Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Controllable conformation and reactivity of bicyclic α-methylene cyclopentanones and their NF-kB inhibitory activity

Aki Kohyama*, Aya Shiuchi, Yue Zhou, Masaru Tanioka, Kenji Sugimoto, Hiroaki Sakurai, Yuji Matsuya*

[a] *Faculty of Pharmaceutical Sciences, University of Toyama, 2630 Sugitani, Toyama 930-0194, Japan*

* Corresponding Authors:

aki.kohyama.d5@tohoku.ac.jp (Aki Kohyama)

matsuya@pha.u-toyama.ac.jp (Yuji Matsuya)

Contents:

1. General Experimental Procedure

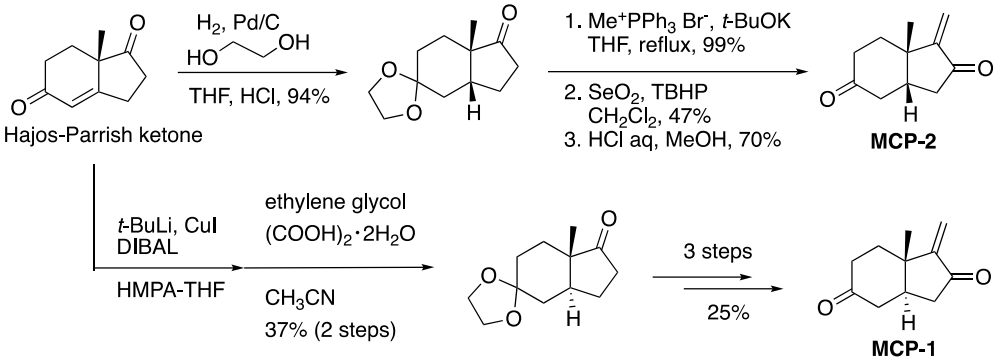
All reactions were carried out under argon atmosphere with dehydrated solvents under anhydrous conditions, unless otherwise noted. Dehydrated solvent was purchased from Kanto Chemical Co., Inc. Reagents were obtained from commercial suppliers and used without further purification, unless otherwise noted. Reactions were monitored by thin-layer chromatography (TLC) carried out on silica gel plates (Merck Kieselgel 60F_{254}). Column chromatography was performed on Silica gel 60N (Kanto Chemical Co., Inc., spherical, neutral, 40-50 μm). Infrared spectra were obtained on a JASCO FT/IR-460Plus spectrometer. Only the strongest and/or structurally important absorption are reported as the IR data afforded in cm^{-1}.

^{1}H NMR spectra and $^{13}C\{^{1}H\}$ NMR were recorded by using a JEOL ECA 500 II, a JEOL ECX 400, or a Varian GEMINI 300 spectrometer. The chemical shifts (δ) of ^{1}H NMR are given from TMS (0.00 ppm) in $CDCl_3$, as an internal reference. Coupling constant (*J*) is reported in hertz. Multiplicities are reported by using the following abbreviations: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; br, broad. The chemical shifts (δ) of $^{13}C\{^{1}H\}$ NMR are given from $CDCl_3$ (77.0 ppm) as an internal reference.

Mass spectra were recorded on a JEOL JMS-GCmateII or a JEOL JMS-AX 505 HAD.

2. Synthetic Procedure and analytical data

< Synthesis of MCP-1 and MCP-2>



< Synthesis of MCP-3-6>

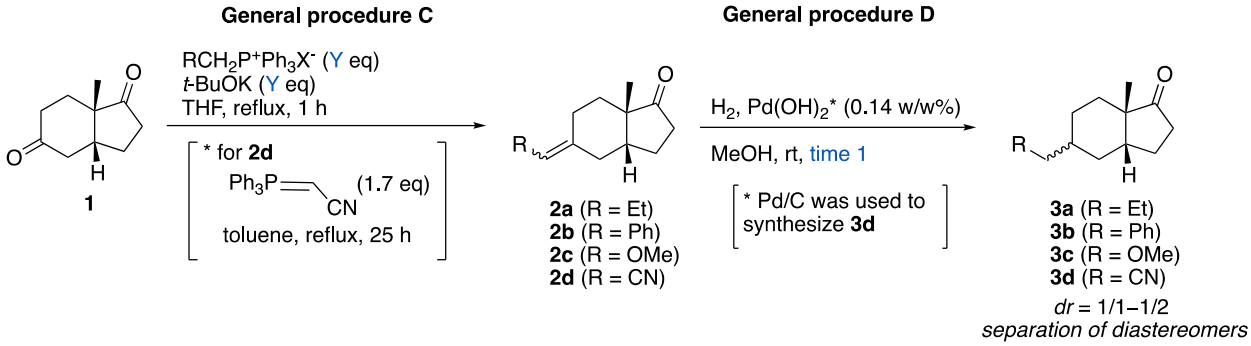


Table S1

entry	-R	Wittig reaction		hydrogenation	products
		X	Y (eq)	time 1 (h)	(%yield in 2 steps)
1	-Et	Br	3	61	**3a** (94%)
2	-Ph	Br	3	3	**3b** (88%)
3	-OMe	Cl	5	14	**3c** (59%)
4	-CN	Br	–	15	**3d** (86%)

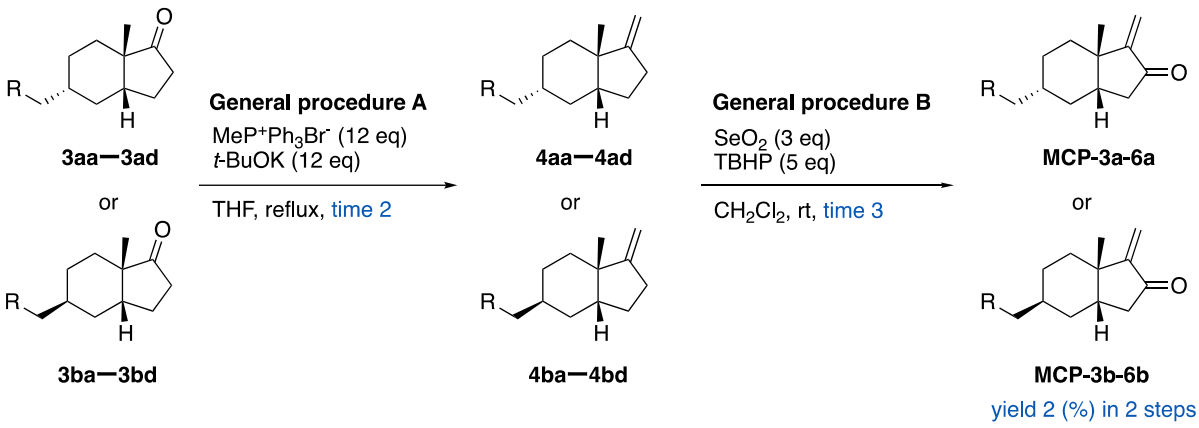


Table S2

entry	-R	time 2 (h)	time 3 (h)	Products (%yield in 2 steps)
1	-Et	1	37	**MCP-3a** (11%)
2		1	37	**MCP-3b** (7%)
3	-Ph	5	39	**MCP-4a** (48%)
4		5	37	**MCP-4b** (51%)
5	-OMe	1.5	37	**MCP-5a** (19%)
6		1	36	**MCP-5b** (15%)
7	-CN	1.5	60	**MCP-6a** (49%)
8		1.5	61	**MCP-6b** (23%)

General procedure A: Wittig Reaction 1

To a suspension of Ph_3PMeBr (12 eq) in THF (0.16 M) was added *t*-BuOK (1.0 M THF solution, 12 eq) at room temperature. After the resulting yellow suspension was stirred for 1-5 h, a solution of ketone ***trans*-S2**, ***cis*-S2**, **3aa, 3ba**, **3ab**, **3bb**, **3ac**, **3bc**, **3ad,** or **3bd** (1.0 eq) in THF (0.24 M) was added to the reaction mixture. After being refluxed for 1-1.5 h, the reaction mixture was cooled to room temperature, quenched with saturated NH_4Cl solution, and extracted with EtOAc. The combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (***ttrans*-S3**, ***cis*-5**: hexane/EtOAc = 5/1, **4ac**, **4bc**: pentane, **4ad**, **4bd**: hexane/EtOAc = 30/1, **4ae**, **4be**: hexane/EtOAc = 20/1, **4af**, **4bf**: hexane/EtOAc = 10/1) to afford alkene ***ttrans*-S3**, ***cis*-S3**, **4ac**, **b**, **4ad**, **4bd**, **4ae**, **4be**, **4af**, or **4bf**.

General procedure B: SeO_2 Oxidation

To a solution of SeO_2 (3 eq) in CH_2Cl_2 (0.17 M) was added *t*-butyl hydroperoxide (5.5 M decane solution, 5 eq) at 0 °C. After the reaction mixture was stirred for 30 min, a solution of alkene ***cis*-S3**, **4aa**, **4ba**, **4ab**, **4bb**, **4ac**, **4bc**, **4ae**, or **4be** (1 eq) in CH_2Cl_2 (0.35 M) was added. After being stirred for 36-61 h at room temperature, the reaction was quenched with saturated $Na_2S_2O_3$ solution and the mixture was extracted with CH_2Cl_2. The organic layers were washed sequentially with saturated Na_2CO_3 solution and water, brine, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (***cis*-S5**: hexane/EtOAc = 2/1, **MCP-3a**, **b**: pentane/Et_2O = 20/1, **MCP-4a**, **b**: hexane/EtOAc = 100/1-30/1, **MCP-5a**, **b**: hexane/EtOAc = 10/1, **MCP-6a**, **b**: hexane/EtOAc = 4/1) to afford **MCP-2**−**6**.

General procedure C: Wittig Reaction 2

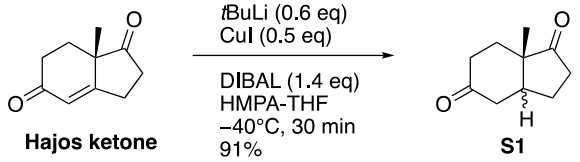
To a suspension of Ph_3PMe-RBr (3-5 eq) in THF (0.16 M) was added *t*-BuOK (1.0 M THF solution, 3-5 eq) at room temperature. After the resulting orange or dusty red suspension was stirred for 1-1.5 h, a solution of ketone **1** (1.0 eq) in THF (0.24 M) was added to the reaction mixture. After being stirred for 1-25 h, the reaction was quenched with saturated NH_4Cl solution and the mixture was extracted with Et_2O or EtOAc. The combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (**2a**: pentane/Et_2O = 10/1, **2b**, **2c**: hexane/EtOAc = 10/1) to afford alkene **2a**, **2b**, or **2c**.

General procedure D: Hydrogenation

A solution of alkene **2a**, **2b**, **2c**, or **2d** and $Pd(OH)_2$ * (0.14 w/w%) in MeOH (0.22 M) was stirred under H_2 (1 atm) at room temperature for 3-61 h. The mixture was filtered through celite and washed with EtOAc. The filtrate was concentrated under reduced pressure. The residue was purified by silica gel column chromatography (**3a**: pentane/Et_2O = 100/1-40/1, **3b**: hexane/EtOAc = 100/1-30/1, **3c**: hexane/EtOAc = 50/1-10/1, **3d**: hexane/EtOAc = 5/1-3/1) to afford reductant **3aa**, **3ba**, **3ab**, **3bb**, **3ac**, **3bc**, or **3ad**, **3bd**.

* When **3ad** and **3bd** were reduced, Pd/C was used instead of $Pd(OH)_2$.

1,4-Reductant S1 [12]



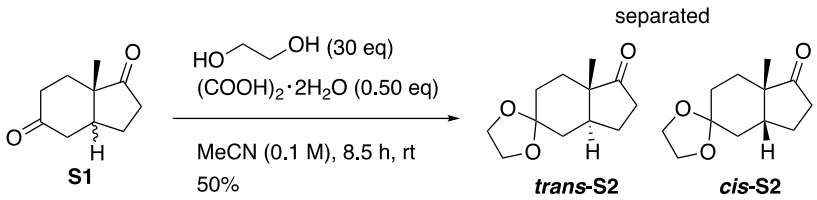
To a stirred slurry of CuI (2.32 g, 12.2 mmol) in THF (123 mL) was added dropwise *tert*-butyllithium (9.13 mL, 14.6 mmol, 1.6 M in pentane) at −50 °C. After the reaction mixture was stirred at −50 °C for 15 min, HMPA (28.8 mL) was added to the reaction mixture at −50 °C. After the reaction mixture was cooled to −78 °C, a solution of **Hajos ketone** (4.00 g, 24.4 mmol) in THF (20 mL) was added. To the mixture was added a solution of DIBAL (34.2 mL, 34.2 mmol, 1.0 M in hexane) in HMPA (20 mL) and THF (20 mL) slowly over 1.5 h at −78 °C. After being stirred for 30 min at −40 °C, the reaction was quenched with 3 M aqueous HCl and the mixture was extracted with EtOAc. The combined organic extracts were washed with brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (hexane/acetone = 4/1) to give 1,4-reductant **S1** (3.70 g, 22.3 mmol, 91%, *cis*/*trans* = 1/30) as a yellow oil.

^{1}H NMR spectrum of 1,4-reductant **S1** was identical with reported data. [15]

Note: HMPA was distilled under vacuum after treated with CaH_2.

CuI was purified as follows: CuI was dissolved in saturated aqueous NaI and the resulting mixture was refluxed for 30 min. After cooled to room temperature, the reaction mixture was diluted with H_2O, filtered. The solid was washed with water, EtOH, EtOAc, Et_2O, and pentane, and dried under reduced pressure.

Acetal *trans*-S2, *cis*-S2

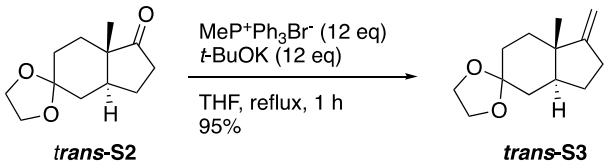


To a solution of **S1** (300 mg, 1.80 mmol, *cis*/*trans* = 1/30) in CH_3CN (18 mL) was added ethylene glycol (3.01 mL, 54.0 mmol) and oxalic acid dihydrate (113 mg, 0.90 mmol). After being stirred for 8.5 h, the reaction was quenched with saturated aqueous $NaHCO_3$ and the solution was extracted with AcOEt. The combined organic extracts were dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (hexane/Acetone = 5/1) to give acetal **S2** (191 mg, 0.908 mmol, 50%, *cis*/*trans* = 1/110) as a white solid.

Acetal **S2** (*cis*/*trans* = 1/110) was further purified by silica gel column (hexane/Acetone = 50/1-5/1) 5 times to give acetal ***trans*-S2** (186 mg, 0.885 mmol, 50%, *trans* only).

^{1}H NMR spectrum of acetal ***trans*-S2** was identical with reported data [15].

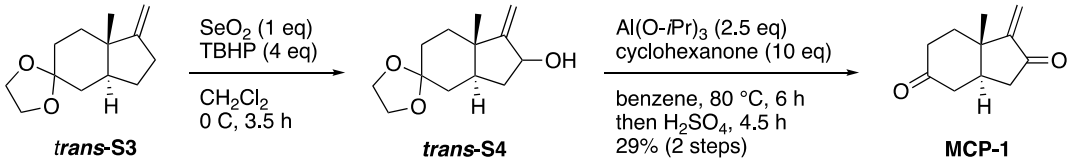
Alkene *ttrans*-S3



Following the general procedure A, ketone ***trans*-S2** (186 mg, 0.885 mmol) was converted to alkene ***trans*-S3** (178 mg, 0.841 mmol, 95%) as a yellow oil.

***trans*-S3**: IR (neat) 1655 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 4.67-4.65 (1H, m), 4.65-4.63 (1H, m), 3.96-3.92 (4H, m), 2.51 (1H, ddddd, *J* = 17.6, 10.4, 2.4, 2.4, 2.4 Hz), 2.30 (1H, ddddd, *J* = 17.2, 8.4, 8.4, 2.4, 2.4 Hz), 1.81-1.33 (9H, m), 0.85 (3H, s); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) 160.1, 110.1, 101.5, 64.3, 64.1, 45.3, 43.4, 35.4, 32.5, 31.2, 29.6, 25.8, 16.8; LRMS (EI): m/z 208 (M^+); HRMS (EI) calcd for $C_{13}H_{20}O_2$ (M^+): 208.1463, found 208.1460

MCP-1



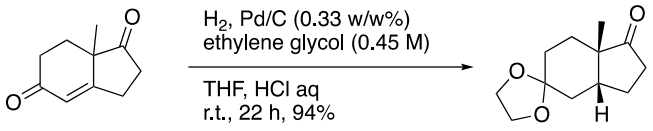
*After allylic oxidation, other compounds (enone and compounds which acetal was deprotected) were obtained and used in the next reaction.

To a solution of SeO_2 (168 mg, 1.51 mmol) in CH_2Cl_2 (3.2 ml) was added *t*-butyl hydroperoxide (5.5 M decane solution, 1.10 mL, 6.03 mmol) slowly. After the reaction mixture was stirred for 30 min, a solution of alkene ***ttrans*-S3** (314 mg, 1.51 mmol) in CH_2Cl_2 (5.7 ml) was added to the reaction mixture at 0 °C slowly. After being stirred for 9.5 h at 0 °C, the reaction mixture was quenched with H_2O and extracted with CH_2Cl_2. The organic layers were washed with distilled water and brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (hexane/EtOAc = 2/1) to give allylic alcohol ***trans*-S4** (315 mg, containing inpurity *) as a white solid.

To a solution of allylic alcohol ***trans*-S4** (315 mg) in benzene (14.5 mL) was added $Al(O\text{-}iPr)_3$ (771 mg, 3.78 mmol) followed by addition of cyclohexanone (1.57 mL, 15.1 mmol) at room temperature. After being stirred at 80 °C for 6.5 h, the reaction mixture was cooled to the room temperature and 10% aqueous H_2SO_4 (10 mL) was added to the mixture. After benzene was removed by concentrated, MeCN (3 mL) was added to the residue. After 4.5 h, the organic layer was separated and the aqueous layer was extracted with EtOAc. The extracts were washed with brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (CH_2Cl_2/MeOH = 70/1-50/1) to give the **MCP-1** (76.1 mg, 0.458 mmol, 29%) as a white solid.

MCP-1: IR (neat) 1727, 1704 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) 5.96 (1H, s), 5.19 (1H, s), 2.46 (1H, dd, *J* = 13.6, 16.0 Hz), 2.36 (1H, dd, *J* = 6.8, 17.6 Hz), 2.07-2.23 (3H, m), 1.87-1.82 (1H, m), 1.18 (3H, s); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) 208.9, 204.5, 154.2, 114.1, 41.7, 41.5, 41.4, 39.8, 37.7, 33.7, 17.8; LRMS (EI): m/z 178 (M^+); HRMS (EI) calcd for $C_{11}H_{14}O_2$ (M^+): 178.0994, found 178.0999.

Acetal *cis*-S2 [13]



Hajos ketone ***cis*-S2**

Ethylene glycol (13.7 mL, 246 mmol) and 10% Pd/C (325 mg, 0.33 w/w%) were added to a solution of **Hajos ketone** (1.00 g, 6.09 mmol) in THF (6.9 mL). A catalytic amount of 35% aqueous HCl was added to the mixture to adjust the pH value to 5-6. The suspension was stirred under H_2 (1 atm) at room temperature for 22 h. The mixture was filtered through celite and washed with EtOAc. To the filtrate was added saturated aqueous $NaHCO_3$ and the organic layer was separated. The extracts were washed with brine, dried over Na_2SO_4, and concentrated under reduced pressure. The

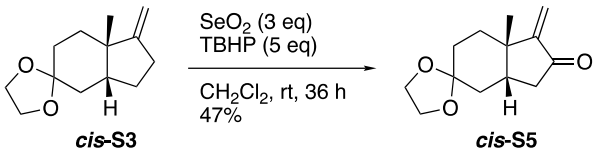
residue was purified by silica gel column chromatography (hexane/acetone = 9/1-7/3) to afford acetal ***cis*-S2** (1.20 g, 5.71 mmol, 94%) as a yellow oil.

^{1}H NMR spectrum of acetal ***cis*-S2** was identical with reported data [16].

Alkene *cis*-S3

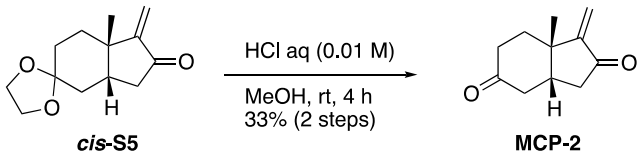
Following the general procedure A, ketone ***cis*-S2** (1.00 g, 4.76 mmol) was converted to alkene ***cis*-S3** (985 mg, 4.73 mmol, 99%) as a yellow oil.

Enone *cis*-S5



Following the general procedure B, alkene ***cis*-S3** (150 mg, 0.720 mmol) was converted to enone ***cis*-S5** (75.8 mg) as a yellow oil, which was used without further purification.

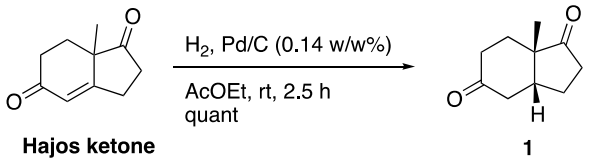
MCP-2



To a solution of ***cis*-S5** (75.8 mg, <0.341 mmol) in MeCN (2.4 mL) was added 10% aqueous HCl (24 mL). After the reaction mixture was stirred at room temperature for 4 h, the reaction mixture was diluted with Et_2O. The organic layer was separated and the aqueous layer was extracted with Et_2O. The extracts were dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (pentane/Et_2O = 1/1) to give the **MCP-2** (44.0 mg, 0.239 mmol, 33% in 2 steps) as a white solid.

MCP-2: IR (neat) 1721, 1638 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 6.14 (1H, s), 5.33 (1H, s), 2.62 (1H, dd, *J* = 18.8, 7.6 Hz), 2.56 (1H, dd, *J* = 15.2, 6.0 Hz), 2.47-2.40 (2H, m), 2.35-2.28 (1H, m), 2.20-2.06 (3H, m), 1.92 (1H, ddd, *J* = 14.0, 7.2, 5.6 Hz), 1.39 (3H, s); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) 210.5, 205.1, 152.5, 117.0, 42.4, 42.2, 41.8, 41.5, 37.2, 34.8, 25.8; LRMS (ESI): m/z 201.0885 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{11}H_{14}O_2Na$ ($[M+Na]^+$): 201.0886, found 201.0886

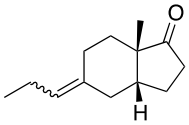
Reductant 1



A solution of **racemic Hajos ketone** (986 mg, 9.00 mmol) and Pd/C (136 mg, 0.14 w/w%) in AcOEt (20 mL) was stirred under H_2 (1 atm) at room temperature for 2.5 h. The mixture was filtered through celite and the filtrate was concentrated under reduced pressure to afford reductant **1** (1.02 g, 6.00 mmol, quant) as a yellow oil.

^{1}H NMR spectrum of reductant **1** was identical with reported data. [16]

Alkene 2a

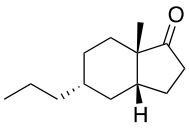


2a (*dr* = 1:2)

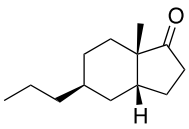
Following the general procedure C, diketone **1** (365 mg, 2.20 mmol) was converted to alkene **2a** (301 mg, 1.46 mmol, mixture of *dr* = 1:2, 66%) as a yellow oil.

Alkene 2a: IR (neat) 2539, 1739 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 5.25 (0.34H, t, *J* = 7.0 Hz), 5.17 (0.66H, t, *J* = 7.0 Hz), 2.43-2.35 (2H, m), 2.27-2.16 (2H, m), 2.16-1.92 (5H, m), 1.89-1.81 (1H, m), 1.78-1.70 (1H, m), 1.27-1.21 (2H, m), 1.12 (1H, s), 1.11 (2H, s), 0.95 (1H, t, *J* = 7.2 Hz), 0.94 (2H, t, *J* = 7.6 Hz); $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) 222.5, 222.3, 134.4, 134.3, 126.20, 126.17, 126.08, 126.06, 48.4, 48.3, 44.5, 44.2, 36.5, 35.5, 35.4, 32.1, 31.0, 30.2, 28.1, 23.9, 23.2, 23.1, 20.4, 20.1, 19.7, 14.8, 14.7; LRMS (ESI): m/z 215.1409 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{20}ONa$ ($[M+Na]^+$): 215.1406, found 215.1410

Reductant 3aa, 3ba



3aa



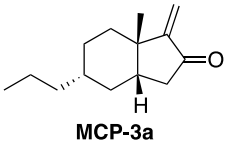
3ba

Following the general procedure D, alkene **2a** (256 mg, 1.33 mmol) was converted to reductant **3aa** (162 mg, 0.834 mmol, 63%) as a yellow oil and **3ba** (79.9 mg, 0.411 mmol, 31%) as a yellow oil.

3aa: IR (neat) 2924, 1739 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 2.38-2.07 (4H, m), 1.94 (1H, ddd, *J* = 12.8, 5.6, 5.6 Hz), 1.75-1.68 (1H, m), 1.58-1.52 (2H, m), 1.31-1.07 (6H, m), 0.97 (3H, s), 0.86 (3H, t, *J* = 7.2 Hz), 0.65-0.52 (2H, m); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 222.1, 49.9, 43.2, 39.2, 37.1, 35.9, 33.2, 31.7, 30.2, 24.4, 23.9, 19.7, 14.2; LRMS (ESI): m/z 217.1560 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{22}ONa$ ($[M+Na]^+$): 217.1563, found 215.1560

3ba: IR (neat) 2924, 1739 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 2.45 (1H, ddd, *J* = 19.2, 8.0, 2.0 Hz), 2.17 (1H, ddd, *J* = 19.2, 9.0, 9.0 Hz), 1.96-1.77 (3H, m), 1.65-1.13 (10H, m), 1.07 (3H, s), 1.10-0.98 (1H, m), 0.89 (3H, t, *J* = 7.6 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) 223.2, 47.3, 42.7, 39.1, 36.2, 31.5, 31.3, 28.2, 27.7, 23.2, 19.8, 18.9, 14.3; LRMS (ESI): m/z 217.1560 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{22}ONa$ ($[M+Na]^+$): 217.1563, found 215.1560

MCP-3a



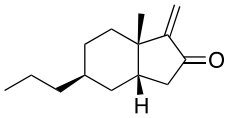
MCP-3a

Following the general procedure A, reductant **3aa** (162 mg, 0.834 mmol) was converted to alkene **4aa** (79.9 mg, <0.472 mmol) as a yellow oil.

Following the general procedure B, alkene **4aa** (79.9 mg, <0.472 mmol) was converted to **MCP-3a**. After column chromatography, **MCP-3a** (containing inpurity) was further purified by GPC to afford **MCP-3a** (28.5 mg, 0.138 mmol, 17% in 2 steps) as a yellow oil.

MCP-3a: IR (neat) 2919, 1730, 1647 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 6.06 (1H, s), 5.14 (1H, s), 2.64 (1H, dd, *J* = 17.8, 6.5 Hz), 2.05-2.00 (1H, m), 1.96-1.90 (1H, m), 1.92 (1H, d, *J* = 17.8 Hz) 1.64 (1H, dddd, *J* = 13.0, 2.0, 2.0, 2.0 Hz), 1.55-1.49 (2H, m), 1.32-1.22 (3H, m), 1.12-1.07 (2H, m), 1.10 (3H, s), 0.88-0.81 (1H, m), 0.85 (3H, t, *J* = 7.5 Hz), 0.45 (1H, ddd, *J* = 12.0, 12.0, 12.0 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) 208.2, 150.8, 115.6, 43.4, 43.2, 40.4, 39.1, 38.4, 36.2, 34.5, 30.5, 28.3, 19.8, 14.3; LRMS (ESI): m/z 229.16 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{14}H_{22}ONa$ ($[M+Na]^+$): 229.1563, found 229.1565

MCP-3b



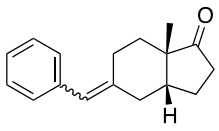
MCP-3b

Following the general procedure A, **3ba** (79.9 mg, 0.411 mmol) was converted to alkene **4ba** (60.5 mg, <0.315 mmol) as a yellow oil.

Following the general procedure B, alkene **4ba** (60.5 mg, <0.315 mmol) was converted to **MCP-3b**. After column chromatography, **MCP-3b** (containing inpurity) was further purified by GPC to afford (9.20 mg, 0.0446 mmol, 11%) as a yellow oil.

MCP-3b: IR (neat) 1726, 1641 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 5.93 (1H, s), 5.13 (1H, s), 2.38 (1H, dd, *J* = 18.5, 12.0 Hz), 2.23 (1H, dd, *J* = 18.5, 8.0 Hz), 2.04-2.01 (1H, m), 1.63-1.56 (2H, m), 1.48-1.20 (8H, m), 1.15-1.10 (1H,m), 1.24 (3H, s), 0.89 (3H, t, *J* = 7.5 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) 207.4, 156.3, 114.6, 41.6, 40.3, 39.1, 38.7, 34.3, 30.5, 28.4, 22.7, 19.9, 14.3 (one carbon is overlapped.); LRMS (ESI): m/z 229.16 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{14}H_{22}ONa$ ($[M+Na]^+$): 229.1563, found 229.1561

Alkene 2b



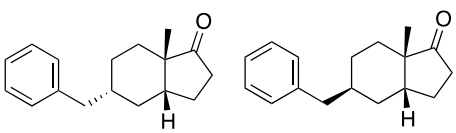
dr = 2 : 3

2b

Following the general procedure C, reductant **1** (100 mg, 0.602 mmol) was converted to alkene **2b** (145 mg, 0.589 mmol, mixture of *dr* = 2:3, 98%) as a yellow oil.

Alkene 2b: ^{1}H NMR (500 MHz, $CDCl_3$) 7.34-7.30 (2H, m), 7.23-7.18 (3H, m), 6.39 (0.4H, s), 6.32 (0.6H, s), 2.60-2.56 (0.6H, m), 2.50-2.38 (2.4H, m), 2.34-2.03 (4H, m), 1.99-1.64 (3H, m), 1.39-1.23 (1H, m), 1.16 (1.8H, s), 1.15 (1.2H, s)

Reductant 3ab, 3bb



3ab **3bb**

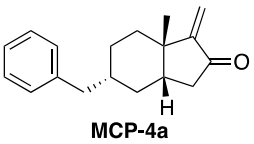
Following the general procedure D, alkene **2b** (481 mg, 2.00 mmol) was converted to reductant **3b** (424 mg, 1.75 mmol, 88%, **3ab** : **3bb** = 1 : 1). **3b** was further purified by silica gel

column (hexane/EtOAc = 100/1-30/1) to give **3ab** (190 mg, 0.783 mmol, 39%) as a yellow oil and **3bb** (190 mg, 0.783 mmol, 39%) as a yellow oil.

3ab: ^{1}H NMR (500 MHz, $CDCl_3$) 7.27 (2H, dd, *J* = 7.0, 6.8 Hz), 7.18 (1H, t, *J* = 7.0 Hz), 7.11 (2H, d, *J* = 6.8 Hz), 2.47* (1H, dd, *J* = 13.2, 6.8 Hz), 2.39* (1H, dd, *J* = 13.2, 7.2 Hz), 2.43 (1H, dddd, *J* = 8.4, 8.4, 8.4, 2.4 Hz), 2.39-2.31 (1H, m), 2.27-2.07 (1H, m), 1.90 (1H, ddd, *J* = 12.4, 6.4, 6.0 Hz), 1.70 (1H, dddd, *J* = 12.8, 6.0, 2.8, 2.8 Hz), 1.58-1.42 (3H, m), 1.18 (1H, ddd, *J* = 13.2, 13.2, 3.8 Hz), 0.96 (3H, s), 0.79-0.68 (1H, m), 0.63 (1H, ddd, *J* = 12.8, 12.4, 12.4 Hz) *other analysis : 2.45 (1H, dd, *J* = 20.0, 6.8Hz), 2.41 (1H, dd, *J* = 20.4, 7.2 Hz)

3bb: ^{1}H NMR (500 MHz, $CDCl_3$) 7.28 (2H, dd, *J* = 7.2, 6.6 Hz), 7.19 (1H, t, *J* = 7.2 Hz), 7.14 (2H, d, *J* = 6.6 Hz), 2.53* (1H, dd, *J* = 13.2, 6.5Hz), 2.48* (1H, dd, *J* = 12.8, 6.8 Hz), 2.15 (1H, ddd, *J* = 19.4, 10.0, 10.0 Hz), 2.01-1.95 (1H, m), 1.89-1.71 (3H, m), 1.63 (1H, dddd, *J* = 14.0, 4.0, 2.0, 2.0 Hz), 1.59-1.51 (1H, m), 1.43-1.30 (2H, m), 1.20-1.00 (2H, m), 1.08 (3H, s) *other analysis : 2.52 (1H, dd, *J* = 22.8, 6.4 Hz), 2.48 (1H, dd, *J* = 27.2, 6.8 Hz), 2.43 (1H, dddd, *J* = 19.4, 19.4, 8.4, 2.4 Hz)

MCP-4a



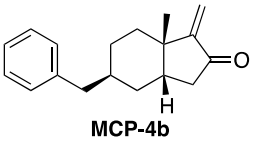
MCP-4a

Following the general procedure A, reductant **3ab** (190 mg, 0.784 mmol) was converted to alkene **4ab** (159 mg, <0.661 mmol) as a yellow oil.

Following the general procedure B, alkene **4ab** (159 mg, <0.661 mmol) was converted to **MCP-4a** (115 mg, 0.452 mmol, 56% in 2 steps) as a yellow liquid.

MCP-4a: IR (neat) 1725, 1645, 1496 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 7.27 (2H, t, *J* = 7.3 Hz), 7.18 (1H, t, *J* = 7.3 Hz), 7.10 (2H, d, *J* = 7.3 Hz), 7.20-7.17 (1H, m), 7.11-7.09 (2H, m), 6.08 (1H, s), 5.15 (1H, s), 2.61 (1H, dd, *J* = 18.0, 7.0 Hz), 2.45 (1H, dd, *J* = 13.5, 6.5 Hz), 2.39 (1H, dd, *J* = 13.5, 7.5 Hz), 2.04-2.00 (1H, m), 1.93-1.88 (2H, m), 1.62 (1H, dddd, *J* = 13.5, 5.5, 3.0, 3.0 Hz), 1.58-1.47 (3H, m), 1.08 (3H, s), 0.95-0.89 (1H, m), 0.53 (1H, ddd, *J* = 12.0, 12.0, 12.0 Hz); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 208.0, 150.7, 140.7, 129.1, 128.1, 125.8, 115.8, 43.5, 43.4, 43.1, 40.3, 38.7, 37.9, 34.3, 30.4, 28.2; LRMS (ESI): m/z 227.16 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{18}H_{22}ONa$ ($[M+Na]^+$): 277.1563, found 277.1564

MCP-4b



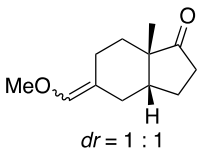
MCP-4b

Following the general procedure A, Reductant **3bb** (190 mg, 0.784 mmol) was converted to alkene **4bb** (166 mg, <0.691mmol) as a yellow oil.

Following the general procedure B, alkene **4bb** (166 mg, <0.691mmol) was converted to **MCP-4b** (118 mg, 0.465 mmol, 59%) as a yellow liquid.

MCP-4b: IR (neat) 1725, 1640, 1603, 1496 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 7.28 (2H, t, *J* = 7.3 Hz), 7.20 (1H, t, *J* = 7.3 Hz), 7.14 (2H, d, *J* = 7.3 Hz), 5.92 (1H, s), 5.12 (1H, s), 2.56* (1H, dd, *J* = 17.5, 6.5 Hz), 2.54* (1H, dd, *J* = 17.5, 7.0 Hz), 2.34 (1H, dd, *J* = 18.5, 12.0 Hz), 2.24 (1H, dd, *J* = 18.5, 8.0 Hz), 2.06-2.00 (1H, m), 1.77-1.68 (1H, m), 1.65-1.66 (1H, m), 1.57-1.39 (3H, m), 1.35 (1H, ddd, *J* = 14.0, 3.5, 3.5 Hz), 1.26 (3H, s), 1.23-1.17 (1H, m) *other analysis : 2.57 (1H, dd, *J* = 13.3, 6.5Hz), 2.53 (1H, dd, *J* = 13.3, 7.0 Hz); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 207.1, 156.1, 140.5, 129.1, 128.2, 125.9, 114.7, 43.1, 41.5, 40.2, 39.0, 34.1, 33.1, 30.3, 28.1, 22.7; LRMS (ESI): m/z 277.16 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{14}H_{22}ONa$ ($[M+Na]^+$): 277.1563, found 277.1572

Alkene 2c

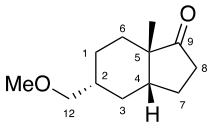


2c

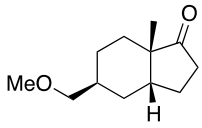
Following the general procedure C, diketone **1** (500 mg, 3.01 mmol) was converted to alkene **2c** (512 mg, 2.61 mmol, mixture of *dr* = 1:1, 87%) as a yellow oil.

Alkene 2c: ^{1}H NMR (500 MHz, $CDCl_3$) 5.89 (0.5H, s), 5.79 (0.5H, s), 3.552 (1.5H, s), 3.546 (1.5H, s), 2.44-2.17 (4H, m), 2.02-1.71 (5H, m), 1.58-1.51 (1H, m), 1.28-1.17 (1H, m), 1.11 (1.5H, s), 1.10 (1.5H, s)

Reductant 3ac, 3bc



3ac

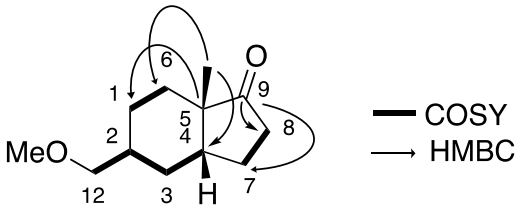


3bc

Following the general procedure D, alkene **2c** (512 mg, 2.64 mmol) was converted to reductant **3ac** (187 mg, 0.953 mmol, 36%) as a yellow oil and **3bc** (121 mg, 0.616 mmol, 23%) as a yellow oil.

3ac: IR (neat) 1738 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 3.31 (3H, s, -OC*H*$_3$), 3.17 (1H, dd, *J* = 9.0, 5.5 Hz, *H12*), 3.09 (1H, dd, *J* = 9.0, 7.0 Hz, *H12*), 2.40-2.31 (1H, m, *H8*), 2.24 (1H, ddd, *J* = 9.0, 9.0, 9.0 Hz, *H7*), 2.20-2.16 (1H, m, *H8*), 2.13 (1H, ddd, *J* = 13.5, 3.0, 3.0 Hz, *H6*$_{eq}$), 1.97 (1H, ddd, *J* = 12.5, 5.8, 5.5 Hz, *H4*), 1.83 (1H, dddd, *J* = 12.8, 5.8, 3.0, 3.0 Hz, *H3*$_{eq}$), 1.60-1.50 (3H, m, *H1*$_{eq}$, *H2* and *H7*), 1.23 (1H, ddd, *J* = 13.5, 13.5, 4.0 Hz, *H6*$_{ax}$), 0.99 (3H, s, -C*H*$_3$), 0.71 (1H, dddd, *J* = 13.5, 13.5, 13.5, 3.5 Hz, *H1*$_{ax}$), 0.63 (1H, ddd, *J* = 12.8, 12.5, 12.5 Hz, *H3*$_{ax}$); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 222.0 (*C9*), 78.2 (*C12*), 58.8 (-O*C*H$_3$), 50.1 (*C5*), 42.7 (*C4*), 36.7 (*C2*), 33.7 (*C3*), 33.2 (*C8*), 31.1 (*C6*), 26.9 (*C1*), 24.4 (-*C*H$_3$), 23.9 (*C7*); LRMS (ESI): m/z 219.1357 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{12}H_{20}O_2Na$ ($[M+Na]^+$): 219.1361, found 219.1357

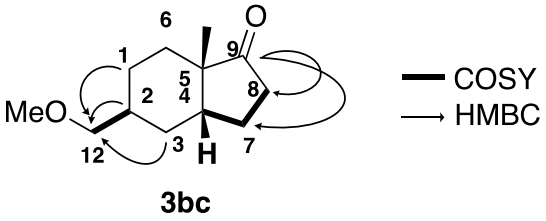
3bc: IR (neat) 1737 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) 3.34 (3H, s, -OC*H*$_3$), 3.22 (2H, d, *J* = 6.5 Hz, *H12*), 2.46 (1H, ddd, *J* = 19.2, 8.0, 8.0, 1.5 Hz, *H8*), 2.18 (1H, ddd, *J* = 19.2, 10.0, 10.0 Hz, *H8*), 2.01-1.98 (1H, m, *H4*), 1.92-1.79 (3H, m, *H2* and *H7*), 1.69 (1H, dddd, *J* = 14.0, 4.0, 2.0, 2.0 Hz, *H3*$_{ax}$), 1.66-1.62 (1H, m, *H1*$_{eq}$), 1.43-1.35 (2H, m, *H3*$_{eq}$, *H6*$_{ax}$) , 1.21 (1H, ddd, *J* = 10.5, 3.5, 3.5 Hz, *H6*$_{eq}$), 1.11 (1H, dddd, *J* = 13.5, 13.5, 13.5, 3.5 Hz, *H1*$_{ax}$), 1.08 (3H, s, -C*H*$_3$); $^{13}C\{^1H\}$ NMR (125 MHz, $CDCl_3$) 222.9 (*C9*), 78.3 (*C12*), 58.9 (-O*C*H$_3$), 47.2 (*C5*), 42.3 (*C4*), 36.2 (*C8*), 32.3 (*C2*), 28.0 (*C3*), 27.6 (*C6*), 24.6 (*C1*), 23.2 (*C7*), 18.9 (-*C*H$_3$); LRMS (ESI): m/z 219.14 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{12}H_{20}O_2Na$ ($[M+Na]^+$): 219.1361, found 219.1354



3ac

Table S3 ^{13}C and ^1H NMR Spectroscopic Data, COSY, and key HMBC of **3ac** (δ in ppm)

position	δ_C, type	δ_H (J in Hz)	COSY	selected HMBC
1_{ax}	26.9, CH_2	0.71, dddd (13.5, 13.5, 13.5, 3.5)	1_{eq}, 6_{ax}, 6_{eq}	
1_{eq}		1.60-1.50, m	1_{ax}, 6_{ax}, 6_{eq}	
2	36.7, CH	1.60-1.50, m	12	
3_{ax}	33.7, CH_2	0.63, ddd (12.8, 12.5, 12.5)	3_{eq}, 4	2, 4, 12
3_{eq}		1.83, dddd (12.8, 5.8, 3.0, 3.0)	2, 3_{ax}, 4	
4	42.7, CH	1.97, ddd (12.5, 5.8, 5.5)	3_{ax}, 3_{eq}	2, 3_{ax}, 3_{eq}, 6_{eq}, 8, $-CH_3$
5	50.1, C			1_{eq}, 3_{eq}, 6_{ax}, 6_{eq}, 7
6_{ax}	31.1, CH_2	1.23, ddd (13.5, 13.5, 4.0)	1_{ax}, 1_{eq}, 6_{eq}	
6_{eq}		2.13, ddd (13.5, 3.0, 3.0)	1_{ax}, 6_{ax}	
7	23.9, CH_2	2.24, ddd (9.0, 9.0, 9.0)	8	
		1.60-1.50, m		
8	33.2, CH_2	2.40-2.31, m	7	
		2.20-2.16, m		
9	222.0, C			4, 6_{ax}, 7, 8, $-CH_3$
12	78.2, CH_2	3.17, dd (9.0, 5.5)	2	3_{eq}
		3.09, dd (9.0, 7.0)		
$-CH_3$	24.4, CH_3	0.99, s		4, 6_{ax}
$-OCH_3$	58.8, CH_3	3.31, s		

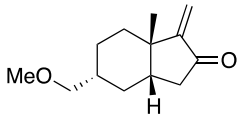


3bc

Table S4 ^{13}C and ^{1}H NMR Spectroscopic Data, COSY, and key HMBC of **3bc** (δ in ppm)

position	δ_C, type	δ_H (J in Hz)	COSY	selected HMBC
1_{ax}	24.6, CH_2	1.11, dddd (13.5, 13.5, 13.5, 3.5)	1_{eq}	12
1_{eq}		1.66-1.62, m	1_{ax}	
2	32.3, CH	1.92-1.79, m	12	12
3_{ax}	28.0, CH_2	1,43-1.35, m	3_{eq}	12
3_{eq}		1.69, dddd (14.0, 4.0, 2.0, 2.0)	3_{ax}	
4	42.3, CH	2.01-1.98, m	7	
5	47.2, C			
6_{ax}	27.6, CH_2	1.43-1.35, m	6_{eq}	
6_{eq}		1.21, ddd (10.5, 3.5, 3.5)	6_{ax}	
7	23.2, CH_2	1.92-1.79, m	8	
8	36.2, CH_2	2.46, ddd (19.2, 8.0, 8.0) 2.18, ddd (19.2, 10.0, 10.0)	7, 8	
9	222.9, C			7, 8
12	78.3, CH_2	3.22, d (6.5)	2	
$-CH_3$	18.9, CH_3	1.08, s		
$-OCH_3$	58.9, CH_3	3.34, s		

MCP-5a



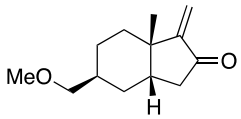
MCP-5a

Following the general procedure A, reductant **3ac** (187 mg, 0.953 mmol) was converted to alkene **4ac** (136 mg, <0.700 mmol) as a yellow oil.

Following the general procedure B, alkene **4ac** (136 mg, <0.700 mmol) was converted to **MCP-5a** (73.5 mg, 0.353 mmol, 37% in 2 steps) as a yellow oil.

MCP-5a: IR (neat) 1726, 1647 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 6.07 (1H, s), 5.15 (1H, s), 3.30 (3H, s), 3.14 (1H, dd, *J* = 9.1, 6.3 Hz), 3.09 (1H, dd, *J* = 9.1, 7.0 Hz), 2.65 (1H, dd, *J* = 18.0, 7.5 Hz), 2.08-2.03 (1H, m), 1.97 (1H, ddd, *J* = 12.5, 5.5, 5.5 Hz), 1.94 (1H, d, *J* = 18.0 Hz), 1.73 (1H, dddd, *J* = 13.5, 5.5, 3.0, 3.0 Hz), 1.65-1.50 (3H, m), 1.11 (3H, s), 0.96-0.87 (1H, m), 0.52 (1H, ddd, *J* = 12.0, 12.0, 12.0 Hz); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 207.8, 150.6, 115.8, 78.0, 58.9, 43.5, 43.0, 40.0, 37.1, 35.0, 33.9, 30.4, 25.1; LRMS (ESI): m/z 231.14 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{20}O_2Na$ ($[M+Na]^+$): 231.1356, found 231.1351

MCP-5b



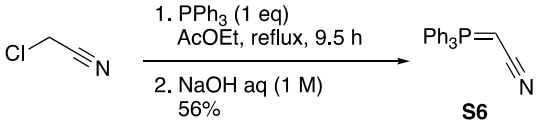
MCP-5b

Following the general procedure A, reductant **3bc** (121 mg, 0.616 mmol) was converted to alkene **4bc** (84.6 mg, <0.435 mmol) as a yellow oil.

Following the general procedure B, alkene **4bc** (84.6 mg, <0.435 mmol) was converted to **MCP-5b** (37.6 mg, 0.181 mmol, 29% in 2 steps) as a yellow oil.

MCP-5b: IR (neat) 1725, 1642 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) 5.94 (1H, s), 5.14 (1H, s), 3.34 (3H, s), 3.26* (1H, dd, *J* = 13.5, 6.0 Hz), 3.24* (1H, dd, *J* = 13.5 , 6.0 Hz) 2.39 (1H, dd, *J* = 18.5, 12.0 Hz), 2.29 (1H, dd, *J* = 18.5, 8.0 Hz), 2.08-2.04 (1H, m), 1.81-1.67 (2H, m), 1.65-1.61 (1H, m), 1.51-1.44 (2H, m), 1.38 (1H, ddd, *J* = 15.0, 2.5, 2.5 Hz), 1.26 (3H, s), 1.20 (1H, dddd, *J* = 14.0, 14.0, 14.0, 3.5 Hz) *other analysis : 3.27 (1H, dd, *J* = 9.0, 6.0 Hz), 3.23 (1H, dd, *J* = 9.0, 6.0 Hz); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 207.0, 156.1, 114.8, 77.9, 58.9, 41.6, 40.1, 38.7, 33.8, 31.5, 27.0, 25.3, 22.6; LRMS (ESI): m/z 231.14 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{20}O_2Na$ ($[M+Na]^+$): 231.1356, found 231.1351

(Triphenylphosphoranylidiene)acetonitrile [17]



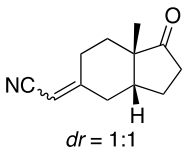
S6

To a solution of triphenylphosphine (8.42 g, 32.1 mmol) in AcOEt (16.7 mL) was added choloroacetonitrile (2.00 mL, 31.8 mmol). After the reaction mixture was refluxed for 9.5 h, a white precipitate was formed. After the suspension was cooled to room temperature, the precipitate was collected by filtration, washed with Et_2O, and dried under air. After the precipitate was dried under

air overnight, 1 M aqueous NaOH (46 mL) was added to a solution of the precipitate in H_2O (101 mL). After the reaction mixture was stirred for 40 min, a white precipitate was filtered, washed with H_2O, dried under vacuum, and recrystallization (benzene) to afford (triphenylphosphoranylidiene)acetonitrile **S6** (5.37 g, 17.8 mmol, 56%) as a white solid.

^{1}H NMR spectrum of **S6** was identical with reported data. [17]

Alkene 2d

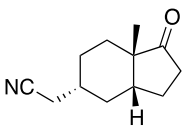


dr = 1:1
2d

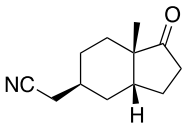
(Triphenylphosphoranylidiene)acetonitrile (1.54 g, 5.12 mmol) was added to a solution of diketone **1** (500 mg, 3.01 mmol) in toluene (12 mL). After being refluxed for 25.5 h, the reaction mixture was cooled to room temperature and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (hexane/EtOAc = 4/1-2/1) to afford alkene **2d** (554 mg, 2.93 mmol, mixture of *dr* = 1:1, 97%) as a yellow oil.

Alkene 2d: ^{1}H NMR (500 MHz, $CDCl_3$) 5.20 (0.5H, s), 5.16 (0.5H, s), 2.67 (0.5H, ddd, *J* =14.5, 6.0, 1.5 Hz), 2.57-2.38 (3H, m), 2.35-2.14 (3.5H, m), 2.10-1.95 (1H, m), 1.83-1.76 (1H, m), 1.72-1.60 (1H, m), 1.42 (1H, dddd, *J* = 19.0, 14.0, 6.0, 6.0 Hz), 1.16 (1.5H, s), 1.15 (1.5H, s)

Reductant 3ad, 3bd



3ad



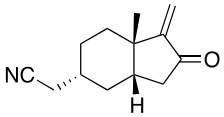
3bd

Following the general procedure D, alkene **2d** (554 mg, 2.93 mmol) was converted to reductant **3d** (482 mg, 2.52 mmol, 86%, **3ad** : **3bd** = 1 : 1.2). **3d** was further purified by silica gel column (hexane/EtOAc = 5/1-2/1) to give **3ad** (262 mg, 1.37 mmol, 47%) and **3bd** (220 mg, 1.15 mmol, 39%) as yellow oils.

3ad: ^{1}H NMR (400 MHz, $CDCl_3$) 2.41-2.35 (1H, m), 2.28-2.14 (5H, m), 2.03 (1H, ddd, *J* = 12.2, 6.0, 6.0 Hz), 1.91 (1H, dddd, *J* = 13.0, 5.6, 2.8, 2.8 Hz), 1.69-1.57 (3H, m), 1.27 (1H, ddd, *J* = 13.2, 13.2, 3.8 Hz), 1.01 (3H, s), 0.84 (1H, dddd, *J* = 13.2, 13.2, 13.2, 9.2 Hz), 0.74 (1H, ddd, *J* = 13.0, 12.2, 12.0 Hz)

3bd: ^{1}H NMR (400 MHz, $CDCl_3$) 2.48 (1H, ddd, *J* =19.5, 8.5, 2.5 Hz), 2.30 (2H, d, *J* = 7.0 Hz), 2.21 (1H, ddd, *J* = 19.5, 11.0, 9.0 Hz), 2.09-2.03 (1H, m), 1.97-1.77 (4H, m), 1.75-1.70 (1H, m), 1.55-1.41 (2H, m), 1.31-1.22 (2H, m), 1.10 (3H, s)

MCP-6a



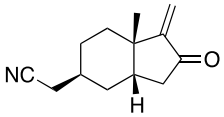
MCP-6a

Following the general procedure A, reductant **3ad** (246 mg, 1,29 mmol) was converted to alkene **4ad** (245 mg) as a yellow oil.

Following the general procedure B, alkene **3ad** (245 mg) was converted to **MCP-6a** (154 mg, 0.758 mmol, 59%) as a yellow oil.

MCP-6a: IR (neat) 2245, 1723, 1644 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 6.10 (1H, s), 5.18 (1H, s), 2.67 (1H, dd, *J* = 18.0, 6.8 Hz), 2.20 (2H, d, *J* = 6.4 Hz), 2.11 (1H, ddd, *J* = 14.0, 3.2, 3.2 Hz), 2.04 (1H, ddd, *J* = 12.8, 5.2, 5.2 Hz), 1.97 (1H, d, *J* = 18.0 Hz), 1.85-1.69 (3H, m), 1.60 (1H, ddd, *J* = 14.0, 14.0, 4.4 Hz), 1.13 (3H, s), 1.05 (1H, dddd, *J* = 12.8, 12.8, 12.8, 3.6 Hz), 0.64 (1H, ddd, *J* = 12.4, 12.4, 12.4 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) 206.9, 149.9, 118.4, 116.2, 42.8, 42.7, 40.0, 37.2, 33.9, 33.7, 30.1, 27.7, 24.2; LRMS (ESI): m/z 226.12 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{17}NONa$ ($[M+Na]^+$): 226.1202, found 226.1205

MCP-6b



MCP-6b

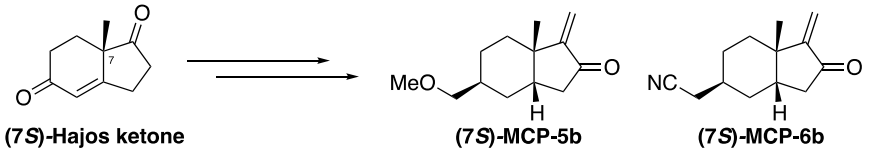
Following the general procedure A, Reductant **3bd** (185 mg, 0.967 mmol) was converted to alkene **4bd** (184 mg) as a yellow oil.

Following the general procedure B, alkene **4bd** (184 mg) was converted to **MCP-6b** (55.9 mg, 0.275 mmol, 28%) as a yellow oil.

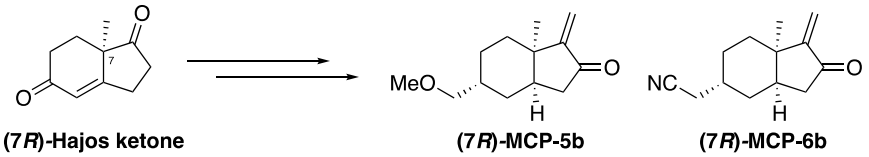
MCP-6b: IR (neat) 2246, 1725, 1641 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) 5.98 (1H, d, *J* = 1.6 Hz), 5.18 (1H, d, *J* = 1.6 Hz), 2.35 (2H, s), 2.33 (2H, d, *J* = 1.6 Hz), 2.14-2.07 (1H, m), 1.94-1.82 (1H, m), 1.79 (1H, dddd, *J* = 14.0, 3.6, 3.6, 3.6 Hz), 1.74-1.69 (1H, m), 1.67-1.60 (1H, m), 1.56-1.32 (3H, m), 1.28 (3H, s); $^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 206.0, 155.3, 118.3, 115.5, 41.0, 39.8, 38.7, 33.6, 29.4, 28.7, 27.6, 24.1, 22.4; LRMS (ESI): m/z 226.12 ($[M+Na]^+$); HRMS (ESI) calcd for $C_{13}H_{17}NONa$ ($[M+Na]^+$): 226.1202, found 226.1202

(7*S*)-MCP-5b and **(7*S*)-MCP-6b** were synthesized from **(7*S*)-Hajos ketone** by following the same procedure for the corresponding racemic compounds.

(7*R*)-MCP-5b and **(7*R*)-MCP6b** were synthesized from **(7*R*)-Hajos ketone** by following the same procedure for the corresponding racemic compounds.



(7*S*)-Hajos ketone **(7*S*)-MCP-5b** **(7*S*)-MCP-6b**



(7*R*)-Hajos ketone **(7*R*)-MCP-5b** **(7*R*)-MCP-6b**

Optical rotation

(7*S*)-MCP-5b: $[\alpha]^{22}_{D}$ 95.99 (*c* 1.100, $CHCl_3$)

(7*R*)-MCP-5b: $[\alpha]^{22}_{D}$ -108.4 (*c* 1.000, $CHCl_3$)

(7*S*)-MCP-6b: $[\alpha]^{21}_{D}$ 120.6 (*c* 1.050, $CHCl_3$)

(7*R*)-MCP-6b: $[\alpha]^{21}_{D}$ -108 (*c* 0.300, $CHCl_3$)

3. NMR Monitoring Experiments

To a solution of **MCP-5a** in CD_3OD (40 mM, 1.2 mL) methyl thioglycolate in CD_3OD (40 mM, 1.2 mL) was added. The reaction mixture was monitored by ^{1}H-NMR (400 MHz, CD_3OD) 30 min, 12 h, and 24 h after the mixing.

To a solution of **MCP-5b** in CD_3OD (40 mM, 0.81 mL) methyl thioglycolate in CD_3OD (40 mM, 0.81 mL) was added. The reaction mixture was monitored by ^{1}H-NMR (400 MHz, CD_3OD) 30 min, 12 h, and 24 h after the mixing.

To a solution of **MCP-5a** in DMSO-d_6 (40 mM, 0.5 mL) methyl thioglycolate in DMSO-d_6/D_2O 1:1 (40 mM, 0.5 mL) was added. The reaction mixture was monitored by ^{1}H-NMR (500 MHz, DMSO-d_6) 30 min, 6 h, and 24 h after the mixing.

To a solution of **MCP-5b** in DMSO-d_6 (40 mM, 0.5 mL) methyl thioglycolate in DMSO-d_6/D_2O 1:1 (40 mM, 0.5 mL) was added. The reaction mixture was monitored by ^{1}H-NMR (500 MHz, DMSO-d_6) 30 min, 6 h, and 24 h after the mixing.

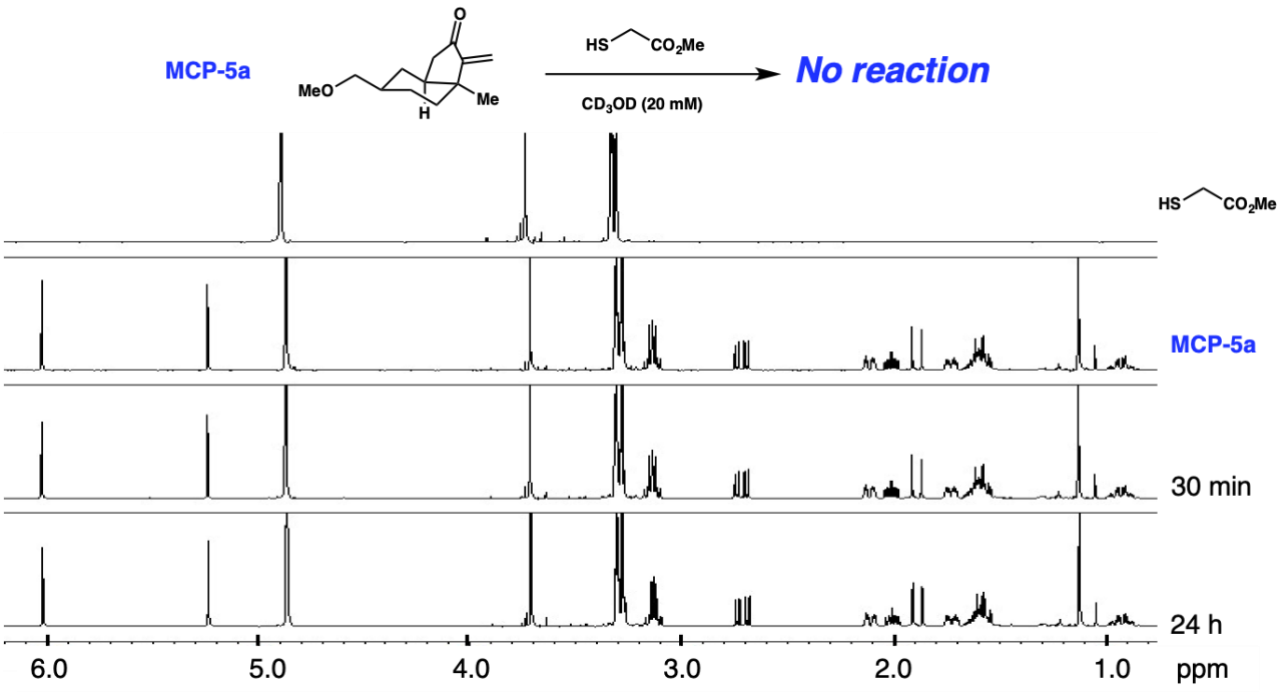


Figure S1-1. NMR spectra of **MCP-5a**, methyl thioglycolate, and reaction mixture in CD_3OD

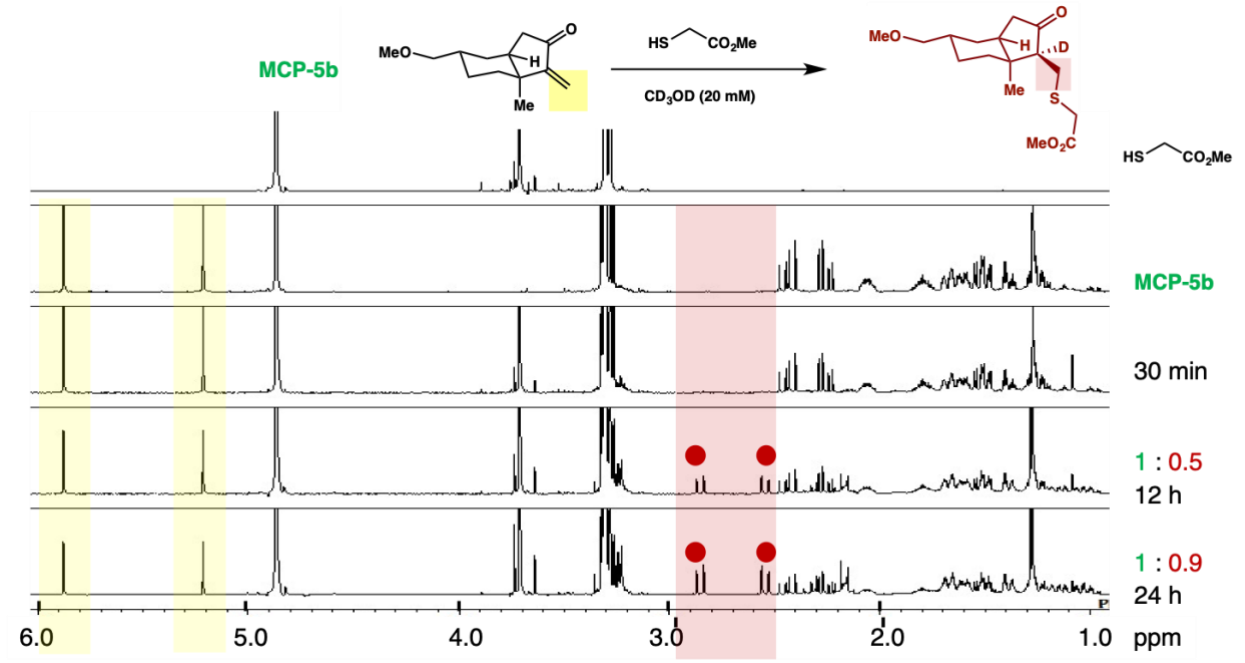


Figure S1-2. NMR spectra of **MCP-5b**, methyl thioglycolate, and reaction mixture in CD_3OD

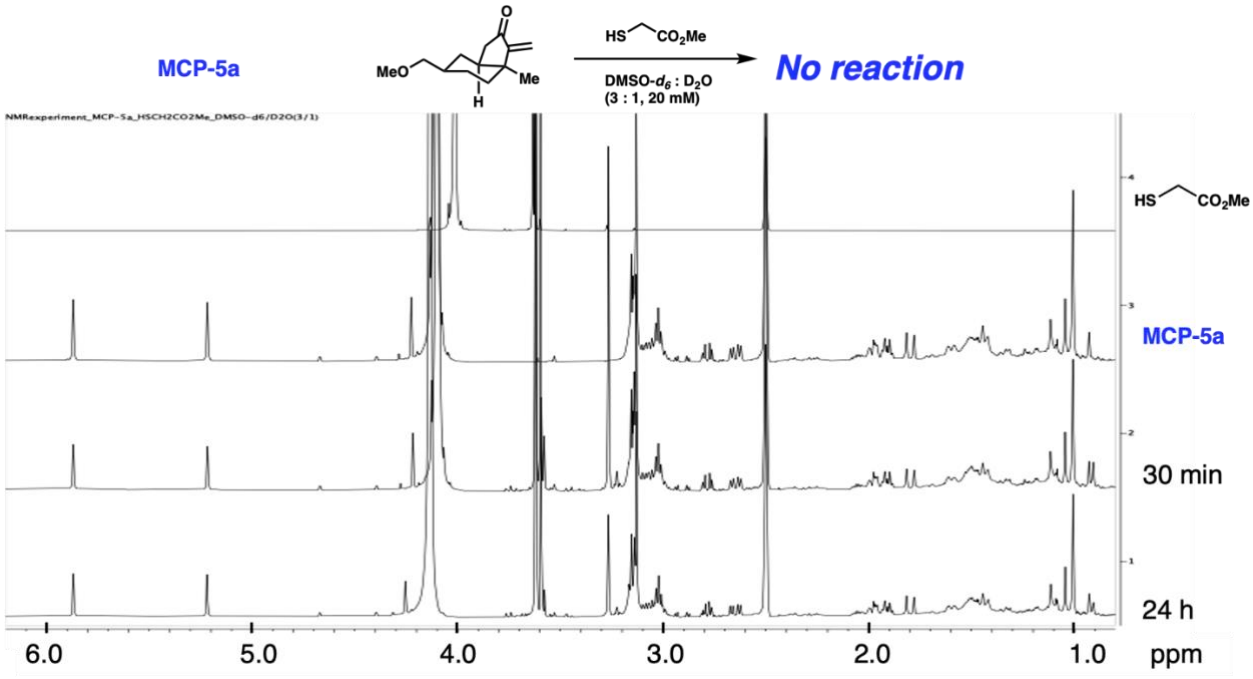


Figure S1-3. NMR spectra of **MCP-5a**, methyl thioglycolate, and reaction mixture in DMSO-d_6 : D_2O (3 : 1)

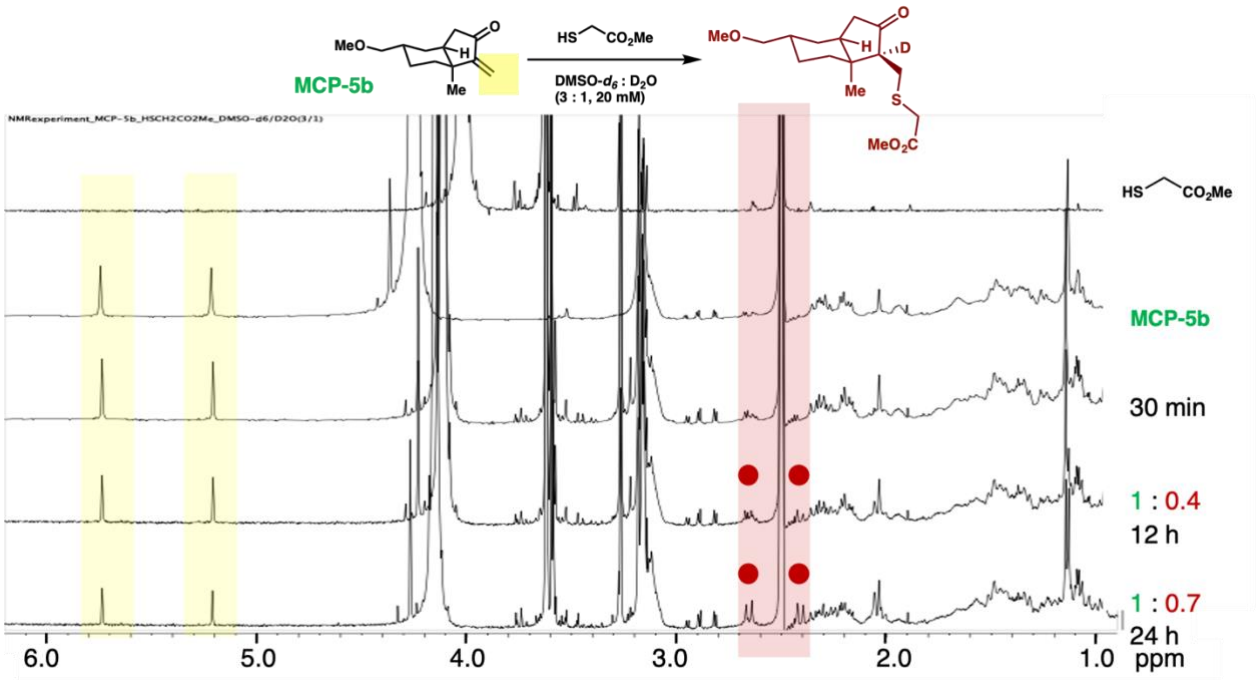


Figure S1-4. NMR spectra of **MCP-5b**, methyl thioglycolate, and reaction mixture in DMSO-d_6 : D_2O (3 : 1)

4. Comparison of ^{1}H-NMR of MCP-3a－6a and MCP-3b－6b

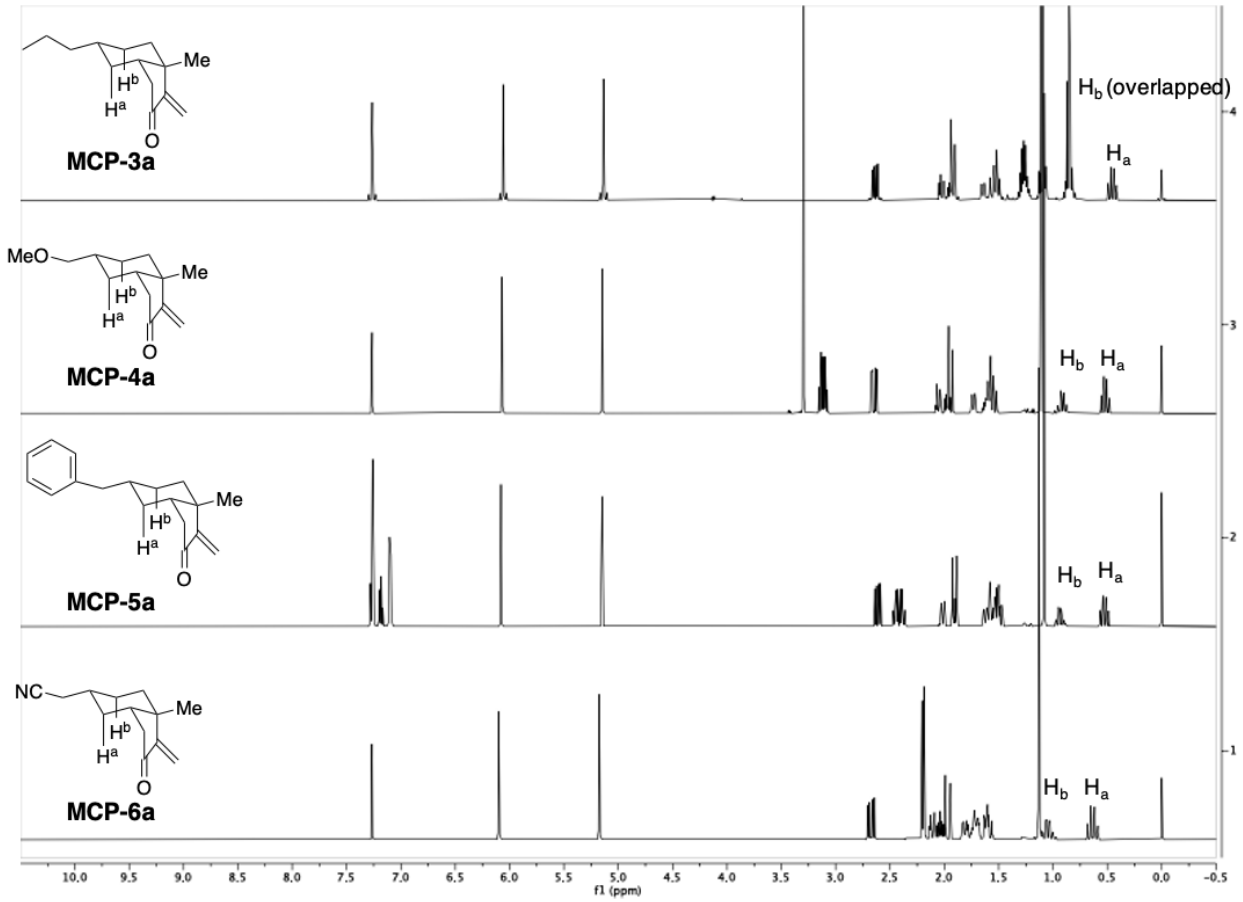


Figure S2-1. In ^{1}H-NMR of **MCP-3a**, **MCP-4a**, **MCP-5a**, and **MCP-6a**, H^{a} and H^{b} appear in upfield region (< 1 ppm).

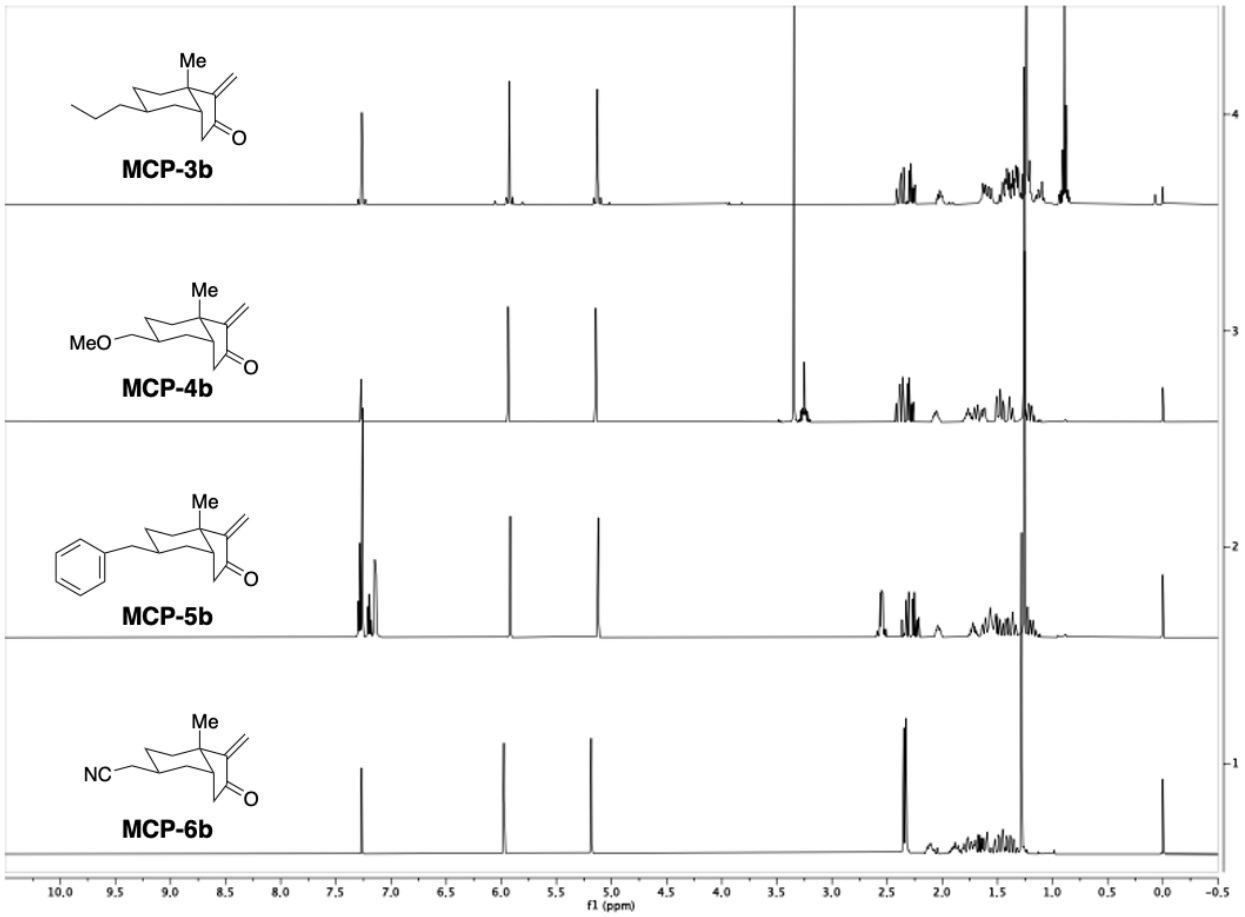


Figure S2-2. In ^{1}H-NMR of **MCP-3b**, **MCP-4b**, **MCP-5b**, and **MCP-6b**, any hydrogens on the rings do not appear in upfield region (< 1 ppm).

5. References

1. Robichaud, A. J. M. B., Gabriel; Harrison, Boyd L.; Salituro, Francesco G.; Griffin, Andrew; Blanco-Pillado, Maria Jesus, *WO Patent* 2018, WO 2018013613.
2. Gasic, M. J.; Djarmati, Z.; Pelletier, S. W., Carbon-13 nuclear magnetic resonance spectroscopy of polycyclic .delta.-lactones. *The Journal of Organic Chemistry* **1976,** *41* (7), 1219-1221.
3. Bruttomesso, A. C.; Doller, D.; Gros, E. G., Stereospecific Synthesis of Steroidal 20,16-γ-Carbolactones. *Synthetic Communications* **1998,** *28* (21), 4043-4057.
4. Shi, B.; Wu, H.; Yu, B.; Wu, J., 23-oxa-analogues of OSW-1: efficient synthesis and extremely potent antitumor activity. *Angew Chem Int Ed Engl* **2004,** *43* (33), 4324-7.
5. Cocker, J. D.; Halsall, T. G., 684. Studies in the synthesis of terpenes. Part II. The preparation of an intermediate for the synthesis of diterpenes. *Journal of the Chemical Society (Resumed)* **1957**, 3441.
6. Ihara, M.; Toyota, M.; Fukumoto, K.; Kametani, T., An enantioselective total synthesis of (+)-atisirene by intramolecular double Michael reaction. *Journal of the Chemical Society, Perkin Transactions 1* **1986**, 2151.
7. Scheck, M.; Koch, M. A.; Waldmann, H., Synthesis of a dysidiolide-inspired compound library and discovery of acetylcholinesterase inhibitors based on protein structure similarity clustering (PSSC). *Tetrahedron* **2008,** *64* (21), 4792-4802.
8. De Brabandere, V.I.; Thienpont, L.M.; Stöckl, D.; De Leenheer, A.P. 13C-NMR and mass spectral data of steroids with a 17,17-dialkyl-18-nor-13(14)-ene substructure, *Journal of Lipid Research*, **1997**, *38*, 780-789.

6. Cell cultures

HeLa cells (ATCC, Manassas, VA, USA) were cultured in Dulbecco's Modified Eagle's medium (DMEM; Nissui, Tokyo, Japan) supplemented with 10% fetal calf serum (Merck KGaA), 2 mM L-glutamine (Thermo Fisher Scientific, Waltham, MA, USA), 100 U/mL penicillin (Meiji Seika Pharma Co., Ltd., Tokyo, Japan), and 100 μg/mL streptomycin (Meiji Seika Pharma Co., Ltd.) at 37°C in 5% CO_2.

7. Immunoblotting

HeLa cells were pre-treated with each compound or Me_2SO (Wako Pure Chemical Industries, Osaka, Japan) for 30 min, then stimulated with 20 ng/mL recombinant human TNF-α (R&D Systems, Minneapolis, MN, USA). After washing with cold PBS, cells were harvested. Whole-cell lysates were prepared with lysis buffer (25 mM HEPES (pH 7.7), 0.3 M NaCl, 1.5 mM $MgCl_2$, 0.2 mM EDTA, 0.1% Triton X-100, 20 mM β-glycerophosphate, 1 mM sodium orthovanadate, 1 mM phenylmethylsulfonyl fluoride, 1 mM dithiothreitol, 10 mg/mL aprotinin and 10 mg/mL leupeptin). The lysates were mixed with the same volume of SDS–PAGE sample buffer (100 mM Tris-HCl (pH 6.8), 2.0% SDS, 70 mM DTT, 10% glycerol and 0.10% bromophenol blue) and heated at 95 °C for 5 min. Samples were resolved using SDS-PAGE and transferred to an Immobilon-P nylon membrane (Merck KGaA). The membrane was treated overnight with BlockAce (KAC Co., Ltd., Kyoto, Japan), then, probed with phospho-specific antibodies against p65 (Ser-536) (Cell Signaling Technology, Danvers, MA, USA), or β-Actin (Santa Cruz Biotechnology, Santa Cruz, CA, USA) at room temperature. Antibodies were detected using horseradish peroxidase-conjugated anti-rabbit, or anti-mouse IgG (DAKO, Glostrup, Denmark) diluted in PBS containing 0.1% Tween 20 (Wako Pure Chemical Industries). Signals were detected with an enhanced chemiluminescence system (Thermo Fisher Scientific).

The NF-kB inhibitory activity of MCP-1 was assessed, however, MCP-1 was inactive (data not shown).

8. NF-κB inhibitory activity of both enantiomers

The whole blots after cutting membrane at molecular weight 63-48 kDa for pp65 (65 kDa) and β-Actin (43 kDa) for Fig.4 and S3 were shown.

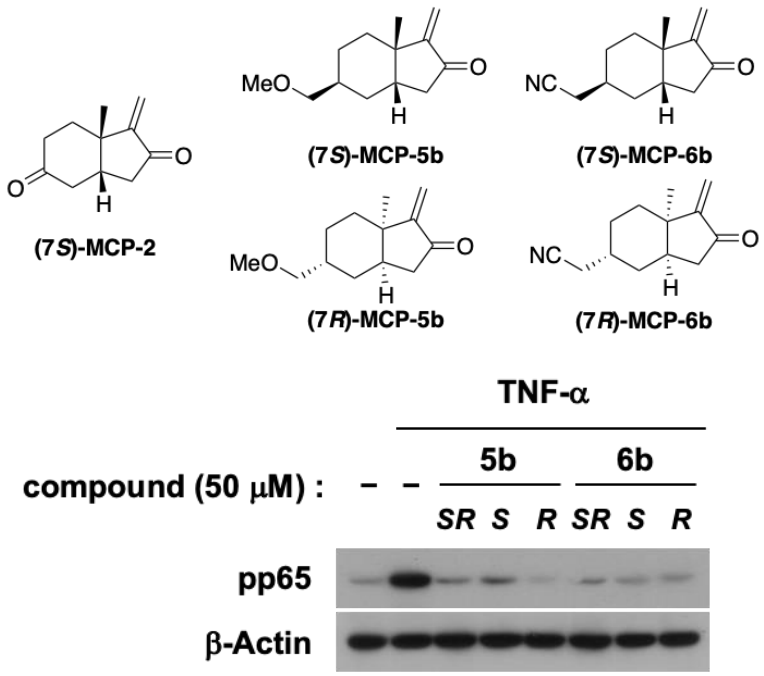


Figure S3-1. **Racemic-, (7*S*)-, (7*R*)-MCP-5b** and **racemic-, (7*S*)-, (7*R*)-MCP-6b** inhibits TNF-α-induced p65 phosphorylation. HeLa cells were pre-treated with 50 μM compounds for 30 min, then stimulated with 20 ng/mL TNF-α. Whole-cell lysates were immunoblotted with anti-phospho-p65 (Ser-536) and β-Actin antibodies.

*Compound names are shown without "MCP-". *SR*: racemic. *S*: (7*S*)-, *R*: (7*R*)-

The whole blots after cutting membrane at molecular weight 63-48 kDa for pp65 (65 kDa) and β-Actin (43 kDa) for Fig.4 and S3-1 were shown as below.

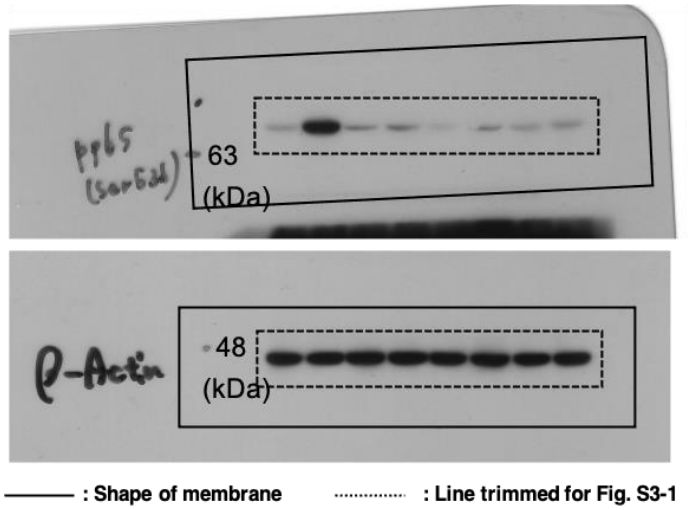


Figure S3-2. Full bots for “Figure S3-1”.

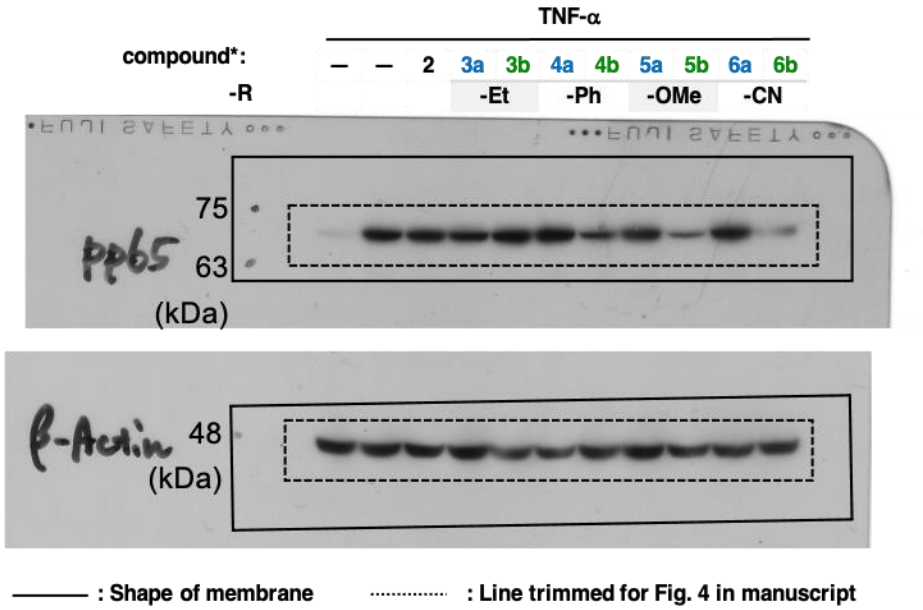


Figure S3-3: Full blots for “Figure 4” in manuscript.

9. General Procedure of Molecular Modeling

Conformational searches of **MCP-3a**, **MCP-4a**, **MCP-5a**, **MCP-6a**, **MCP-3b**, **MCP-4b**, **MCP-5b**, and **MCP-6b** were performed by a MacroModel program on Maestro Version 11.4.

The conformational search on these compounds, we ran 100 00 steps of the torsional sampling (MCMM: Monte Carlo Multiple Minimum) method with PRCG energy minimization using the OPLS3e force field (solvent: water) and obtained some conformational isomers (see **9.1**) with energies within 10.0 kcal/mol of the lowest energy structure. (torsional sampling options: Maximum interaction: 5000; Energy window for saving structures: 50 $kJ \cdot mol^{-1}$)

9.1. 3D structures, calculated total energies, and relative energies

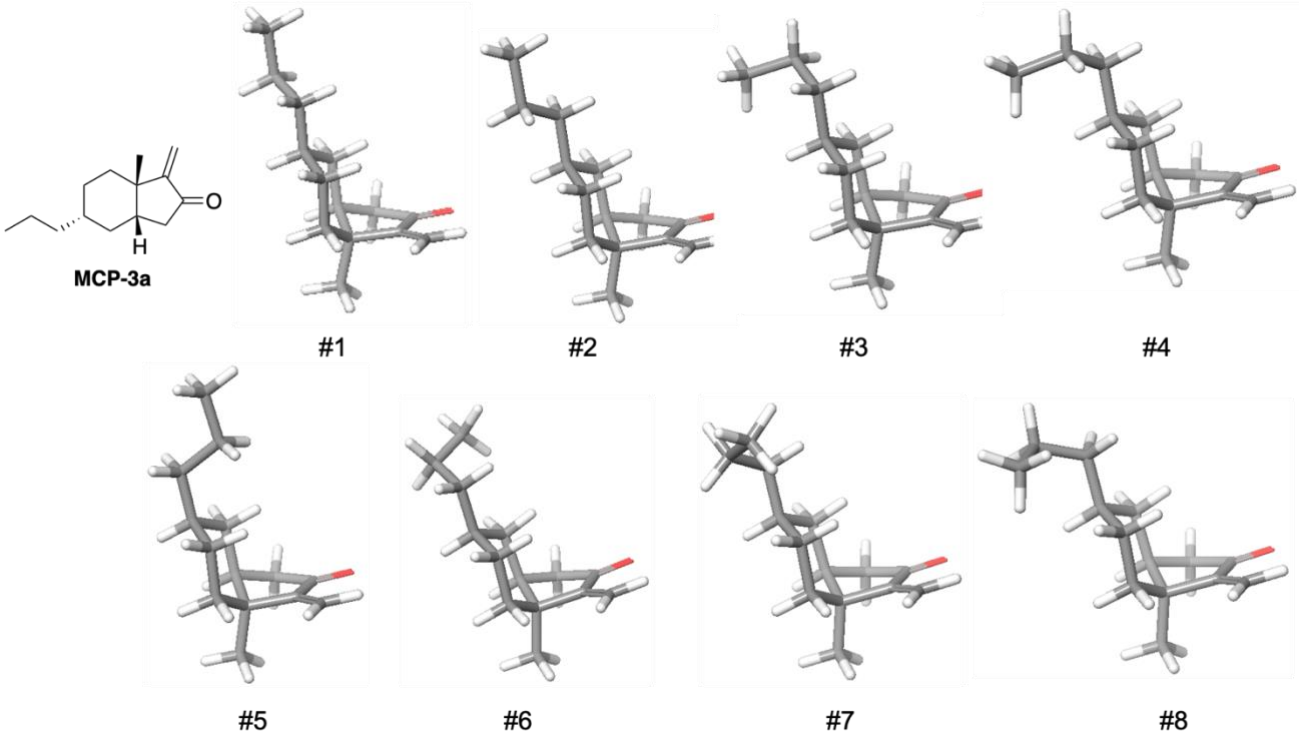


Figure S4-1. 3D structures of the conformers of **MCP-3a**

Table S4-1. Total and relative energies for conformers of **MCP-3a**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-17.682
#2	0.227	-17.455
#3	2.120	-15.562
#4	2.426	-15.256
#5	3.873	-13.809
#6	8.892	-8.790
#7	9.571	-8.111
#8	9.755	-7.927

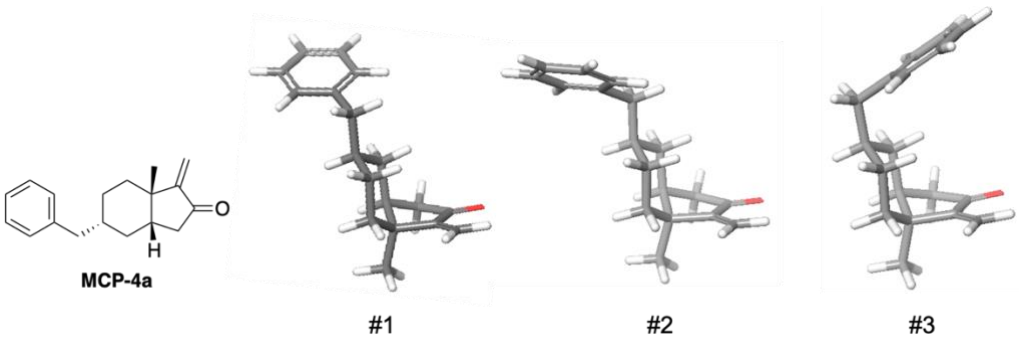


Figure S4-2. 3D structures of the conformers of **MCP-4a**

Table S4-2. Total and relative energies for conformers of **MCP-4a**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	1.516
#2	0.288	1.804
#3	0.330	1.846

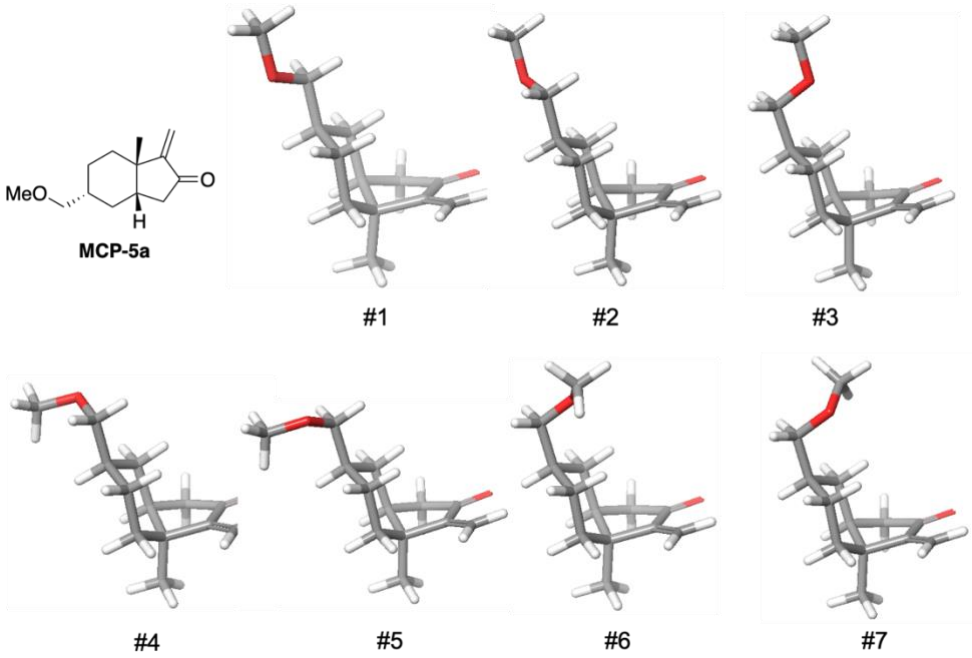


Figure S4-3. 3D structures of the conformers of **MCP-5a**

Table S4-3. Total and relative energies for conformers of **MCP-5a**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-20.268
#2	0.042	-20.226
#3	0.555	-19.713
#4	3.633	-16.635
#5	3.637	-16.631
#6	7.465	-12.803
#7	7.564	-12.704

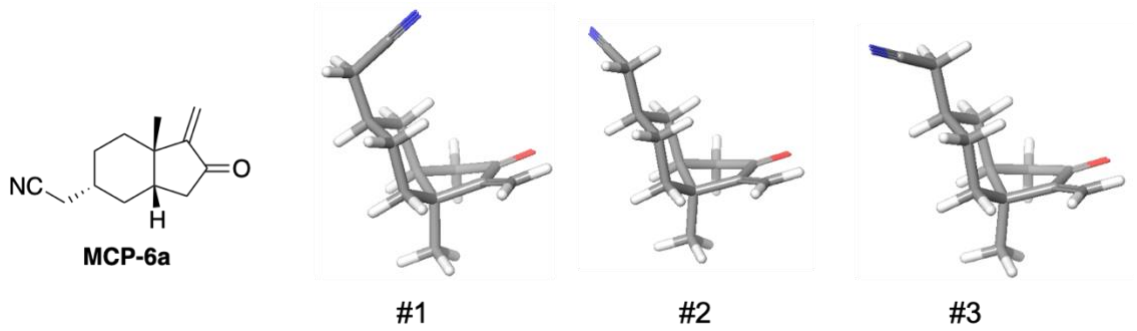


Figure S4-4. 3D structures of the conformers of **MCP-6a**

Table S4-4. Total and relative energies for conformers of **MCP-6a**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-37.729
#2	0.088	-37.641
#3	0.196	-37.533

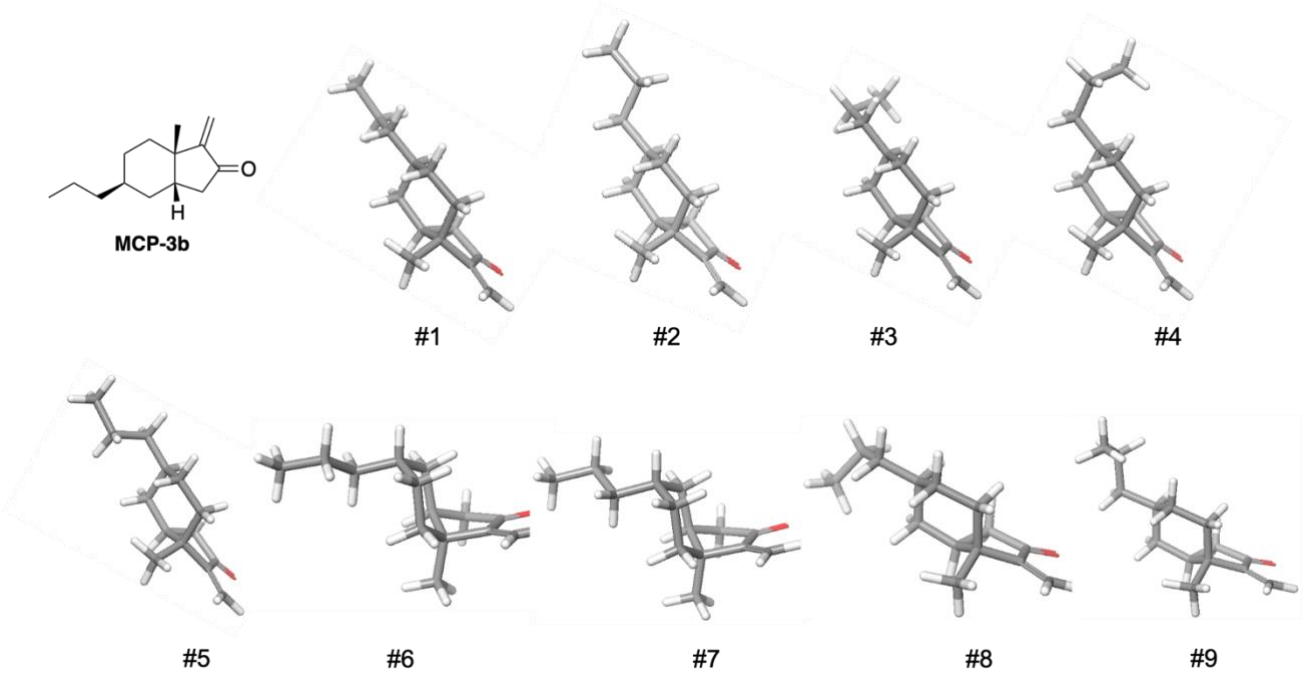


Figure S4-5. 3D structures of the conformers of **MCP-3b**

Table S4-5. Total and relative energies for conformers of **MCP-3b**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-17.374
#2	0.226	-17.148
#3	1.770	-15.604
#4	2.347	-15.027
#5	4.196	-13.178
#6	8.531	-8.843
#7	8.669	-8.705
#8	9.365	-8.009
#9	9.720	-7.654

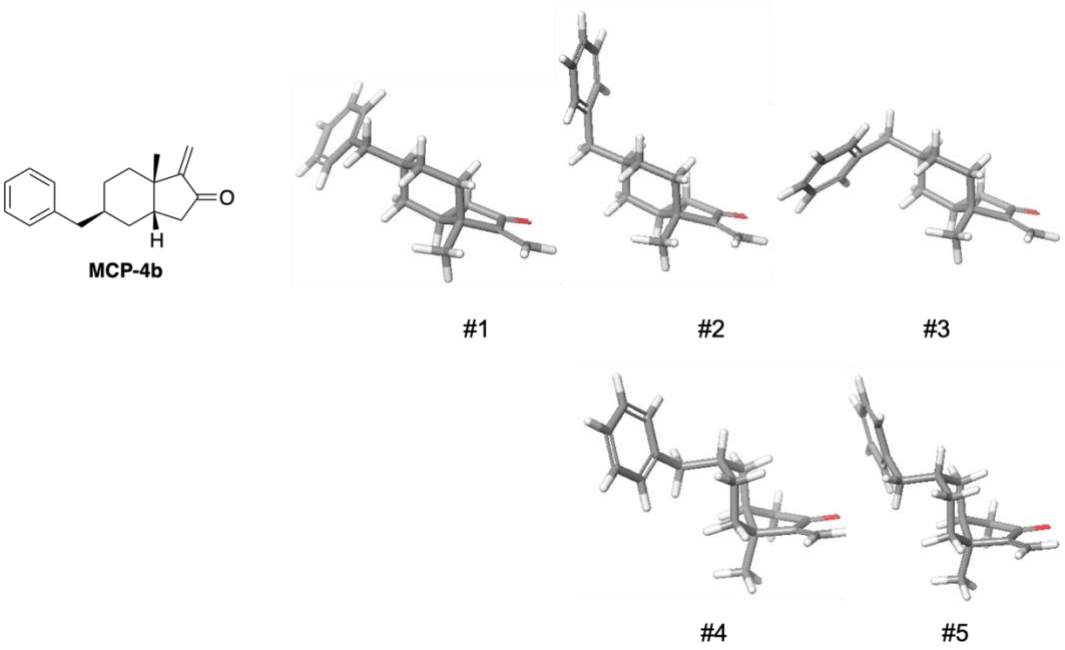


Figure S4-6. 3D structures of the conformers of **MCP-4b**

Table S4-6. Total and relative energies for conformers of **MCP-4b**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	1.502
#2	0.227	1.729
#3	0.657	2.159
#4	8.101	9.603
#5	8.213	9.715

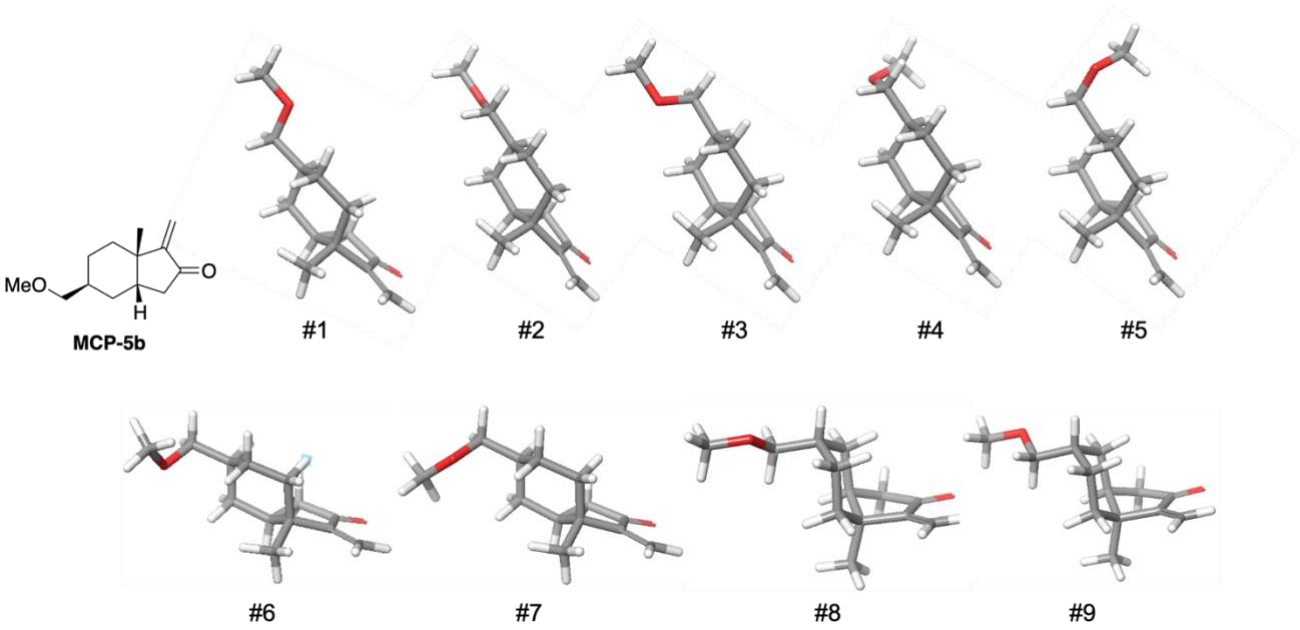


Figure S4-7. 3D structures of the conformers of **MCP-5b**

Table S4-7. Total and relative energies for conformers of **MCP-5b**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-21.436
#2	0.132	-21.304
#3	3.378	-18.058
#4	3.586	-17.850
#5	7.525	-13.911
#6	7.573	-13.863
#7	8.311	-13.125
#8	8.314	-13.122

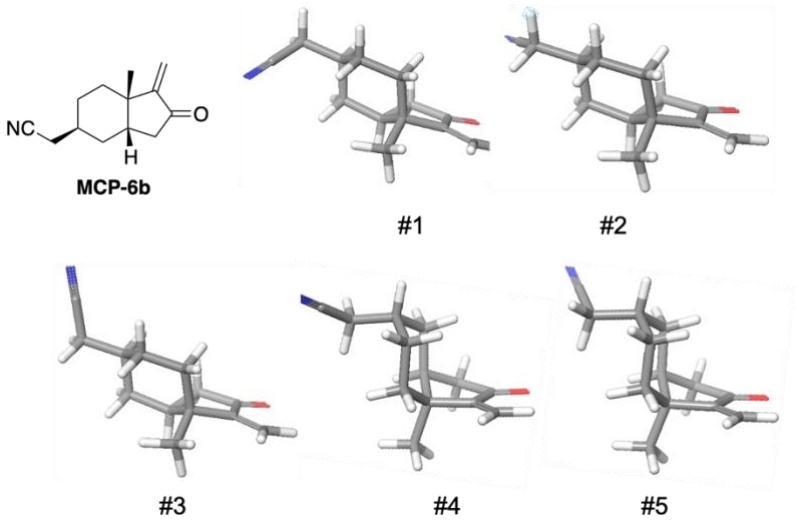


Figure S4-8. 3D structures of the conformers of **MCP-6b**

Table S4-8. Total and relative energies for conformers of **MCP-6b**

No.	Relative Energy /kJ^{-1}·mol	Total Energy /kJ^{-1}·mol
#1	0.000	-37.941
#2	0.073	-37.868
#3	0.173	-37.768
#4	7.317	-30.624
#5	7.456	-30.485

Table S5-1. Cartesian coordinates of the conformers of MCP-3a

MCP-3a #1

atom	x	y	z
C	-2.7030	-1.7529	2.2085
C	-2.5846	-0.3183	1.6117
C	-1.6153	-0.1797	0.4106
C	-1.7040	-1.3919	-0.5614
C	-1.7237	-2.7667	0.1280
C	-2.8722	-2.8645	1.1510
C	-0.2828	0.0000	1.1441
C	-0.5157	0.5622	2.4848
C	-2.0292	0.6657	2.6462
C	0.9573	-0.2903	0.6973
O	0.3537	0.8526	3.3102
C	-1.9123	1.1045	-0.4086
H	-3.5869	-0.0126	1.3033
C	-2.9423	-4.2810	1.7702
C	-4.1852	-4.5370	2.6452
C	-4.2673	-5.9865	3.1441
H	-3.5372	-1.7674	2.9103
H	-1.8165	-1.9834	2.8026
H	-0.8921	-1.3562	-1.2888
H	-2.6181	-1.3094	-1.1525
H	-0.7657	-2.9459	0.6196
H	-1.8260	-3.5457	-0.6294
H	-3.8096	-2.6885	0.6182
H	-2.3447	1.6871	2.4381
H	-2.3292	0.4231	3.6648
H	1.8391	-0.1248	1.3016
H	1.1157	-0.7011	-0.2888
H	-2.9099	1.0760	-0.8485
H	-1.8569	2.0121	0.1933
H	-1.2017	1.2236	-1.2277
H	-2.0385	-4.4741	2.3512
H	-2.9362	-5.0166	0.9635
H	-5.0884	-4.3008	2.0796
H	-4.1824	-3.8696	3.5077
H	-5.1538	-6.1381	3.7611
H	-4.3211	-6.6915	2.3134
H	-3.3977	-6.2490	3.7481

MCP-3a #2

atom	x	y	z
C	-2.7866	-1.4241	2.4618
C	-2.5645	-0.1089	1.6570
C	-1.6186	-0.2369	0.4365
C	-1.8369	-1.5671	-0.3419
C	-1.9628	-2.8199	0.5424
C	-3.0874	-2.6571	1.5861
C	-0.2568	-0.0702	1.1175
C	-0.4052	0.7038	2.3612
C	-1.8995	0.9641	2.5251
C	0.9415	-0.5334	0.7036
O	0.5073	1.0353	3.1221
C	-1.8246	0.9332	-0.5619
H	-3.5451	0.2349	1.3201
C	-3.2889	-3.9198	2.4577
C	-3.8275	-5.1460	1.6946
C	-4.1158	-6.3367	2.6199
H	-3.5956	-1.2703	3.1781
H	-1.9026	-1.6438	3.0637
H	-1.0433	-1.7126	-1.0757
H	-2.7543	-1.4895	-0.9287
H	-1.0123	-3.0172	1.0415
H	-2.1537	-3.6809	-0.0983
H	-4.0237	-2.4657	1.0568
H	-2.1315	1.9674	2.1707
H	-2.1924	0.9025	3.5724
H	1.8497	-0.3595	1.2649
H	1.0380	-1.0989	-0.2113
H	-2.8322	0.9293	-0.9796
H	-1.6751	1.9112	-0.1037
H	-1.1281	0.8654	-1.3988
H	-3.9907	-3.6835	3.2600
H	-2.3513	-4.1785	2.9535
H	-3.1130	-5.4598	0.9328
H	-4.7416	-4.8761	1.1626
H	-4.4929	-7.1894	2.0540
H	-3.2150	-6.6614	3.1424
H	-4.8648	-6.0848	3.3719

MCP-3a #3

atom	x	y	z
C	-2.5290	-1.9227	2.3182
C	-2.5816	-0.4844	1.7211
C	-1.7125	-0.2604	0.4579
C	-1.7570	-1.4771	-0.5116
C	-1.6044	-2.8468	0.1713
C	-2.6663	-3.0470	1.2700
C	-0.3550	0.0400	1.1006
C	-0.5466	0.5809	2.4565
C	-2.0489	0.5475	2.7201
C	0.8731	-0.1378	0.5698
O	0.3469	0.9498	3.2228
C	-2.1790	0.9905	-0.3334
H	-3.6261	-0.2716	1.4823
C	-2.5617	-4.4654	1.8851
C	-3.6323	-4.8313	2.9357
C	-5.0720	-4.8196	2.3979
H	-3.3119	-2.0126	3.0718
H	-1.5886	-2.0710	2.8524
H	-1.0033	-1.3688	-1.2924
H	-2.7132	-1.4789	-1.0384
H	-0.6025	-2.9369	0.5951
H	-1.6875	-3.6337	-0.5803
H	-3.6468	-2.9550	0.7989
H	-2.4686	1.5359	2.5383
H	-2.2562	0.2804	3.7555
H	1.7753	0.1075	1.1139
H	1.0008	-0.5341	-0.4266
H	-3.1974	0.8709	-0.7054
H	-2.1656	1.9002	0.2676
H	-1.5390	1.1723	-1.1979
H	-1.5756	-4.5850	2.3378
H	-2.6024	-5.2054	1.0835
H	-3.5568	-4.1714	3.8008
H	-3.414	-5.8302	3.3173
H	-5.7738	-5.1631	3.1587
H	-5.3833	-3.8177	2.1009
H	-5.1791	-5.4745	1.5323

MCP-3a #4

atom	x	y	z
C	-2.6388	-1.5205	2.6348
C	-2.5683	-0.2236	1.7747
C	-1.7102	-0.3336	0.4892
C	-1.8954	-1.7025	-0.2283
C	-1.8691	-2.9283	0.7012
C	-2.9196	-2.8012	1.8237
C	-0.3156	-0.0536	1.0574
C	-0.4226	0.7542	2.2838
C	-1.9147	0.9217	2.5546
C	0.8768	-0.4527	0.5670
O	0.5198	1.1724	2.9609
C	-2.0698	0.7835	-0.5263
H	-3.5926	0.0425	1.5041
C	-2.9702	-4.0419	2.7507
C	-3.3618	-5.3768	2.0807
C	-4.7667	-5.3809	1.4578
H	-3.4003	-1.3951	3.4066
H	-1.6989	-1.6591	3.1728
H	-1.1513	-1.8222	-1.0166
H	-2.8576	-1.7063	-0.7442
H	-0.8726	-3.0473	1.1300
H	-2.0528	-3.8215	0.1038
H	-3.9023	-2.6837	1.3629
H	-2.2405	1.8940	2.1878
H	-2.1232	0.8792	3.6228
H	1.8107	-0.1995	1.0507
H	0.9426	-1.0439	-0.3342
H	-3.1032	0.6985	-0.8645
H	-1.9532	1.7853	-0.1117
H	-1.4351	0.7313	-1.4120
H	-3.6721	-3.8500	3.5645
H	-1.9983	-4.1667	3.2317
H	-3.3151	-6.1664	2.8328
H	-2.6241	-5.6555	1.3274
H	-5.0195	-6.3707	1.0756
H	-5.5278	-5.1071	2.1895
H	-4.8391	-4.6846	0.6219

MCP-3a #5

atom	x	y	z
C	-3.1025	-1.4760	2.0873
C	-2.6625	-0.1195	1.4596
C	-1.5498	-0.2219	0.3840
C	-1.7374	-1.4540	-0.5511
C	-2.0905	-2.7643	0.1743
C	-3.3480	-2.5871	1.0475
C	-0.3020	-0.2351	1.2724
C	-0.5848	0.4371	2.5516
C	-2.0635	0.8113	2.5188
C	0.9088	-0.7637	0.9966
O	0.2204	0.6200	3.4679
C	-1.5128	1.0459	-0.5104
H	-3.5512	0.3371	1.0181
C	-3.8558	-3.9121	1.6686
C	-2.8836	-4.6271	2.6310
C	-3.4624	-5.9371	3.1839
H	-4.0006	-1.3227	2.6879
H	-2.3370	-1.8180	2.7850
H	-0.8504	-1.6022	-1.1680
H	-2.5421	-1.2453	-1.2586
H	-1.2428	-3.0782	0.7849
H	-2.2494	-3.5561	-0.5594
H	-4.1498	-2.2379	0.3925
H	-2.1641	1.8582	2.2361
H	-2.5187	0.6837	3.5001
H	1.7288	-0.7198	1.7008
H	1.1052	-1.2535	0.0544
H	-2.4405	1.1664	-1.0710
H	-1.3664	1.9626	0.0615
H	-0.7011	0.9929	-1.2372
H	-4.1175	-4.5966	0.8594
H	-4.7933	-3.7163	2.1923
H	-2.6335	-3.9738	3.4675
H	-1.9441	-4.8452	2.1219
H	-2.7570	-6.4215	3.8603
H	-4.3837	-5.7614	3.7408
H	-3.6865	-6.6427	2.3828

MCP-3a #6

atom	x	y	z
C	-2.7592	-1.9115	2.0730
C	-2.6370	-0.4325	1.5970
C	-1.6430	-0.1894	0.4340
C	-1.7030	-1.3177	-0.6354
C	-1.7178	-2.7436	-0.0600
C	-2.8825	-2.9407	0.9306
C	-0.3283	-0.0639	1.2095
C	-0.5949	0.3842	2.5864
C	-2.1124	0.4663	2.7211
C	0.9233	-0.3097	0.7682
O	0.2538	0.6098	3.4526
C	-1.9312	1.1563	-0.2833
H	-3.6343	-0.1080	1.2912
C	-2.9381	-4.4094	1.4221
C	-4.1355	-4.7688	2.3307
C	-3.8205	-4.7132	3.8353
H	-3.6237	-1.9843	2.7327
H	-1.8946	-2.1828	2.6817
H	-0.8792	-1.2148	-1.3428
H	-2.6082	-1.1958	-1.2333
H	-0.7664	-2.9502	0.4336
H	-1.7953	-3.4596	-0.8799
H	-3.8134	-2.7374	0.3962
H	-2.4304	1.4997	2.5901
H	-2.4335	0.1393	3.7092
H	1.7905	-0.1902	1.4038
H	1.1061	-0.6368	-0.2446
H	-2.9187	1.1587	-0.7465
H	-1.8957	2.0115	0.3922
H	-1.2037	1.3462	-1.0737
H	-1.9996	-4.6822	1.9086
H	-2.9937	-5.0489	0.5390
H	-4.4567	-5.7862	2.0996
H	-4.9938	-4.1353	2.1001
H	-4.6952	-4.9897	4.4252
H	-3.0200	-5.4064	4.0965
H	-3.5118	-3.7204	4.1595

MCP-3a #7

atom	x	y	z
C	-2.9354	-1.2845	2.4910
C	-2.5914	-0.0505	1.6049
C	-1.6097	-0.3320	0.4403
C	-1.8935	-1.6966	-0.2513
C	-2.1428	-2.8722	0.7098
C	-3.2846	-2.5603	1.6977
C	-0.2676	-0.2102	1.1680
C	-0.4091	0.6635	2.3447
C	-1.8865	1.0367	2.4226
C	0.9091	-0.7857	0.8429
O	0.4941	0.9878	3.1197
C	-1.6912	0.7731	-0.6464
H	-3.5316	0.3323	1.2014
C	-3.6094	-3.7308	2.6601
C	-4.1038	-5.0328	1.9900
C	-3.0045	-6.0896	1.7879
H	-3.7590	-1.0243	3.1581
H	-2.0925	-1.5147	3.1457
H	-1.0859	-1.9492	-0.9393
H	-2.7805	-1.5978	-0.8800
H	-1.2273	-3.1106	1.2540
H	-2.3879	-3.7517	0.1150
H	-4.1864	-2.3525	1.1170
H	-2.0322	2.0243	1.9872
H	-2.2242	1.0736	3.4575
H	1.8046	-0.6340	1.4304
H	1.0002	-1.4236	-0.0237
H	-2.6795	0.8090	-1.1064
H	-1.4884	1.7694	-0.2525
H	-0.9698	0.5953	-1.4451
H	-4.3962	-3.3910	3.3365
H	-2.7540	-3.9392	3.3058
H	-4.5946	-4.8116	1.0406
H	-4.8774	-5.4784	2.6182
H	-3.4103	-6.9874	1.3203
H	-2.1947	-5.7311	1.1540
H	-2.5658	-6.3891	2.7406

MCP-3a #8

atom	x	y	z
C	-2.6991	-1.4451	2.6326
C	-2.5635	-0.1803	1.7330
C	-1.6747	-0.3589	0.4762
C	-1.8782	-1.7475	-0.1977
C	-1.9133	-2.9351	0.7793
C	-3.0048	-2.7415	1.8539
C	-0.2882	-0.0973	1.0726
C	-0.4045	0.7524	2.2694
C	-1.8975	0.9707	2.4936
C	0.9053	-0.5432	0.6273
O	0.5312	1.1662	2.9583
C	-1.9754	0.7309	-0.5868
H	-3.5712	0.1074	1.4248
C	-3.1306	-3.9626	2.8037
C	-4.1698	-5.0273	2.3891
C	-3.8632	-5.7650	1.0776
H	-3.4767	-1.2667	3.3774
H	-1.7796	-1.5988	3.2010
H	-1.1139	-1.9171	-0.9569
H	-2.8239	-1.7453	-0.7431
H	-0.9367	-3.0479	1.2535
H	-2.0757	-3.8528	0.2162
H	-3.9662	-2.5985	1.3552
H	-2.1848	1.9393	2.0869
H	-2.1356	0.9693	3.5565
H	1.8329	-0.2992	1.1274
H	0.9784	-1.1648	-0.2528
H	-3.0011	0.6611	-0.9513
H	-1.8432	1.7430	-0.2032
H	-1.3181	0.6310	-1.4516
H	-3.4271	-3.6142	3.7949
H	-2.1548	-4.4274	2.9564
H	-5.1590	-4.5705	2.3250
H	-4.2409	-5.7665	3.1891
H	-4.5618	-6.5884	0.9239
H	-3.9565	-5.1042	0.2157
H	-2.8563	-6.1844	1.0796

Table S5-2. Cartesian coordinates of the conformers of MCP-4a

MCP-4a #1

atom	x	y	z
C	-0.6048	-0.7501	-1.2894
C	-2.1583	-0.8506	-1.3132
C	-2.8094	-1.2984	0.0204
C	-2.1164	-0.6644	1.2617
C	-0.5787	-0.6848	1.2211
C	-0.0473	-0.0084	-0.0568
C	-2.6952	-2.8198	-0.1088
C	-2.6335	-3.2042	-1.5279
C	-2.6256	-1.9030	-2.3229
C	-2.6502	-3.7419	0.8747
O	-2.5685	-4.3526	-1.9622
C	-4.3114	-0.9134	0.0706
H	-2.5419	0.1337	-1.5904
C	1.4983	0.0749	-0.0474
C	2.0862	0.7882	-1.2585
C	2.7562	0.0575	-2.2433
C	3.2855	0.7098	-3.3540
C	3.1404	2.0900	-3.4779
C	2.4734	2.8244	-2.4994
C	1.9477	2.1726	-1.3865
H	-0.2695	-0.2619	-2.2060
H	-0.1650	-1.7491	-1.3136
H	-2.4686	-1.1418	2.1765
H	-2.4268	0.3785	1.3485
H	-0.2241	-1.7158	1.2755
H	-0.1879	-0.1809	2.1063
H	-0.4299	1.0143	-0.0788
H	-3.6314	-1.6987	-2.6857
H	-1.9659	-1.9874	-3.1851
H	-2.5657	-4.7989	0.6566
H	-2.6977	-3.4576	1.9149
H	-4.4473	0.1681	0.0370
H	-4.8810	-1.3323	-0.7594
H	-4.7789	-1.2713	0.9887
H	1.9289	-0.9247	0.0360
H	1.8347	0.6073	0.8437
H	2.8657	-1.0134	-2.1513
H	3.8051	0.1470	-4.1159
H	3.5487	2.5954	-4.3413
H	2.3636	3.8942	-2.6036
H	1.4282	2.7414	-0.6290

MCP-4a #2

atom	x	y	z
C	-0.6048	-0.7501	-1.2894
C	-2.1583	-0.8506	-1.3132
C	-2.8094	-1.2984	0.0204
C	-2.1164	-0.6644	1.2617
C	-0.5787	-0.6848	1.2211
C	-0.0473	-0.0084	-0.0568
C	-2.6952	-2.8198	-0.1088
C	-2.6335	-3.2042	-1.5279
C	-2.6256	-1.9030	-2.3229
C	-2.6502	-3.7419	0.8747
O	-2.5685	-4.3526	-1.9622
C	-4.3114	-0.9134	0.0706
H	-2.5419	0.1337	-1.5904
C	1.4983	0.0749	-0.0474
C	2.0862	0.7882	-1.2585
C	2.7562	0.0575	-2.2433
C	3.2855	0.7098	-3.3540
C	3.1404	2.0900	-3.4779
C	2.4734	2.8244	-2.4994
C	1.9477	2.1726	-1.3865
H	-0.2695	-0.2619	-2.2060
H	-0.165	-1.7491	-1.3136
H	-2.4686	-1.1418	2.1765
H	-2.4268	0.3785	1.3485
H	-0.2241	-1.7158	1.2755
H	-0.1879	-0.1809	2.1063
H	-0.4299	1.0143	-0.0788
H	-3.6314	-1.6987	-2.6857
H	-1.9659	-1.9874	-3.1851
H	-2.5657	-4.7989	0.6566
H	-2.6977	-3.4576	1.9149
H	-4.4473	0.1681	0.0370
H	-4.881	-1.3323	-0.7594
H	-4.7789	-1.2713	0.9887
H	1.9289	-0.9247	0.0360
H	1.8347	0.6073	0.8437
H	2.8657	-1.0134	-2.1513
H	3.8051	0.1470	-4.1159
H	3.5487	2.5954	-4.3413
H	2.3636	3.8942	-2.6036
H	1.4282	2.7414	-0.6290

MCP-4a #3

atom	x	y	z
C	-0.6048	-0.7501	-1.2894
C	-2.1583	-0.8506	-1.3132
C	-2.8094	-1.2984	0.0204
C	-2.1164	-0.6644	1.2617
C	-0.5787	-0.6848	1.2211
C	-0.0473	-0.0084	-0.0568
C	-2.6952	-2.8198	-0.1088
C	-2.6335	-3.2042	-1.5279
C	-2.6256	-1.9030	-2.3229
C	-2.6502	-3.7419	0.8747
O	-2.5685	-4.3526	-1.9622
C	-4.3114	-0.9134	0.0706
H	-2.5419	0.1337	-1.5904
C	1.4983	0.0749	-0.0474
C	2.0862	0.7882	-1.2585
C	2.7562	0.0575	-2.2433
C	3.2855	0.7098	-3.3540
C	3.1404	2.0900	-3.4779
C	2.4734	2.8244	-2.4994
C	1.9477	2.1726	-1.3865
H	-0.2695	-0.2619	-2.2060
H	-0.1650	-1.7491	-1.3136
H	-2.4686	-1.1418	2.1765
H	-2.4268	0.3785	1.3485
H	-0.2241	-1.7158	1.2755
H	-0.1879	-0.1809	2.1063
H	-0.4299	1.0143	-0.0788
H	-3.6314	-1.6987	-2.6857
H	-1.9659	-1.9874	-3.1851
H	-2.5657	-4.7989	0.6566
H	-2.6977	-3.4576	1.9149
H	-4.4473	0.1681	0.0370
H	-4.881	-1.3323	-0.7594
H	-4.7789	-1.2713	0.9887
H	1.9289	-0.9247	0.0360
H	1.8347	0.6073	0.8437
H	2.8657	-1.0134	-2.1513
H	3.8051	0.1470	-4.1159
H	3.5487	2.5954	-4.3413
H	2.3636	3.8942	-2.6036
H	1.4282	2.7414	-0.6290

Table S5-3. Cartesian coordinates of the conformers of MCP-5a

MCP-5a #1

atom	x	y	z
C	-3.2086	0.6037	-0.9990
C	-2.4673	-0.7519	-1.1983
C	-2.5503	-1.7308	0.0007
C	-3.9592	-1.7368	0.6636
C	-4.5679	-0.3430	0.8945
C	-4.6317	0.4605	-0.4215
C	-1.4001	-1.2103	0.8681
C	-0.4017	-0.5284	0.0277
C	-0.9630	-0.5354	-1.3909
C	-1.2525	-1.3200	2.2052
O	0.6553	-0.0276	0.4195
C	-2.2289	-3.1850	-0.4355
H	-2.8945	-1.2285	-2.0837
C	-5.3153	1.8328	-0.2459
O	-6.6671	1.6444	0.1624
C	-7.3687	2.8659	0.3647
H	-3.2444	1.1346	-1.9522
H	-2.6326	1.2460	-0.3295
H	-3.9346	-2.2885	1.6041
H	-4.6501	-2.2931	0.0271
H	-3.9805	0.1980	1.6388
H	-5.5671	-0.4529	1.3196
H	-5.2284	-0.1039	-1.1412
H	-0.5092	-1.3501	-1.9535
H	-0.7316	0.3964	-1.9052
H	-0.3953	-0.9122	2.7239
H	-1.9907	-1.8240	2.8111
H	-2.9577	-3.5560	-1.1572
H	-1.2467	-3.2802	-0.8992
H	-2.2441	-3.8655	0.4170
H	-5.2939	2.3806	-1.1906
H	-4.7735	2.4322	0.4893
H	-8.3927	2.6538	0.6729
H	-6.9059	3.4693	1.1476
H	-7.4146	3.4589	-0.5504

MCP-5a #2

atom	x	y	z
C	-3.5485	0.5408	-0.6398
C	-2.6769	-0.6719	-1.0834
C	-2.5132	-1.7898	-0.0224
C	-3.8316	-2.0604	0.7604
C	-4.5708	-0.7960	1.2307
C	-4.8734	0.1437	0.0461
C	-1.3463	-1.2305	0.7972
C	-0.5328	-0.3266	-0.0331
C	-1.2386	-0.2374	-1.3827
C	-1.0432	-1.4801	2.0885
O	0.4928	0.2587	0.3232
C	-2.0703	-3.1263	-0.6752
H	-3.1373	-1.0907	-1.9812
C	-5.7022	1.3678	0.4889
O	-6.0593	2.1415	-0.6528
C	-6.8128	3.3048	-0.3303
H	-3.7516	1.1705	-1.5078
H	-2.9846	1.1712	0.0507
H	-3.6403	-2.7139	1.6124
H	-4.5166	-2.6215	0.1216
H	-3.9715	-0.2770	1.9814
H	-5.4973	-1.0856	1.7300
H	-5.4793	-0.4083	-0.6755
H	-0.7542	-0.9118	-2.0875
H	-1.1768	0.7717	-1.7879
H	-0.1897	-1.0282	2.5760
H	-1.6463	-2.1464	2.6871
H	-2.8233	-3.5005	-1.3699
H	-1.1393	-3.0351	-1.2355
H	-1.9127	-3.9002	0.0772
H	-5.1320	1.9722	1.1980
H	-6.6082	1.0358	1.0007
H	-7.0544	3.8497	-1.2431
H	-7.7530	3.0505	0.1621
H	-6.2513	3.9791	0.3187

MCP-5a #3

atom	x	y	z
C	-3.5325	0.3858	-1.0995
C	-2.5434	-0.8105	-1.2336
C	-2.5253	-1.7894	-0.0313
C	-3.9499	-2.0566	0.5388
C	-4.8192	-0.7993	0.7145
C	-4.9386	-0.0195	-0.6107
C	-1.5505	-1.0672	0.9039
C	-0.6411	-0.2116	0.1235
C	-1.0949	-0.3206	-1.3290
C	-1.4745	-1.1494	2.2490
O	0.2773	0.4748	0.5784
C	-1.9136	-3.1590	-0.4294
H	-2.8154	-1.3565	-2.1398
C	-5.9033	1.1823	-0.5087
O	-5.4351	2.1220	0.4558
C	-6.2825	3.2563	0.5934
H	-3.6055	0.9025	-2.0581
H	-3.1297	1.1227	-0.4017
H	-3.8859	-2.5951	1.4851
H	-4.4826	-2.7308	-0.1347
H	-4.3908	-0.1606	1.4894
H	-5.8086	-1.0884	1.0732
H	-5.3652	-0.6933	-1.3568
H	-0.4625	-1.0372	-1.8511
H	-1.0050	0.6386	-1.8372
H	-0.7434	-0.5911	2.8183
H	-2.1461	-1.7814	2.8108
H	-2.5115	-3.6565	-1.1940
H	-0.9016	-3.0711	-0.8257
H	-1.8608	-3.8321	0.4275
H	-6.9004	0.8296	-0.2362
H	-5.9973	1.6608	-1.4861
H	-5.8706	3.9324	1.3429
H	-6.3653	3.8110	-0.3429
H	-7.2843	2.9715	0.9192

MCP-5a #4

atom	x	y	z
C	-3.5175	0.6733	-0.5181
C	-2.7447	-0.5743	-1.0409
C	-2.5975	-1.7334	-0.0224
C	-3.8897	-1.9499	0.8187
C	-4.5266	-0.6591	1.3617
C	-4.8288	0.3340	0.2215
C	-1.3597	-1.2710	0.7521
C	-0.5345	-0.3910	-0.0922
C	-1.2992	-0.2169	-1.4008
C	-1.0090	-1.5791	2.0185
O	0.5413	0.1205	0.2279
C	-2.2698	-3.0722	-0.7355
H	-3.2737	-0.9360	-1.9257
C	-5.5579	1.5944	0.7477
O	-5.8279	2.5512	-0.2773
C	-6.9056	2.2117	-1.1457
H	-3.7238	1.3416	-1.3558
H	-2.8833	1.2466	0.1612
H	-3.6966	-2.6398	1.6412
H	-4.6381	-2.4494	0.2004
H	-3.8605	-0.2011	2.0957
H	-5.4435	-0.9081	1.8991
H	-5.4961	-0.1684	-0.4803
H	-0.8923	-0.896	-2.1487
H	-1.1961	0.7992	-1.7793
H	-0.1066	-1.1946	2.4745
H	-1.6214	-2.2270	2.6278
H	-3.0774	-3.3783	-1.4017
H	-1.3635	-3.0188	-1.3395
H	-2.1232	-3.878	-0.0149
H	-4.9328	2.0877	1.4936
H	-6.4808	1.3229	1.2649
H	-7.0753	3.0274	-1.8487
H	-6.6930	1.3174	-1.7321
H	-7.8338	2.0548	-0.5937

MCP-5a #5

atom	x	y	z
C	-3.1644	0.7333	-0.9126
C	-2.5246	-0.6627	-1.1747
C	-2.6303	-1.6668	0.0015
C	-4.0112	-1.5969	0.7174
C	-4.5153	-0.1724	1.0058
C	-4.5724	0.6689	-0.2862
C	-1.4167	-1.2490	0.8372
C	-0.4054	-0.6123	-0.0230
C	-1.0171	-0.5421	-1.4189
C	-1.2284	-1.4055	2.1645
O	0.6967	-0.1944	0.3407
C	-2.4247	-3.1266	-0.4834
H	-3.0150	-1.0846	-2.0550
C	-5.1521	2.0847	-0.0488
O	-6.4514	2.0621	0.5431
C	-7.5096	1.7180	-0.3473
H	-3.1982	1.2927	-1.8494
H	-2.5222	1.3160	-0.2488
H	-3.9896	-2.1744	1.6425
H	-4.7610	-2.0886	0.0945
H	-3.8665	0.3081	1.7405
H	-5.5037	-0.2270	1.4655
H	-5.2200	0.1590	-1.0008
H	-0.6405	-1.3694	-2.0189
H	-0.7418	0.3861	-1.9179
H	-0.3271	-1.0707	2.6604
H	-1.9767	-1.8756	2.7852
H	-3.2027	-3.4276	-1.1861
H	-1.4687	-3.2744	-0.9865
H	-2.4551	-3.8280	0.3515
H	-5.1682	2.6599	-0.9772
H	-4.4977	2.6335	0.6301
H	-8.4624	1.7878	0.1779
H	-7.5543	2.3962	-1.2010
H	-7.4177	0.6966	-0.7177

MCP-5a #6

atom	x	y	z
C	-3.4697	0.3975	-1.2129
C	-2.5230	-0.8396	-1.2496
C	-2.5834	-1.7538	0.0013
C	-4.0359	-1.9385	0.5317
C	-4.8577	-0.6408	0.6148
C	-4.9056	0.0716	-0.7519
C	-1.6155	-1.0179	0.9329
C	-0.6471	-0.2392	0.1429
C	-1.0545	-0.4088	-1.3175
C	-1.5909	-1.0294	2.2824
O	0.2806	0.4366	0.5949
C	-2.0105	-3.1637	-0.3026
H	-2.7848	-1.4225	-2.1356
C	-5.8309	1.3110	-0.7594
O	-5.3518	2.3338	0.1154
C	-6.1311	2.5194	1.2928
H	-3.4914	0.8636	-2.1995
H	-3.0620	1.1562	-0.5418
H	-4.0253	-2.4307	1.5049
H	-4.5719	-2.6249	-0.1268
H	-4.4214	0.0178	1.3679
H	-5.8681	-0.8710	0.9574
H	-5.3305	-0.6282	-1.4748
H	-0.4324	-1.1747	-1.7784
H	-0.9105	0.5180	-1.8713
H	-0.8598	-0.4678	2.8484
H	-2.3057	-1.6052	2.8511
H	-2.6005	-3.6797	-1.0610
H	-0.9830	-3.1333	-0.6664
H	-2.0122	-3.7914	0.5896
H	-6.8610	1.0172	-0.5420
H	-5.8603	1.7288	-1.7667
H	-5.6802	3.2949	1.9122
H	-7.1460	2.8382	1.0499
H	-6.1886	1.6093	1.8913

MCP-5a #7

atom	x	y	z
C	-3.6533	0.3941	-1.0243
C	-2.6182	-0.7537	-1.2186
C	-2.5374	-1.7703	-0.0508
C	-3.9394	-2.1182	0.5318
C	-4.8601	-0.9071	0.7623
C	-5.0335	-0.0885	-0.5333
C	-1.5792	-1.0369	0.8928
C	-0.7190	-0.1194	0.1267
C	-1.1934	-0.2000	-1.3211
C	-1.4787	-1.1574	2.2333
O	0.1775	0.5902	0.5895
C	-1.8739	-3.0980	-0.5041
H	-2.8841	-1.2796	-2.1385
C	-6.0578	1.0596	-0.3803
O	-5.6666	1.9769	0.6426
C	-5.2939	3.2669	0.1688
H	-3.7612	0.9462	-1.9597
H	-3.2683	1.1143	-0.3002
H	-3.8364	-2.6840	1.4585
H	-4.4533	-2.7929	-0.1557
H	-4.4489	-0.2767	1.5532
H	-5.8303	-1.2520	1.1241
H	-5.4376	-0.7570	-1.2966
H	-0.5408	-0.8717	-1.8771
H	-1.1526	0.7781	-1.7985
H	-0.7629	-0.5865	2.8094
H	-2.1143	-1.8345	2.7843
H	-2.4627	-3.5958	-1.2757
H	-0.8735	-2.9531	-0.9128
H	-1.7777	-3.7959	0.3287
H	-7.0253	0.6429	-0.0962
H	-6.2273	1.5454	-1.3448
H	-4.9849	3.8907	1.0078
H	-4.4595	3.2166	-0.5322
H	-6.1305	3.7650	-0.3239

Table S5-4. Cartesian coordinates of the conformers of MCP-6a

MCP-6a #1

atom	x	y	z
C	-1.5862	-1.1915	-1.4828
C	-2.9365	-0.7941	-0.8149
C	-3.9904	-1.9283	-0.7362
C	-3.3550	-3.3042	-0.3782
C	-2.0712	-3.6398	-1.1564
C	-1.0139	-2.5323	-0.9816
C	-4.6220	-1.8201	-2.1274
C	-4.4670	-0.4515	-2.6480
C	-3.6434	0.3071	-1.6117
C	-5.2433	-2.7867	-2.8355
O	-4.8953	-0.0331	-3.7263
C	-5.0738	-1.6184	0.3308
H	-2.7092	-0.4413	0.1937
C	0.3249	-2.8896	-1.6643
C	0.2439	-3.0865	-3.1221
N	0.1805	-3.2416	-4.2699
H	-0.8572	-0.3949	-1.3244
H	-1.7161	-1.2565	-2.5649
H	-4.0843	-4.1049	-0.5072
H	-3.1068	-3.3166	0.6850
H	-2.3093	-3.7757	-2.2130
H	-1.6747	-4.5956	-0.8093
H	-0.8049	-2.4288	0.0855
H	-4.3102	0.8936	-0.9813
H	-2.9487	0.9935	-2.0940
H	-5.6563	-2.6036	-3.8184
H	-5.3525	-3.7868	-2.4430
H	-4.6438	-1.5596	1.3314
H	-5.5872	-0.6736	0.1503
H	-5.8392	-2.3953	0.3537
H	0.7313	-3.8085	-1.2421
H	1.0617	-2.1061	-1.4879

MCP-6a #2

atom	x	y	z
C	-1.7652	-1.5985	-2.1318
C	-2.7968	-0.8910	-1.2031
C	-3.9398	-1.7959	-0.6763
C	-3.4391	-3.2194	-0.2927
C	-2.4953	-3.8664	-1.3207
C	-1.2805	-2.9638	-1.6032
C	-4.9205	-1.7210	-1.8504
C	-4.7187	-0.4692	-2.5990
C	-3.5304	0.2301	-1.9461
C	-5.8564	-2.6245	-2.2100
O	-5.3700	-0.0970	-3.5780
C	-4.6140	-1.1799	0.5783
H	-2.2426	-0.4799	-0.3561
C	-0.2870	-3.6488	-2.5659
C	0.9465	-2.8838	-2.8147
N	1.9186	-2.2817	-3.0110
H	-0.9151	-0.9327	-2.2906
H	-2.2009	-1.7550	-3.1206
H	-4.2848	-3.8809	-0.1010
H	-2.9021	-3.1647	0.6563
H	-3.0390	-4.0667	-2.2460
H	-2.1638	-4.8371	-0.9480
H	-0.7545	-2.7923	-0.6611
H	-3.8947	0.9942	-1.2610
H	-2.9087	0.7201	-2.6943
H	-6.5022	-2.4738	-3.0646
H	-5.9967	-3.5386	-1.6523
H	-3.9117	-1.0956	1.4086
H	-5.0121	-0.1811	0.3971
H	-5.4467	-1.7953	0.9215
H	-0.7554	-3.8324	-3.5328
H	0.0135	-4.6205	-2.1740

MCP-6a #3

atom	x	y	z
C	-1.7875	-0.9367	-1.8752
C	-2.9868	-0.7681	-0.8953
C	-3.9570	-1.9751	-0.8284
C	-3.2085	-3.3399	-0.8700
C	-2.0983	-3.4332	-1.9309
C	-1.0719	-2.2955	-1.7605
C	-4.8673	-1.6699	-2.0217
C	-4.8743	-0.2232	-2.2955
C	-3.8839	0.4000	-1.3166
C	-5.5867	-2.5396	-2.7617
O	-5.5313	0.3458	-3.1707
C	-4.8071	-1.9437	0.4696
H	-2.5713	-0.5832	0.0980
C	0.0951	-2.3993	-2.7657
C	0.8936	-3.6311	-2.6474
N	1.5232	-4.6012	-2.5546
H	-1.0741	-0.1266	-1.7131
H	-2.1299	-0.8209	-2.9055
H	-3.9171	-4.1580	-1.0049
H	-2.7475	-3.5230	0.1026
H	-2.5381	-3.3964	-2.9294
H	-1.6080	-4.4049	-1.8517
H	-0.6447	-2.3706	-0.7577
H	-4.4282	0.8139	-0.4690
H	-3.3302	1.2112	-1.7875
H	-6.2016	-2.2169	-3.5912
H	-5.5755	-3.5986	-2.5506
H	-4.1819	-2.0316	1.3590
H	-5.3824	-1.0236	0.5761
H	-5.5209	-2.7682	0.4943
H	0.7808	-1.5615	-2.6399
H	-0.2755	-2.3500	-3.7895

Table S5-6. Cartesian coordinates of the conformers of MCP-3b

MCP-3b #1

atom	x	y	z
C	-1.6098	-1.1376	-1.0128
C	-2.1212	0.3119	-1.2071
C	-3.2227	0.4751	-2.2768
C	-2.8901	-0.3278	-3.5681
C	-2.4737	-1.7876	-3.3037
C	-1.2779	-1.8776	-2.3315
C	-3.1501	1.9853	-2.5205
C	-1.8262	2.5034	-2.1404
C	-1.0405	1.3185	-1.5969
C	-4.6034	0.0562	-1.7148
H	-2.5139	0.6301	-0.2359
C	-4.1149	2.7924	-3.0112
O	-1.4545	3.6762	-2.2317
C	-0.8602	-3.3502	-2.1054
C	0.4604	-3.5293	-1.3309
C	0.8890	-4.9998	-1.2276
H	-2.3716	-1.7050	-0.4753
H	-0.7404	-1.1200	-0.3551
H	-2.0741	0.1594	-4.1051
H	-3.7374	-0.3014	-4.2552
H	-2.2214	-2.2649	-4.2521
H	-3.3220	-2.3459	-2.9045
H	-0.4354	-1.3675	-2.8033
H	-0.4224	1.6177	-0.7516
H	-0.3921	0.9352	-2.3832
H	-4.6060	-0.9848	-1.3915
H	-4.8885	0.6605	-0.8525
H	-5.3916	0.1615	-2.4607
H	-3.9633	3.8551	-3.1462
H	-5.0823	2.4013	-3.2904
H	-0.7550	-3.8380	-3.0764
H	-1.6617	-3.8853	-1.5925
H	0.3646	-3.1208	-0.3243
H	1.2529	-2.9581	-1.8178
H	1.8236	-5.0967	-0.6738
H	0.1371	-5.5977	-0.7106
H	1.0445	-5.4398	-2.2136

MCP-3b #2

atom	x	y	z
C	-1.6834	-0.9070	-0.6513
C	-2.2356	0.4790	-1.0667
C	-3.1745	0.4602	-2.2921
C	-2.6111	-0.4387	-3.4312
C	-2.1547	-1.8338	-2.9611
C	-1.1152	-1.7443	-1.8209
C	-3.1500	1.9413	-2.6814
C	-1.9268	2.5846	-2.1756
C	-1.1658	1.5154	-1.4046
C	-4.5977	0.0017	-1.8901
H	-2.7840	0.8619	-0.1999
C	-4.0749	2.6281	-3.3856
O	-1.6108	3.7661	-2.3371
C	-0.6436	-3.1325	-1.3263
C	0.1540	-3.9464	-2.3642
C	0.6940	-5.2644	-1.7914
H	-2.4888	-1.4703	-0.1765
H	-0.9241	-0.7782	0.1220
H	-1.7538	0.0516	-3.8964
H	-3.3480	-0.5383	-4.2297
H	-1.7391	-2.3696	-3.8147
H	-3.0183	-2.4145	-2.6335
H	-0.2386	-1.2187	-2.2055
H	-0.6960	1.9372	-0.5171
H	-0.3889	1.1040	-2.0470
H	-4.5907	-1.0022	-1.4655
H	-5.0392	0.6630	-1.1433
H	-5.2723	-0.0182	-2.7464
H	-3.9637	3.6807	-3.6094
H	-4.9678	2.1455	-3.7554
H	-1.5031	-3.7134	-0.9866
H	-0.0143	-2.9949	-0.4448
H	0.9880	-3.3497	-2.7380
H	-0.4719	-4.1707	-3.2287
H	1.2519	-5.8196	-2.5464
H	1.3661	-5.0877	-0.9506
H	-0.1151	-5.9071	-1.4418

MCP-3b #3

atom	x	y	z
C	-1.7792	-1.2870	-0.9690
C	-2.1676	0.1974	-1.1826
C	-3.2147	0.4429	-2.2906
C	-2.9024	-0.3891	-3.5686
C	-2.6115	-1.8760	-3.2879
C	-1.4608	-2.0547	-2.2747
C	-3.0138	1.9416	-2.5339
C	-1.6671	2.3547	-2.1080
C	-0.9975	1.1137	-1.5351
C	-4.6429	0.1372	-1.7767
H	-2.5675	0.5493	-0.2261
C	-3.8937	2.8205	-3.0598
O	-1.2006	3.4939	-2.1880
C	-1.1653	-3.5565	-2.0358
C	0.0372	-3.8745	-1.1209
C	1.3842	-3.3549	-1.6477
H	-2.6003	-1.7917	-0.4572
H	-0.9326	-1.3353	-0.2835
H	-2.0325	0.0301	-4.0778
H	-3.7208	-0.2990	-4.2847
H	-2.3644	-2.3762	-4.2258
H	-3.5145	-2.3641	-2.9177
H	-0.5705	-1.6082	-2.7207
H	-0.3879	1.3666	-0.6688
H	-0.3541	0.6769	-2.2972
H	-4.7392	-0.8988	-1.4519
H	-4.9092	0.7661	-0.9260
H	-5.3939	0.3011	-2.5500
H	-3.6536	3.8671	-3.1911
H	-4.8787	2.5060	-3.3725
H	-1.0018	-4.0452	-2.9982
H	-2.0547	-4.0321	-1.6183
H	0.1055	-4.9576	-1.0046
H	-0.1385	-3.4888	-0.1159
H	2.2039	-3.6789	-1.0054
H	1.5884	-3.7252	-2.6531
H	1.4112	-2.2653	-1.6798

MCP-3b #4

atom	x	y	z
C	-1.8797	-0.9996	-0.5477
C	-2.3076	0.4090	-1.0286
C	-3.1588	0.4216	-2.3166
C	-2.5795	-0.5398	-3.3951
C	-2.2510	-1.9499	-2.8666
C	-1.2900	-1.9007	-1.6577
C	-3.0085	1.8879	-2.7324
C	-1.7827	2.4620	-2.1548
C	-1.1499	1.3646	-1.3109
C	-4.6339	0.0669	-2.0068
H	-2.8877	0.8482	-0.2104
C	-3.8350	2.6163	-3.5130
O	-1.3779	3.6159	-2.3171
C	-0.9469	-3.3051	-1.1005
C	-0.2333	-4.2678	-2.0743
C	1.1389	-3.7722	-2.5574
H	-2.7523	-1.4964	-0.1197
H	-1.1683	-0.9026	0.2742
H	-1.6611	-0.1182	-3.8081
H	-3.2643	-0.6105	-4.2416
H	-1.8110	-2.5309	-3.6776
H	-3.1716	-2.4663	-2.5908
H	-0.3590	-1.4371	-1.9877
H	-0.7154	1.7764	-0.4011
H	-0.3599	0.8875	-1.8886
H	-4.7232	-0.9242	-1.5621
H	-5.0809	0.7743	-1.3071
H	-5.2473	0.0692	-2.9082
H	-3.6385	3.6536	-3.7493
H	-4.7306	2.1841	-3.9348
H	-1.8640	-3.7824	-0.7503
H	-0.3226	-3.1933	-0.2120
H	-0.8709	-4.4820	-2.9328
H	-0.0969	-5.2273	-1.5723
H	1.6301	-4.5269	-3.1727
H	1.0513	-2.8697	-3.1630
H	1.8003	-3.5506	-1.7189

MCP-3b #5

atom	x	y	z
C	-1.1403	-0.8904	-1.0224
C	-1.8944	0.4496	-1.2135
C	-3.0782	0.3912	-2.2052
C	-2.7092	-0.3928	-3.4998
C	-2.0396	-1.7556	-3.2343
C	-0.7850	-1.6035	-2.3478
C	-3.2739	1.8833	-2.4896
C	-2.0327	2.6255	-2.2169
C	-1.0256	1.6065	-1.7030
C	-4.3286	-0.2271	-1.5331
H	-2.2685	0.7331	-0.2244
C	-4.3899	2.5027	-2.9302
O	-1.8689	3.8395	-2.3622
C	-0.0134	-2.9308	-2.1437
C	-0.7769	-4.0554	-1.4126
C	0.0607	-5.3335	-1.2651
H	-1.7697	-1.5466	-0.4206
H	-0.2385	-0.7250	-0.4306
H	-3.5953	-0.5290	-4.1218
H	-2.0250	0.2021	-4.1078
H	-1.7723	-2.2210	-4.1844
H	-2.7597	-2.4248	-2.7626
H	-0.0986	-0.9464	-2.8860
H	-0.4117	2.0331	-0.9110
H	-0.3758	1.3099	-2.5246
H	-4.1370	-1.2427	-1.1865
H	-4.6495	0.3524	-0.6665
H	-5.1730	-0.2781	-2.2210
H	-4.4266	3.5704	-3.1013
H	-5.2948	1.9481	-3.1309
H	0.9093	-2.7182	-1.6004
H	0.3079	-3.2996	-3.1197
H	-1.6947	-4.2975	-1.9498
H	-1.0826	-3.7203	-0.4209
H	0.3529	-5.7322	-2.2375
H	0.9710	-5.1489	-0.6932
H	-0.5010	-6.1114	-0.7465

MCP-3b #6

atom	x	y	z
C	-0.4649	-0.1171	-1.8075
C	-1.7849	0.3130	-1.0980
C	-3.0658	0.1966	-1.9653
C	-3.0724	-1.0821	-2.8563
C	-1.7355	-1.3820	-3.5595
C	-0.5579	-1.4579	-2.5631
C	-3.0211	1.5338	-2.7122
C	-2.2641	2.5259	-1.9308
C	-1.7423	1.7916	-0.7001
C	-4.3407	0.1609	-1.0814
H	-1.8929	-0.3082	-0.2062
C	-3.5677	1.8360	-3.9088
O	-2.0738	3.7037	-2.2445
C	-0.6068	-2.6669	-1.5933
C	-0.5332	-4.0437	-2.2816
C	-0.4646	-5.2025	-1.2770
H	0.3511	-0.1477	-1.0835
H	-0.1722	0.6479	-2.5294
H	-3.8709	-1.0244	-3.5967
H	-3.3267	-1.9484	-2.2438
H	-1.5373	-0.5973	-4.2918
H	-1.8141	-2.3011	-4.1403
H	0.3589	-1.5607	-3.1481
H	-2.3961	1.9980	0.1461
H	-0.7405	2.1311	-0.4404
H	-4.3538	-0.7178	-0.4354
H	-4.4299	1.0329	-0.4329
H	-5.2439	0.1259	-1.6922
H	-3.4752	2.8190	-4.3507
H	-4.1229	1.1019	-4.4735
H	-1.5021	-2.6188	-0.9723
H	0.2311	-2.5865	-0.8983
H	0.3399	-4.0829	-2.9354
H	-1.4028	-4.1881	-2.9238
H	-0.4169	-6.1634	-1.7909
H	0.4181	-5.1263	-0.6406
H	-1.3421	-5.2193	-0.6293

MCP-3b #7

atom	x	y	z
C	-0.6165	-0.4243	-2.1226
C	-1.8005	0.0912	-1.2501
C	-3.1555	0.2193	-1.9940
C	-3.4081	-0.9564	-2.9856
C	-2.1889	-1.3553	-3.8392
C	-0.9490	-1.6669	-2.9756
C	-2.9989	1.6069	-2.6247
C	-2.0542	2.4173	-1.8381
C	-1.5297	1.5072	-0.7321
C	-4.3428	0.2561	-0.9954
H	-1.9101	-0.5974	-0.4095
C	-3.6007	2.0891	-3.7326
O	-1.7382	3.5877	-2.0662
C	-1.1095	-2.9707	-2.1519
C	0.1905	-3.4738	-1.4945
C	0.0063	-4.8184	-0.7770
H	0.2552	-0.6073	-1.4944
H	-0.3008	0.3648	-2.8078
H	-4.2526	-0.7288	-3.6368
H	-3.7227	-1.8380	-2.4250
H	-1.9561	-0.5426	-4.5298
H	-2.4380	-2.2117	-4.4678
H	-0.1163	-1.8275	-3.6641
H	-2.0756	1.7084	0.1885
H	-0.4734	1.6938	-0.5432
H	-4.4153	-0.6722	-0.4273
H	-4.2602	1.0661	-0.2701
H	-5.2921	0.3914	-1.5154
H	-3.4174	3.0916	-4.0956
H	-4.2937	1.4876	-4.3017
H	-1.4856	-3.7556	-2.8106
H	-1.8740	-2.8405	-1.3848
H	0.5563	-2.7401	-0.7752
H	0.9709	-3.5750	-2.2508
H	0.9396	-5.1487	-0.3195
H	-0.7408	-4.7472	0.0148
H	-0.3145	-5.5984	-1.4688

MCP-3b #8

atom	x	y	z
C	-1.4728	-1.2617	-1.2068
C	-2.0037	0.1924	-1.2730
C	-3.1852	0.4119	-2.2419
C	-2.9493	-0.3070	-3.6017
C	-2.5136	-1.7778	-3.4596
C	-1.2488	-1.9254	-2.5861
C	-3.1372	1.9348	-2.3966
C	-1.7893	2.4392	-2.0897
C	-0.9599	1.2295	-1.6832
C	-4.5166	-0.0525	-1.6023
H	-2.3205	0.4481	-0.2567
C	-4.1402	2.7626	-2.7595
O	-1.4296	3.6183	-2.1371
C	-0.8200	-3.4116	-2.4946
C	0.5152	-3.6814	-1.7645
C	0.3550	-4.0622	-0.2829
H	-2.1797	-1.8670	-0.6367
H	-0.5458	-1.2668	-0.6333
H	-2.1759	0.2167	-4.1668
H	-3.8456	-0.2428	-4.2206
H	-2.3333	-2.1944	-4.4520
H	-3.3304	-2.3630	-3.0342
H	-0.4421	-1.3859	-3.0870
H	-0.2784	1.4812	-0.8719
H	-0.3740	0.8996	-2.5396
H	-4.4895	-1.1109	-1.3430
H	-4.7373	0.4965	-0.6858
H	-5.3603	0.0900	-2.2780
H	-4.0031	3.8328	-2.8399
H	-5.1252	2.3816	-2.9860
H	-0.7167	-3.7867	-3.5148
H	-1.6193	-4.0105	-2.0540
H	1.1851	-2.8255	-1.8649
H	1.0253	-4.5079	-2.2629
H	1.3257	-4.2561	0.1749
H	-0.1264	-3.2773	0.2987
H	-0.2439	-4.9669	-0.1708

MCP-3b #9

atom	x	y	z
C	-1.5879	-0.8205	-0.5311
C	-2.2065	0.5091	-1.0283
C	-3.1025	0.3770	-2.2780
C	-2.4474	-0.5338	-3.3563
C	-1.9224	-1.8765	-2.8110
C	-0.9352	-1.6797	-1.6398
C	-3.1557	1.8381	-2.7342
C	-1.9891	2.5770	-2.2252
C	-1.1898	1.5919	-1.3838
C	-4.5069	-0.1525	-1.8979
H	-2.8043	0.8973	-0.1972
C	-4.0987	2.4348	-3.4944
O	-1.7393	3.7670	-2.4327
C	-0.3988	-3.0095	-1.0522
C	0.4061	-3.8990	-2.0266
C	-0.4219	-5.0139	-2.6880
H	-2.3749	-1.4066	-0.0530
H	-0.8629	-0.6107	0.2572
H	-1.6063	-0.0115	-3.8160
H	-3.1490	-0.7134	-4.1725
H	-1.4330	-2.4072	-3.6275
H	-2.7578	-2.5032	-2.4950
H	-0.0761	-1.1247	-2.0224
H	-0.7737	2.0810	-0.5041
H	-0.3703	1.1994	-1.9838
H	-4.4514	-1.1348	-1.4286
H	-5.0122	0.5113	-1.1950
H	-5.1508	-0.2519	-2.7721
H	-4.0442	3.4813	-3.7632
H	-4.9493	1.8823	-3.8658
H	-1.2134	-3.5817	-0.6039
H	0.2600	-2.7575	-0.2188
H	1.2184	-4.3760	-1.4749
H	0.8938	-3.2876	-2.7879
H	0.1989	-5.6161	-3.3525
H	-0.8458	-5.6863	-1.9410
H	-1.2472	-4.6229	-3.2813

Table S5-7. Cartesian coordinates of the conformers of MCP-4b

MCP-4b #1

atom	x	y	z
C	-0.4973	-1.1971	1.3366
C	-2.0400	-1.0640	1.3738
C	-2.7052	-1.5786	2.6690
C	-2.1105	-2.9466	3.1147
C	-0.5700	-2.9788	3.1370
C	0.0317	-2.5857	1.7711
C	-4.1546	-1.7241	2.1962
C	-4.2041	-1.8807	0.7338
C	-2.7665	-1.7883	0.2423
C	-5.2755	-1.7213	2.9489
O	-5.2238	-2.0331	0.0565
C	-2.5805	-0.5341	3.8053
H	-2.2576	0.0027	1.2574
C	1.5780	-2.6556	1.8040
C	2.2394	-2.4492	0.4462
C	2.3062	-3.5087	-0.4624
C	2.9102	-3.3237	-1.7038
C	3.4459	-2.0795	-2.0317
C	3.3830	-1.0188	-1.1298
C	2.7792	-1.2042	0.1115
H	-0.0670	-0.4380	1.9919
H	-0.1402	-0.9535	0.3348
H	-2.4504	-3.7336	2.4388
H	-2.5028	-3.2253	4.0940
H	-0.2361	-3.9790	3.4186
H	-0.1989	-2.3098	3.9151
H	-0.3118	-3.3209	1.0402
H	-2.7130	-1.2491	-0.7023
H	-2.3808	-2.7950	0.0900
H	-6.2606	-1.8313	2.5154
H	-5.2279	-1.6090	4.0222
H	-1.5380	-0.3113	4.0330
H	-3.0597	0.4094	3.5407
H	-3.0417	-0.8853	4.7288
H	1.8953	-3.6283	2.1845
H	1.9736	-1.9316	2.5189
H	1.8887	-4.4739	-0.2088
H	2.9626	-4.1417	-2.4097
H	3.9147	-1.9355	-2.9961
H	3.8004	-0.0560	-1.3923
H	2.7282	-0.3794	0.8096

MCP-4b #2

atom	x	y	z
C	-1.1712	-0.1693	1.1726
C	-2.5932	-0.6409	1.5659
C	-2.6329	-1.7644	2.6244
C	-1.5867	-2.8763	2.3201
C	-0.1739	-2.3400	2.0173
C	-0.1845	-1.3176	0.8584
C	-4.0648	-2.2732	2.4332
C	-4.5514	-1.9418	1.0844
C	-3.4345	-1.1637	0.4033
C	-4.8333	-2.9381	3.3222
O	-5.6595	-2.2283	0.6243
C	-2.4191	-1.1903	4.0465
H	-3.1100	0.2409	1.9584
C	1.2241	-0.7646	0.5311
C	2.2066	-1.8172	0.0304
C	3.1509	-2.3658	0.9026
C	4.0481	-3.3263	0.4416
C	3.9985	-3.7339	-0.8902
C	3.0598	-3.1902	-1.7651
C	2.1625	-2.2299	-1.3039
H	-0.7665	0.4258	1.9933
H	-1.2361	0.5130	0.3233
H	-1.9116	-3.4609	1.4573
H	-1.5448	-3.5888	3.1454
H	0.4781	-3.1797	1.7726
H	0.2492	-1.8834	2.9134
H	-0.5494	-1.8286	-0.0352
H	-3.8398	-0.3631	-0.2138
H	-2.8708	-1.8429	-0.2344
H	-5.8405	-3.2563	3.0882
H	-4.4654	-3.1796	4.3087
H	-1.4561	-0.6875	4.1355
H	-3.1872	-0.4610	4.3072
H	-2.4425	-1.9728	4.8054
H	1.6423	-0.2570	1.4024
H	1.1472	0.0094	-0.2349
H	3.1886	-2.0521	1.9372
H	4.7792	-3.7539	1.1146
H	4.6954	-4.4801	-1.2483
H	3.0275	-3.5125	-2.7973
H	1.4329	-1.8092	-1.9828

MCP-4b #3

atom	x	y	z
C	-1.1315	-2.5692	0.1187
C	-2.4846	-2.0015	0.6152
C	-2.4117	-1.2318	1.9526
C	-1.5442	-1.9847	3.0046
C	-0.1751	-2.4459	2.4675
C	-0.3267	-3.3216	1.2047
C	-3.8915	-1.2243	2.3473
C	-4.6033	-2.3332	1.6918
C	-3.5795	-3.0465	0.8199
C	-4.5243	-0.3620	3.1714
O	-5.8007	-2.6007	1.8203
C	-1.8747	0.2038	1.7324
H	-2.8375	-1.3247	-0.1697
C	1.0211	-3.8883	0.6863
C	2.0408	-2.8506	0.2230
C	2.9608	-2.3202	1.1319
C	3.8952	-1.3783	0.7083
C	3.9100	-0.9726	-0.6248
C	2.9999	-1.5013	-1.5382
C	2.0658	-2.4433	-1.1139
H	-0.5321	-1.7361	-0.2510
H	-1.2971	-3.2169	-0.7437
H	-2.0788	-2.8682	3.3586
H	-1.4055	-1.3633	3.8908
H	0.3535	-2.9992	3.2453
H	0.4406	-1.5729	2.2474
H	-0.9196	-4.1917	1.4939
H	-4.0280	-3.3723	-0.1175
H	-3.2132	-3.9223	1.3529
H	-5.5813	-0.4424	3.3875
H	-3.9915	0.4465	3.6502
H	-0.8740	0.1957	1.3001
H	-2.5121	0.7739	1.0552
H	-1.8143	0.7602	2.6682
H	0.8321	-4.5841	-0.1332
H	1.4786	-4.5054	1.4618
H	2.9497	-2.6339	2.1670
H	4.6059	-0.9642	1.4110
H	4.6357	-0.2408	-0.9541
H	3.0185	-1.1821	-2.5716
H	1.3593	-2.8524	-1.8234

MCP-4b #4

atom	x	y	z
C	-2.0400	-1.9900	-0.1672
C	-2.5375	-0.9194	0.8509
C	-2.3130	-1.2772	2.3433
C	-0.9394	-1.9691	2.5930
C	-0.5678	-3.0543	1.5651
C	-0.6224	-2.5266	0.1147
C	-3.5547	-2.1322	2.6165
C	-4.6362	-1.7665	1.6866
C	-4.0524	-0.7183	0.7447
C	-3.7122	-3.0950	3.5493
O	-5.7713	-2.2492	1.6688
C	-2.3716	-0.0114	3.2392
H	-2.0216	0.0152	0.6202
C	0.4751	-1.4865	-0.2330
C	1.8979	-2.0226	-0.1226
C	2.6677	-1.7396	1.0090
C	3.9674	-2.2306	1.1067
C	4.4933	-3.0017	0.0717
C	3.7314	-3.2863	-1.0600
C	2.4315	-2.7955	-1.1573
H	-2.0975	-1.5912	-1.1814
H	-2.7209	-2.8435	-0.1612
H	-0.9033	-2.3895	3.5985
H	-0.1503	-1.2162	2.5806
H	-1.2566	-3.8944	1.6702
H	0.4201	-3.4594	1.7885
H	-0.4667	-3.3803	-0.5488
H	-4.3498	0.2736	1.0818
H	-4.4274	-0.8543	-0.2688
H	-4.6381	-3.6438	3.6577
H	-2.9134	-3.3545	4.2280
H	-1.5749	0.6908	2.9904
H	-3.3131	0.5304	3.1445
H	-2.2580	-0.2681	4.2933
H	0.3721	-0.5923	0.3832
H	0.3317	-1.1335	-1.2559
H	2.2603	-1.1433	1.8140
H	4.5651	-2.0146	1.9821
H	5.5029	-3.3833	0.1477
H	4.1468	-3.8859	-1.8589
H	1.8397	-3.0179	-2.0351

MCP-4b #5

atom	x	y	z
C	-1.1698	-2.4324	0.5417
C	-1.7927	-1.1662	1.2029
C	-2.3912	-1.3918	2.6159
C	-1.5210	-2.3441	3.4908
C	-0.9937	-3.5933	2.7590
C	-0.2307	-3.2347	1.4670
C	-3.7875	-1.9054	2.2498
C	-4.1754	-1.4124	0.9175
C	-2.9741	-0.6398	0.3823
C	-4.6018	-2.6941	2.9826
O	-5.2511	-1.6229	0.3515
C	-2.5381	-0.0511	3.3835
H	-1.0094	-0.4072	1.2562
C	1.1237	-2.5318	1.7477
C	2.0025	-2.3618	0.5138
C	2.0336	-1.1383	-0.1611
C	2.8383	-0.9855	-1.2876
C	3.6104	-2.0563	-1.7343
C	3.5848	-3.2786	-1.0651
C	2.7796	-3.4314	0.0611
H	-0.6540	-2.1555	-0.3786
H	-1.9667	-3.1062	0.2216
H	-2.0702	-2.6468	4.3829
H	-0.6593	-1.7944	3.8723
H	-1.8350	-4.2447	2.5148
H	-0.3562	-4.1756	3.4263
H	0.0007	-4.1765	0.9642
H	-3.1307	0.4259	0.5431
H	-2.8519	-0.8031	-0.6876
H	-5.5758	-3.0021	2.6266
H	-4.3092	-3.0490	3.9595
H	-1.5690	0.4192	3.5544
H	-3.1536	0.6752	2.8519
H	-2.9998	-0.2035	4.3600
H	1.6890	-3.1053	2.4845
H	0.9656	-1.5580	2.2131
H	1.4324	-0.3076	0.1832
H	2.8631	-0.0402	-1.8130
H	4.2355	-1.9377	-2.6094
H	4.1868	-4.1051	-1.4185
H	2.7587	-4.3806	0.5795

Table S5-8. Cartesian coordinates of the conformers of MCP-5b

MCP-5b #1

atom	x	y	z
C	0.2193	-0.2432	0.9613
C	-1.3180	-0.3225	1.1327
C	-2.1320	0.1537	-0.0904
C	-1.5627	1.4778	-0.6793
C	-0.0381	1.4575	-0.9028
C	0.7245	1.1051	0.3948
C	-3.5023	0.3714	0.5580
C	-3.3556	0.5977	2.0047
C	-1.8691	0.4794	2.3099
C	-4.7118	0.3726	-0.0422
O	-4.2732	0.8165	2.7996
C	-2.1870	-0.9466	-1.1783
H	-1.5497	-1.3741	1.3308
C	2.2550	1.0985	0.1984
O	2.6936	2.3971	-0.1898
C	4.0973	2.4736	-0.4107
H	0.5329	-1.0461	0.2913
H	0.7036	-0.4561	1.9161
H	-1.7893	2.3071	-0.0065
H	-2.0721	1.7232	-1.6125
H	0.2833	2.4321	-1.2741
H	0.2107	0.7425	-1.6887
H	0.5059	1.8780	1.1340
H	-1.7078	-0.0159	3.2664
H	-1.4396	1.4787	2.3591
H	-5.6282	0.5370	0.5089
H	-4.8083	0.2089	-1.1055
H	-1.1904	-1.2148	-1.5290
H	-2.6525	-1.8601	-0.8056
H	-2.7566	-0.6240	-2.0503
H	2.5342	0.3592	-0.5558
H	2.7465	0.8125	1.1309
H	4.3677	3.4886	-0.7025
H	4.6597	2.2276	0.4917
H	4.4143	1.8035	-1.2118

MCP-5b #2

atom	x	y	z
C	0.3175	0.1664	0.6765
C	-1.1643	-0.1006	1.0406
C	-2.1650	0.1103	-0.1168
C	-1.8640	1.4185	-0.9057
C	-0.3856	1.5769	-1.3107
C	0.5532	1.4927	-0.0870
C	-3.4760	0.2176	0.6675
C	-3.2122	0.6336	2.0542
C	-1.7007	0.7546	2.1867
C	-4.7290	-0.0162	0.2221
O	-4.0628	0.8203	2.9279
C	-2.1713	-1.1106	-1.0691
H	-1.2143	-1.1424	1.3736
C	2.0296	1.6876	-0.4908
O	2.8427	1.7380	0.6778
C	4.2275	1.8997	0.3927
H	0.6774	-0.6611	0.0624
H	0.9252	0.1402	1.5828
H	-2.1386	2.2846	-0.3006
H	-2.5004	1.4781	-1.7901
H	-0.2533	2.5331	-1.8202
H	-0.1198	0.8104	-2.0408
H	0.2983	2.3180	0.5804
H	-1.3675	0.4037	3.1624
H	-1.4204	1.8012	2.0795
H	-5.5961	0.0882	0.8606
H	-4.9123	-0.3179	-0.7988
H	-1.1885	-1.2829	-1.5078
H	-2.4554	-2.0266	-0.5492
H	-2.8707	-0.9751	-1.8945
H	2.1405	2.6187	-1.0509
H	2.3511	0.8747	-1.1458
H	4.7924	1.9313	1.3247
H	4.6144	1.0693	-0.2006
H	4.4211	2.8304	-0.1433

MCP-5b #3

atom	x	y	z
C	0.3104	0.2700	1.0612
C	-1.1902	-0.1017	1.1587
C	-2.0343	0.2769	-0.0786
C	-1.7037	1.7122	-0.5849
C	-0.1953	1.9868	-0.7425
C	0.5718	1.7143	0.5705
C	-3.4438	0.2028	0.5159
C	-3.3950	0.3777	1.9762
C	-1.9249	0.5221	2.3435
C	-4.6093	0.0103	-0.1381
O	-4.3658	0.3810	2.7374
C	-1.8418	-0.7581	-1.2140
H	-1.2273	-1.1868	1.3002
C	2.0774	2.0375	0.4555
O	2.6959	1.2038	-0.5215
C	4.0883	1.4531	-0.6731
H	0.7933	-0.4272	0.3738
H	0.7928	0.1068	2.0265
H	-2.1059	2.4499	0.1120
H	-2.2170	1.9047	-1.5284
H	-0.0457	3.0212	-1.0565
H	0.2092	1.3694	-1.5464
H	0.1740	2.3940	1.3264
H	-1.7087	0.0167	3.2836
H	-1.6931	1.5799	2.4562
H	-5.5597	-0.0269	0.3774
H	-4.6345	-0.1135	-1.2109
H	-0.8001	-0.8181	-1.5294
H	-2.1409	-1.7598	-0.9024
H	-2.4290	-0.5031	-2.0966
H	2.5574	1.8993	1.4267
H	2.2076	3.0887	0.1890
H	4.4995	0.7863	-1.4313
H	4.2796	2.4782	-0.9948
H	4.6316	1.2726	0.2561

MCP-5b #4

atom	x	y	z
C	0.3654	0.0507	0.5863
C	-1.1151	-0.1231	1.0066
C	-2.1414	0.1028	-0.1253
C	-1.7980	1.3652	-0.9697
C	-0.3271	1.4299	-1.4252
C	0.6447	1.3369	-0.2284
C	-3.4177	0.3073	0.6960
C	-3.0857	0.7546	2.0581
C	-1.5663	0.7980	2.1383
C	-4.6956	0.1270	0.2991
O	-3.8953	1.0163	2.9512
C	-2.2444	-1.1476	-1.0328
H	-1.2092	-1.1488	1.3776
C	2.1194	1.4379	-0.6886
O	3.0498	1.3358	0.3899
C	3.1471	2.4968	1.2105
H	0.6605	-0.8142	-0.0106
H	1.0008	0.0210	1.4732
H	-2.0071	2.2650	-0.3880
H	-2.4588	1.4284	-1.8358
H	-0.1605	2.3596	-1.9724
H	-0.1263	0.6257	-2.1353
H	0.4419	2.1954	0.4126
H	-1.2197	0.4624	3.1147
H	-1.2353	1.8240	1.9857
H	-5.5340	0.2996	0.9606
H	-4.9286	-0.1983	-0.7042
H	-1.2874	-1.3873	-1.4962
H	-2.5588	-2.0287	-0.4718
H	-2.9631	-1.0025	-1.8398
H	2.2901	2.3597	-1.2490
H	2.3377	0.6235	-1.3810
H	3.9271	2.3482	1.9575
H	3.4131	3.3807	0.6285
H	2.2192	2.6981	1.7468

MCP-5b #5

atom	x	y	z
C	0.2470	-0.3643	0.8898
C	-1.2864	-0.3479	1.1081
C	-2.1077	0.1493	-0.1017
C	-1.4793	1.4236	-0.7383
C	0.0339	1.3068	-1.0054
C	0.8133	0.9386	0.2772
C	-3.4424	0.4628	0.5808
C	-3.2388	0.7111	2.0170
C	-1.7534	0.5107	2.2819
C	-4.6672	0.5236	0.0159
O	-4.1174	1.0015	2.8327
C	-2.2606	-0.9695	-1.1611
H	-1.5736	-1.3792	1.3376
C	2.3383	0.8306	0.0339
O	2.8969	2.0140	-0.5375
C	3.0638	3.0978	0.3726
H	0.4911	-1.1993	0.2302
H	0.7473	-0.5852	1.8346
H	-1.6359	2.2797	-0.0793
H	-2.0014	1.6782	-1.6620
H	0.4010	2.2520	-1.4091
H	0.2164	0.5610	-1.7809
H	0.6530	1.7323	1.0076
H	-1.5930	0.0272	3.2445
H	-1.2647	1.4835	2.2959
H	-5.5551	0.7546	0.5892
H	-4.8053	0.3431	-1.0401
H	-1.2927	-1.3045	-1.5340
H	-2.7678	-1.8450	-0.7534
H	-2.8363	-0.6326	-2.0236
H	2.5353	0.0129	-0.6611
H	2.8626	0.5706	0.9562
H	3.5514	3.9282	-0.1383
H	2.1096	3.4655	0.7513
H	3.6917	2.8189	1.2204

MCP-5b #6

atom	x	y	z
C	0.3182	0.1659	1.1546
C	-1.1985	-0.1489	1.1772
C	-1.9756	0.3109	-0.0763
C	-1.5685	1.7499	-0.5110
C	-0.0453	1.9661	-0.5992
C	0.6552	1.6162	0.7324
C	-3.4102	0.2712	0.4581
C	-3.4151	0.3871	1.9251
C	-1.9570	0.4575	2.3561
C	-4.5543	0.1518	-0.2490
O	-4.4157	0.4002	2.6465
C	-1.7767	-0.6867	-1.2438
H	-1.2831	-1.2363	1.2733
C	2.1770	1.8880	0.7041
O	2.8425	1.0416	-0.2347
C	3.3638	1.7178	-1.3743
H	0.8025	-0.5233	0.4603
H	0.7530	-0.0530	2.1314
H	-1.9687	2.4763	0.1989
H	-2.0353	1.9997	-1.4651
H	0.1598	3.0031	-0.8704
H	0.3619	1.3570	-1.4075
H	0.2475	2.2809	1.4962
H	-1.7996	-0.0925	3.2828
H	-1.6892	1.4998	2.5209
H	-5.5259	0.1334	0.2263
H	-4.5398	0.0708	-1.3261
H	-0.7260	-0.7785	-1.5188
H	-2.1288	-1.6862	-0.9850
H	-2.3155	-0.3736	-2.1385
H	2.5974	1.6814	1.6894
H	2.3681	2.9497	0.5280
H	3.8286	0.9972	-2.0475
H	2.5823	2.2361	-1.9316
H	4.1262	2.4447	-1.0895

MCP-5b #7

atom	x	y	z
C	0.3670	0.4183	0.9980
C	-1.1105	-0.0250	1.1367
C	-1.9970	0.2846	-0.0899
C	-1.7496	1.7238	-0.6315
C	-0.2605	2.0714	-0.8245
C	0.5447	1.8647	0.4778
C	-3.3887	0.1522	0.5355
C	-3.3196	0.3604	1.9908
C	-1.8516	0.5865	2.3240
C	-4.5557	-0.1126	-0.0897
O	-4.2738	0.3310	2.7720
C	-1.7743	-0.7629	-1.2082
H	-1.0903	-1.1073	1.3010
C	2.0283	2.2724	0.3304
O	2.6829	1.4958	-0.6742
C	3.6982	0.6278	-0.1812
H	0.8631	-0.2666	0.3084
H	0.8799	0.2948	1.9534
H	-2.1759	2.4547	0.0583
H	-2.2899	1.8702	-1.5682
H	-0.1704	3.1057	-1.1610
H	0.1599	1.4597	-1.6245
H	0.1233	2.5357	1.2286
H	-1.5911	0.1127	3.2694
H	-1.6717	1.6568	2.4103
H	-5.4925	-0.1866	0.4463
H	-4.5960	-0.2605	-1.1590
H	-0.7378	-0.7758	-1.5453
H	-2.0145	-1.7718	-0.8702
H	-2.3922	-0.5572	-2.0827
H	2.5296	2.2233	1.3006
H	2.0876	3.3195	0.0297
H	4.1267	0.0584	-1.0061
H	4.5067	1.1900	0.2890
H	3.3036	-0.0849	0.5446

MCP-5b #8

atom	x	y	z
C	-0.2939	1.1001	1.7835
C	-1.0054	-0.1646	1.2142
C	-1.8008	0.0631	-0.0978
C	-1.0661	1.0175	-1.0867
C	-0.4481	2.2696	-0.4367
C	0.4934	1.9124	0.7349
C	-3.1303	0.5752	0.4659
C	-3.3232	0.0790	1.8387
C	-2.0571	-0.6938	2.1942
C	-4.0413	1.3650	-0.1408
O	-4.3065	0.2878	2.5537
C	-2.0558	-1.2760	-0.8394
H	-0.2389	-0.9245	1.0469
C	1.8010	1.2104	0.3022
O	2.5324	2.0631	-0.5738
C	3.7414	1.4798	-1.0459
H	0.3594	0.8163	2.6107
H	-1.0355	1.7677	2.2270
H	-1.7367	1.3171	-1.8929
H	-0.2638	0.4718	-1.5855
H	-1.2495	2.9164	-0.0747
H	0.0845	2.8554	-1.1878
H	0.7949	2.8478	1.2107
H	-2.2350	-1.7592	2.0548
H	-1.7837	-0.5335	3.2363
H	-4.9543	1.6717	0.3517
H	-3.8920	1.7222	-1.1488
H	-1.1213	-1.7447	-1.1502
H	-2.5872	-2.0044	-0.2262
H	-2.6542	-1.1219	-1.7384
H	1.5870	0.2559	-0.1824
H	2.4083	0.9911	1.1830
H	4.2534	2.1807	-1.7055
H	4.4198	1.2418	-0.2248
H	3.5509	0.5684	-1.6154

MCP-5b #9

atom	x	y	z
C	-0.2404	1.4680	1.3110
C	-0.8664	0.0627	1.0606
C	-1.8525	-0.0148	-0.1342
C	-1.3768	0.8217	-1.3600
C	-0.8321	2.2204	-1.0142
C	0.2941	2.1615	0.0396
C	-3.1454	0.4570	0.5389
C	-3.0912	0.1875	1.9854
C	-1.7058	-0.3888	2.2597
C	-4.2176	1.0405	-0.0374
O	-3.9870	0.4211	2.8006
C	-2.0433	-1.4794	-0.6104
H	-0.0436	-0.6371	0.8990
C	1.5988	1.5324	-0.5004
O	2.6347	1.6884	0.4651
C	3.8707	1.1103	0.0618
H	0.5488	1.3925	2.0612
H	-0.9885	2.1278	1.7549
H	-2.1809	0.9127	-2.0911
H	-0.5899	0.2770	-1.8838
H	-1.6497	2.8386	-0.6383
H	-0.4803	2.7186	-1.9194
H	0.5398	3.1923	0.3029
H	-1.7726	-1.4744	2.3165
H	-1.3154	-0.0270	3.2100
H	-5.0859	1.3385	0.5348
H	-4.2491	1.2322	-1.0996
H	-1.1098	-1.9033	-0.9826
H	-2.3972	-2.1391	0.1824
H	-2.7709	-1.5395	-1.4210
H	1.8911	2.0277	-1.4289
H	1.4522	0.4753	-0.7300
H	4.6193	1.2665	0.8388
H	3.7773	0.0344	-0.0961
H	4.2463	1.5656	-0.8562

Table S5-9. Cartesian coordinates of the conformers of MCP-6b

MCP-6b #1

atom	x	y	z
C	-0.5751	-2.3310	1.2068
C	-1.9257	-1.5920	1.0372
C	-3.0690	-2.4567	0.4615
C	-2.5890	-3.3177	-0.7441
C	-1.2843	-4.0928	-0.4757
C	-0.1454	-3.1494	-0.0329
C	-4.0444	-1.3633	0.0165
C	-3.3284	-0.0980	-0.2115
C	-1.8698	-0.3608	0.1352
C	-3.6859	-3.3558	1.5608
H	-2.2090	-1.2398	2.0346
C	-5.3782	-1.4675	-0.1653
O	-3.8344	0.9619	-0.5885
C	1.1818	-3.9049	0.1977
C	1.1406	-4.9195	1.2652
N	1.1087	-5.7185	2.1056
H	-0.6579	-3.0012	2.0642
H	0.2047	-1.6149	1.4722
H	-2.4242	-2.6763	-1.6120
H	-3.3766	-4.0087	-1.0488
H	-0.9914	-4.6333	-1.3774
H	-1.4617	-4.8546	0.2851
H	0.0373	-2.4468	-0.8483
H	-1.4280	0.5022	0.6313
H	-1.3191	-0.5527	-0.7842
H	-2.9452	-4.0299	1.9911
H	-4.0974	-2.7659	2.3809
H	-4.4931	-3.9756	1.1694
H	-5.9834	-0.6292	-0.4838
H	-5.8939	-2.4019	0.0014
H	1.9769	-3.2047	0.4536
H	1.4900	-4.4157	-0.7145

MCP-6b #2

atom	x	y	z
C	-1.0497	-2.9996	1.4670
C	-2.1693	-1.9662	1.1881
C	-3.3395	-2.4930	0.3286
C	-2.8318	-3.3179	-0.8905
C	-1.7830	-4.3867	-0.5265
C	-0.5771	-3.7725	0.2131
C	-3.9739	-1.1713	-0.1139
C	-2.9863	-0.0820	-0.0537
C	-1.7003	-0.6968	0.4802
C	-4.3175	-3.3335	1.1854
H	-2.5524	-1.6588	2.1667
C	-5.2446	-0.9565	-0.5165
O	-3.1885	1.0957	-0.3596
C	0.4770	-4.8486	0.5502
C	1.7078	-4.3246	1.1660
N	2.6779	-3.9124	1.6509
H	-1.4170	-3.7178	2.2023
H	-0.2062	-2.4994	1.9460
H	-2.3844	-2.6483	-1.6274
H	-3.6739	-3.7830	-1.4057
H	-1.4472	-4.8884	-1.4357
H	-2.2434	-5.1613	0.0890
H	-0.1000	-3.0574	-0.4604
H	-1.1905	-0.0069	1.1511
H	-1.0415	-0.9167	-0.3583
H	-3.8213	-4.1946	1.6330
H	-4.7437	-2.7489	2.0019
H	-5.1480	-3.7161	0.5916
H	-5.5979	0.0228	-0.8110
H	-5.9612	-1.7636	-0.5606
H	0.7739	-5.3855	-0.3507
H	0.0624	-5.5894	1.2340

MCP-6b #3

atom	x	y	z
C	-0.9087	-2.1876	1.7742
C	-2.1437	-1.4386	1.2151
C	-3.2380	-2.3499	0.6174
C	-2.6296	-3.4636	-0.2847
C	-1.4589	-4.2252	0.3667
C	-0.3394	-3.2649	0.8246
C	-4.0272	-1.3288	-0.2071
C	-3.1795	-0.1733	-0.5412
C	-1.8298	-0.4262	0.1155
C	-4.1090	-2.9713	1.7365
H	-2.5645	-0.8741	2.0535
C	-5.3135	-1.4063	-0.6102
O	-3.5225	0.8077	-1.2057
C	0.8447	-4.0109	1.4759
C	1.5143	-4.9813	0.5933
N	2.0423	-5.7457	-0.1016
H	-1.1901	-2.6640	2.7151
H	-0.1307	-1.4679	2.0349
H	-2.2651	-3.0246	-1.2154
H	-3.4072	-4.1660	-0.5893
H	-1.0661	-4.9531	-0.3451
H	-1.8231	-4.8051	1.2164
H	0.0491	-2.7609	-0.0630
H	-1.4093	0.4995	0.5058
H	-1.1470	-0.8312	-0.6295
H	-3.5131	-3.5749	2.4209
H	-4.6058	-2.2055	2.3337
H	-4.8849	-3.6209	1.3304
H	-5.7823	-0.6253	-1.1938
H	-5.9265	-2.2605	-0.3626
H	0.5146	-4.5528	2.3622
H	1.6045	-3.3027	1.8065

MCP-6b #4

atom	x	y	z
C	-0.5602	-1.6562	0.1834
C	-1.7823	-1.4739	1.1332
C	-2.9891	-2.4027	0.8375
C	-2.5528	-3.8468	0.4456
C	-1.3801	-3.9160	-0.5493
C	-0.1556	-3.1244	-0.0452
C	-3.7005	-1.5978	-0.2548
C	-3.3732	-0.1680	-0.1257
C	-2.3669	-0.0630	1.0157
C	-3.9281	-2.5128	2.0680
H	-1.4329	-1.6464	2.1536
C	-4.5191	-2.0561	-1.2252
O	-3.8109	0.7427	-0.8331
C	0.5125	-3.7412	1.2053
C	0.9725	-5.1284	1.0268
N	1.3352	-6.2214	0.8866
H	0.2908	-1.0868	0.5614
H	-0.7838	-1.2187	-0.7917
H	-3.4024	-4.4044	0.0496
H	-2.2612	-4.3919	1.3446
H	-1.7028	-3.5147	-1.5120
H	-1.1134	-4.9565	-0.7415
H	0.5933	-3.1427	-0.8402
H	-2.8859	0.2333	1.9261
H	-1.6120	0.6918	0.7998
H	-3.4201	-2.9683	2.9189
H	-4.3013	-1.5445	2.4028
H	-4.8005	-3.1287	1.8454
H	-4.9721	-1.3967	-1.9535
H	-4.7553	-3.1062	-1.3110
H	-0.1666	-3.7355	2.0571
H	1.3802	-3.1509	1.4996

MCP-6b #5

atom	x	y	z
C	-0.6208	-2.2022	0.2584
C	-1.8746	-2.0479	1.1703
C	-3.1930	-2.6058	0.5730
C	-2.9846	-3.9473	-0.1927
C	-1.7501	-3.9801	-1.1127
C	-0.4606	-3.6071	-0.3560
C	-3.6426	-1.4121	-0.2757
C	-3.0819	-0.1638	0.2679
C	-2.1866	-0.5715	1.4336
C	-4.2500	-2.8562	1.6811
H	-1.6589	-2.5554	2.1131
C	-4.4321	-1.4208	-1.3704
O	-3.2819	0.9719	-0.1699
C	-0.0493	-4.6789	0.6797
C	1.2448	-4.4228	1.3334
N	2.2646	-4.2214	1.8486
H	0.2768	-1.9223	0.8123
H	-0.6763	-1.4872	-0.5651
H	-3.8767	-4.1974	-0.7680
H	-2.8859	-4.7610	0.5274
H	-1.9016	-3.2865	-1.9420
H	-1.6494	-4.9669	-1.5677
H	0.3472	-3.5546	-1.0894
H	-2.7296	-0.4367	2.3680
H	-1.2930	0.0500	1.4730
H	-3.9142	-3.6141	2.3899
H	-4.4771	-1.9601	2.2593
H	-5.1920	-3.2062	1.2566
H	-4.6892	-0.5134	-1.9004
H	-4.8407	-2.3409	-1.7607
H	0.0203	-5.6576	0.2052
H	-0.7924	-4.7670	1.4713

10. DFT calculations on the addition of MCP-5a or MCP-5b with methane thiolate

Computational Details

All calculations were carried out with the Gaussian 09 program package[a]. The molecular structures optimizations were conducted at the ωB97XD level using 6-31+G* basis set for all the atoms[b]. Solvation was evaluated by the self-consistent reaction field (SCRF) method using the polarizable continuum model (PCM, solvent = water)[c]. The vibrational frequencies were computed at the same level to check whether each optimized structure is an energy minimum or a transition state and to evaluate its zero-point vibrational energy and thermal corrections at 298 K. Intrinsic reaction coordinates (IRC) were calculated to confirm the connection between the transition states and the reactants/products. In this study, the Gibbs free energy was adopted as the basis for discussion.

References

a. Gaussian 09, Revision E. 01, Frisch, M. J.; Trucks, G. W.; Schlegel, H. B.; Scuseria, G. E.; Robb, M. A.; Cheeseman, J. R.; Scalmani, G.; Barone, V.; Mennucci, B.; Petersson, G. A.; Nakatsuji, H.; Caricato, M.; Li, X.; Hratchian, H. P.; Izmaylov, A. F.; Bloino, J.; Zheng, G.; Sonnenberg, J. L.; Hada, M.; Ehara, M.; Toyota, K.; Fukuda, R.; Hasegawa, J.; Ishida, M.; Nakajima, T.; Honda, Y.; Kitao, O.; Nakai, H.; Vreven, T.; Montgomery, J. A. Jr.; Peralta, J. E.; Ogliaro, F.; Bearpark, M.; Heyd, J. J.; Brothers, E.; Kudin, K. N.; Staroverov, V. N.; Keith, T.; Kobayashi, R.; Normand, J.; Raghavachari, K.; Rendell, A.; Burant, J. C.; Iyengar, S. S.; Tomasi, J.; Cossi, M.; Rega, N.; Millam, J. M.; Klene, M.; Knox, J. E.; Cross, J. B.; Bakken, V.; Adamo, C.; Jaramillo, J.; Gomperts, R.; Stratmann, R. E.; Yazyev, O.; Austin, A. J.; Cammi, R.; Pomelli, C.; Ochterski, J. W.; Martin, R. L.; Morokuma, K.; Zakrzewski, V. G.; Voth, G. A.; Salvador, P.; Dannenberg, J. J.; Dapprich, S.; Daniels, A. D.; Farkas, O.; Foresman, J. B.; Ortiz, J. V.; Cioslowski, J.; Fox, D. J. Gaussian, Inc., Wallingford CT, **2013**.

b. Frisch, M. J.; Pople, J. A.; Binkley, J. S. *J. Chem. Phys.* **1984**, *80*, 3265–3269.

c. Miertuš, S.; Scrocco, E.; Tomasi, J. *Chem. Phys.* **1981**, *55*, 117-129.

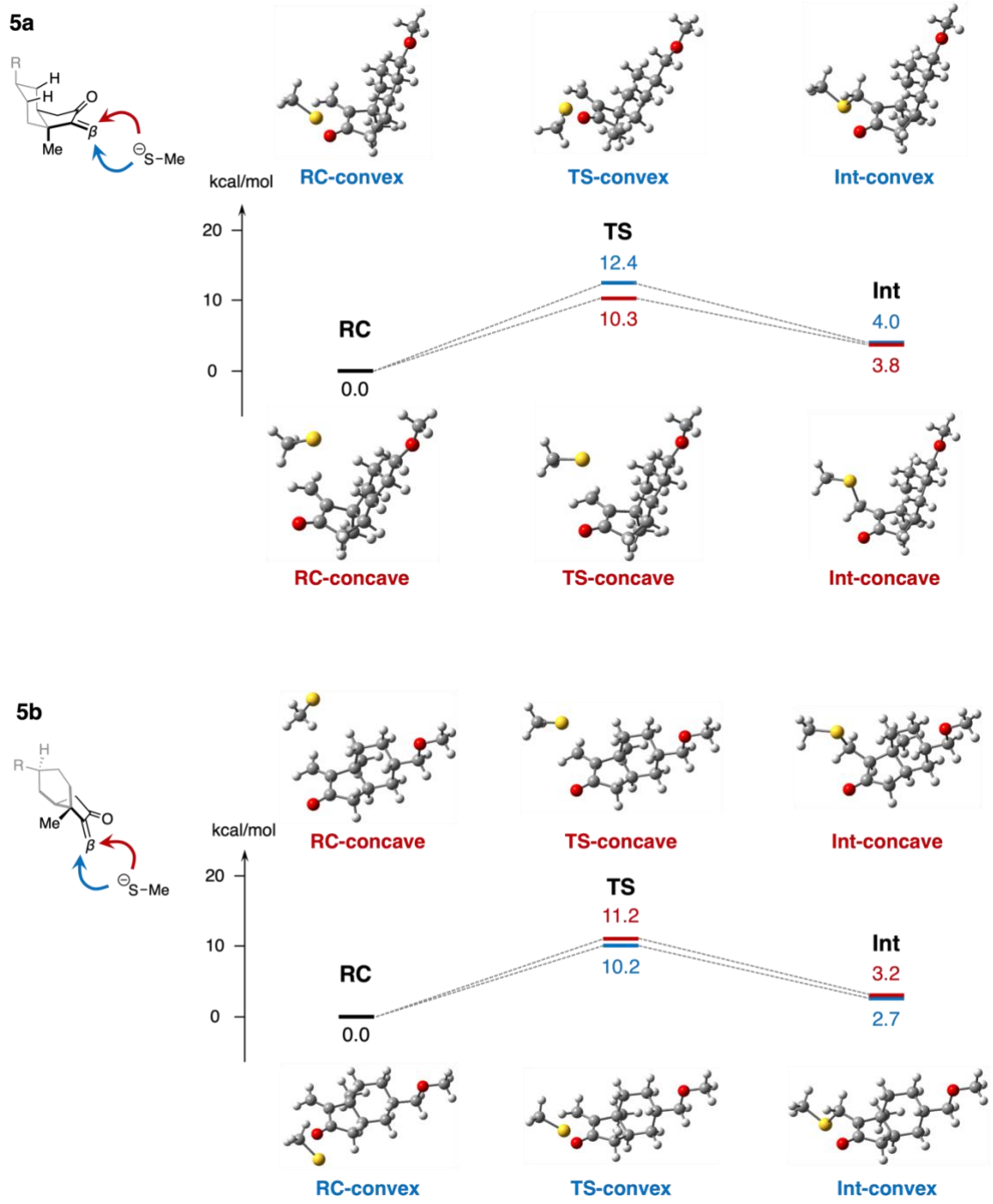


Figure S5. Free energy profiles for additions of methanethiolate to **MCP-5a** and **MCP-5b** in water computed at the ωB97XD/6-31+G* level of theory in PCM water. RC = reactants, TS = transition state, Int = enolate intermediates.