S$: C 63.49, H 5.89, N 3.90. Found: C 63.17, H 5.97, N 3.74.

Dec.: 65.0 °C (recrystallized from ethyl acetate).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{19}H_{21}NNaO_4S^+$ 382.1084. Found: 382.1096.



To 8-OEt-tetralone tosyl oxime **13b** (180.0 mg, 0.50 mmol) was added TFA (5.0 mL) at 0 ºC and the whole was stirred at 20 ºC for 1 hr. The reaction was quenched with crushed ice and the whole was extracted with ethyl acetate. The combined organic phase was washed with brine, dried over anhydrous sodium sulfate and concentrated. Purification with column chromatography (n-hexane : ethyl acetate = 2: 1 to 1: 4) to afford alkyl migration product **14b** (75.9 mg, white solid, 74%) and benzene migration product **15b** (11.6 mg, sticky colorless oil, 11%).

Alkyl migration product **14b**

^{1}H NMR ($CDCl_3$): 7.600 (1H, brs), 7.292-7.250 (1H, m), 6.850 (1H, d, J=8.4), 6.742 (1H, d, J=7.6), 4.125-4.056 (2H, m), 3.039 (2H, brs), 2.722 (2H, brs), 1.875 (2H, brs), 1.379 (3H, t, J=6.4). ^{13}C NMR ($CDCl_3$): 171.29, 156.90, 139.45, 131.36, 123.48, 120.62, 111.78, 64.77, 39.06, 30.28, 29.95, 14.64.

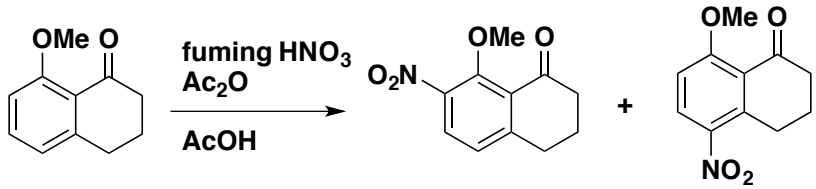
Mp.: 97.0-103.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{15}NNaO_2^+$ 228.0995. Found 228.0984.

Benzene migration product **15b**

^1H NMR ($CDCl_3$): 7.264 (1H, brs), 7.050 (1H, t, J=8.0), 6.813-6.772 (2H, m), 4.042 (2H, q, J=6.8), 2.874 (2H, t, J=6.8), 2.391 (2H, t, J=7.2), 2.265-2.229 (2H, m), 1.419 (3H, t, J=6.8). ^{13}C NMR ($CDCl_3$): 174.51, 149.56, 134.87, 126.98, 125.52, 121.60, 110.02, 64.17, 33.48, 30.57, 28.68, 14.96.

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{12}H_{15}NNaO_2^+$ 228.0995. Found 228.0995.



To a solution of 8-OMe-tetralone (828.4 mg, 4.70 mmol) in 3.0 mL of acetic acid was added a solution of fuming HNO_3 (0.5 mL) in 5.0 mL of acetic anhydride dropwise at 0 °C. The whole was stirred for 30 min and poured onto crushed ice. The whole was extracted with dichloromethane, and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane: ethyl acetate = 4: 1 to 1: 1) to afford 5-nitro-8-OMe-tetralone (380.6 mg, yellow solid, 37%, slow fractions) and 7-nitro-8-OMe tetralone (533.1 mg, yellow solid, 51%, fast fractions).

5-ntiro-8-OMe-tetralone

^1H NMR ($CDCl_3$): 8.105 (1H, d, J=9.2), 6.945 (1H, d, J=9.2), 3.979 (3H, s), 3.187 (2H, t, J=6.4), 2.662 (2H, t, J=6.4), 2.072 (2H, m).

^{13}C NMR ($CDCl_3$): 195.92, 163.53, 142.38, 142.03, 130.52, 123.15, 110.05, 56.69, 40.01, 27.36, 22.10.

Mp.: 65.0-67.0 ºC (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}NNaO_4^+$: 244.0580. Found: 244.0568.

7-nitro-8-OMe-tetralone

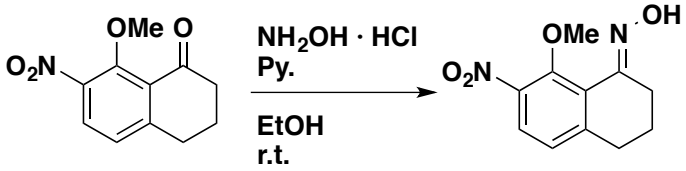
^1H NMR ($CDCl_3$): 7.806 (1H, d, J=8.4), 7.113 (1H, d, J=8.0), 3.977 (3H, s), 3.009 (2H, t, J=6.0), 2.687 (2H, t, J=6.4), 2.127 (2H, m).

^{13}C NMR ($CDCl_3$): 195.59, 154.16, 151.47, 144.30, 128.29, 127.93, 124.33, 64.03, 40.46, 30.87, 22.29.

Mp.: 81.5-83.0 ºC (recrystallized from ethanol).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{11}NNaO_4^+$, 244.0580. Found: 244.0599.

Synthesis of 13c



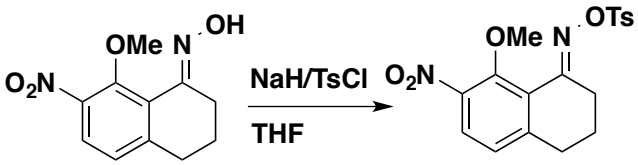
7-nitro-8-OMe-tetralone (343.9 mg, 1.56 mmol) and hydroxylamine hydrochloride (216.1 mg, 3.12 mmol) were dissolved in 4.5 mL of ethanol, and to this solution 0.5 mL of pyridine was added. The whole was stirred for 30 min and cooled to room temperature. The resulted solid was collected, washed with water and n-hexane and dried to afford the desired oxime (272.4 mg, white solid, 74%).

^{1}H NMR (acetone-d_6): 10.644 (1H, s), 7.663 (1H, d, J=8.4), 7.181 (1H, d, J=8.4), 3.819 (3H, s), 2.868-2.773 (4H, m), 1.853-1.789 (2H, m).

^{13}C NMR (acetone-d_6): 151.70, 150.82, 147.77, 144.95, 127.01, 123.77, 123.28, 62.09, 30.64, 24.00, 20.60.

Anal. Calcd. for $C_{11}H_{12}N_2O_4^+$: C 55.93, H 5.12, N 11.86. Found: C 55.78, H 5.16, N 11.76. Dec.: 203.5 ºC (recrystallized from n-Hex/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}N_2NaO_4^+$: 259.0689. Found: 259.0664.



A solution of 7-nitro-8-OMe oxime (80.0 mg, 0.339 mmol) in 1.0 mL of THF was added to a suspension of NaH (16.3 mg, 0.679 mmol) in THF (1.0 mL) at 0 °C. The whole was stirred at room temperature for 20 min and tosyl chloride (71.0 mg, 0.373 mmol) was added at 0 °C. The whole was stirred at room temperature for 30 min and diluted with Et_2O. The reaction was quenched by slowly addition of water and the whole was washed with water, brine and dried over anhydrous sodium sulfate. The mixture was purified with column chromatography (n-hexane : ethyl acetate =3 :1) to afford 7-nitro-8-OMe tetraone tosyl oxime **13c** (120.6 mg, yellow sticky oil, 91%).

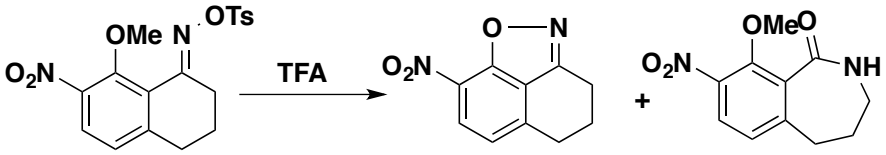
^{1}H NMR (CD_2Cl_2): 7.923 (2H, d, J=8.4), 7.726 (1H, d, J=8.4), 7.422 (2H, d, J=8.0), 7.102 (1H, d, J=8.4), 3.648 (3H, s), 2.970 (2H, t, J=6.8), 2.779 (2H, t, J=6.0), 2.479 (3H, s), 1.867-1.802 (2H, m).

^{13}C NMR ($CDCl_3$): 160.20, 152.63, 148.99, 145.23, 144.37, 132.73, 129.67, 128.98, 126.24, 124.44, 124.01, 63.10, 30.61, 26.04, 21.69, 20.12.

Anal. Calcd. for $C_{18}H_{18}N_2O_6S$: C 55.38, H 4.65, N 7.18. Found C 55.25, H 4.63, N7.17.

Dec.: 129.0 ºC (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}N_2NaO_6S^+$ 413.0778. Found: 413.0785.



To 5-nitro-8-OMe-tetralone tosylated oxime **13c** (108.3 mg, 0.28 mmol) was added 2.8 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 1 hr and then poured onto crushed ice. The mixture was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane : AcOEt =2:1 to 1 :4) to afford alkyl-migrated lactam **14c** (6.1 mg, white solid, 9.3%) and isoxazole **16c** (45.1 mg, yellow solid, 80%).

Alkyl migration product **14c**:

^{1}H NMR ($CDCl_3$): 7.838 (1H, d, J=8.4), 7.032 (1H, d, J=8.0), 6.454 (1H, brs), 4.024 (3H, s), 3.142 (2H, br), 2.862 (2H, t, J=2.8), 1.986 (2H, brs).

^{13}C NMR ($CDCl_3$): 168.41, 152.28, 144.48, 143.233, 130.70, 126.70. 123.74, 64.15, 38.91, 30.18, 29.56.

Anal. Calcd. for $C_{11}H_{12}N_2O_4^+$: C 55.93, H 5.12, N 11.86. Found: C 55.82, H 5.08, N 11.77. Mp.: 126.5-128.5 ºC (recrystallized from dichloromethane). HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}N_2NaO_4^+$: 259.0689. Found 259.0697.

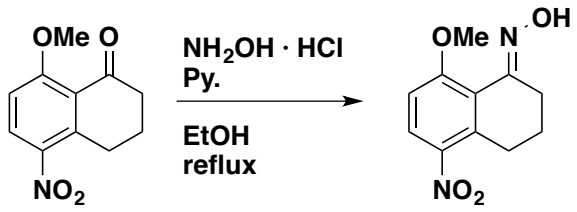
Isoxazole **16c**:

^{1}H NMR ($CDCl_3$): 8.296 (1H, d, J=8.0), 7.225 (1H, d, J=8.0), 3.145 (2H, t, J=6.0), 3.041 (2H, t, J=6.0), 2.250 (2H, m).

^{13}C NMR ($CDCl_3$): 157.12, 152.94, 145.07, 131.15, 126.95, 125.72, 121.32, 26.41, 23.57, 21.46. Anal. Calcd. for $C_{10}H_8N_2O_3$: C 58.82, H 3.95, N 13.72. Found: C 58.54, H 3.92, N 13.64. Mp.: 176.6-117.0 °C (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{10}H_8N_2NaO_3^+$: 227.0427. Found: 227.0435.

Synthesis of 13d



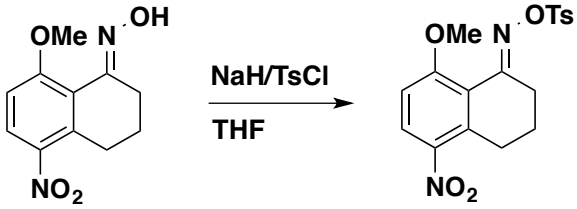
5-nitro-8-OMe-tetralone (441.7 mg, 2.0 mmol) and hydroxylamine hydrochloride (280.0 mg, 4.0 mmol) were dissolved in 4.0 mL of ethanol, and 0.4 mL of pyridine was added to the mixture. The whole was stirred for 10 min and resulted solid was collected. The solid was recrystallized from dichloromethane/n-hexane to afford 5-nitro 8-OMe-tetralone oxime (392.6 mg, white solid, 83%).

^{1}H NMR (acetone-d_6): 10.598 (1H, s), 7.922 (1H, d, J=9.2), 7.147 (1H, d, J=9.2), 3.929 (3H, s), 2.912-2.815 (4H, m), 1.805-1.740 (2H, m).

^{13}C NMR (acetone-d_6): 161.09, 151.24, 142.76, 138.15, 125.53, 122.32, 109.98, 55.79, 26.57, 24.12, 20.63.

Anal. Calcd. for $C_{11}H_{12}N_2O_4$: C 55.93, H 5.12, N 11.86. Found: C 55.93, H 5.14, N 11.73. Dec.: 203.5 ºC (recrystallized from n-hexane/dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}N_2NaO_4^+$, 259.0689. Found: 259.0705.



A solution of 5-nitro-8-OMe tetralone oxime (100.0 mg, 0.423 mmol) in 2.0 mL of THF was added to a suspension of NaH (20.3 mg, 0.846 mmol) in 1.0 mL THF at 0 °C The whole was stirred at room temperature for 20 min and tosyl chloride (84.7 mg, 0.444 mmol) was added at 0 °C. The whole was stirred at room temperature for 30 min and diluted with Et_2O. The reaction was quenched by slow addition of water. The whole was extracted with Et_2O and the organic layer was concentrated. The mixture was purified with column chromatography (n-hexane : ethyl acetate =4 :1) to afford 5-nitro-8-OMe-tetralone tosyl oxime **13d** (161.3 mg, white solid, 98%).

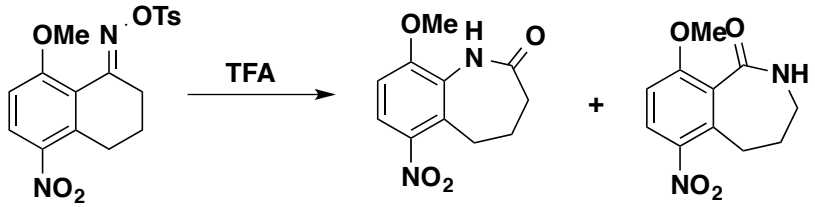
^{1}H NMR ($CDCl_3$): 8.006-7.965 (3H, m), 7.388 (2H, d, J=8.4), 6.890 (1H, d, J=9.2), 3.852 (3H, s), 2.988-2.912 (4H, m), 2.485 (3H, s), 1.783-1.719 (2H, m).

^{13}C NMR ($CDCl_3$): 161.53, 160.40, 144.94, 142.56, 140.21, 133.02, 129.36, 129.17, 128.08, 119.14, 109.68, 56.35, 26.63, 26.10, 21.73, 20.02.

Anal. Calcd. for $C_{18}H_{18}N_2O_6S$: C 55.38, H 4.65, N 7.18. Found: C 55.24, H 4.66, N 7.13.

Mp.: 129.0-130.0 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{18}H_{18}N_2NaO_6S^+$ 413.0778. Found: 413.0770.



To 5-nitro-8-OMe tetralone tosyl oxime **13d** (137.0 mg, 0.35 mmol) was added 3.5 mL of TFA at 0 ºC. The whole was stirred at 20 °C for 1 hr and then poured onto crushed ice. The mixture was extracted with chloroform and the organic layer was concentrated. The residue was purified with column chromatography (n-hexane: AcOEt =2:1) to afford alkyl-migrated lactam **14d** (79.1 mg, white solid, 83%) and benzene migration lactam **15d** (7.5 mg, yellow solid, 8.2%).

Alkyl migration product **14d**:

^{1}H NMR (DMSO-d_6): 8.191 (1H, t, J=6.0), 8.060 (1H, d, J=9.2), 7.190 (1H, d, J=9.2), 3.871 (3H, s), 3.214-3.0647 (2H, m), 2.749-2.678 (1H, m), 2.459-2.335 (1H, m), 2.093-2.028 (1H, m), 1.996-1.799 (1H, m).

^{13}C NMR (DMSO-d_6): 166.92, 160.22, 142.16, 133.62, 128.20, 126.37, 111.39, 56.81, 39.35, 29.80, 25.60.

Anal. Calcd. for $C_{11}H_{12}N_2O_4^+$: C 55.93, H 5.12, N 11.86. Found: C 55.87, H 5.12, N 11.78. Mp.: 250.5-252.0 ºC (recrystallized from chloroform).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}N_2NaO_4^+$: 259.0689. Found 259.0659.

Benzene migration product **15d**:

^{1}H NMR ($CDCl_3$): 7.866 (1H, d, J=9.2), 6.880 (1H, d, J=9.2), 3.976 (3H, s), 3.037-3.002 (2H, m), 2.470-2.462 (4H, m).

^{13}C NMR ($CDCl_3$): 173.70, 153.21, 143.59, 130.41, 128.99, 122.69, 108.12, 56.23, 33.36, 28.02, 27.36.

Anal. Calcd. for $C_{11}H_{12}N_2NaO_4^+$: C 55.93, H 5.12, N 11.86. Found: C 55.91, H 5.18, N 11.59.

Mp.: 188.0-191.5 ºC (recrystallized from dichloromethane).

HRMS (ESI-TOF, $[M+Na]^+$): Calcd. for $C_{11}H_{12}N_2NaO_4^+$: 259.0689. Found: 259.0686.

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