Supplemental material for:

**Concise Total Syntheses of (±)-Mesembrane and (±)-Crinane**

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**Table of Contents**

Materials and Methods S2
General Procedure for Stork-Danheiser’s Sequence (±)-7a-b S3-S4
Characterization of (±)-7a-b S4
General Procedure for Synthesis of 3-Aryl-cyclohexenol (±)-5a-b S5
Characterization of (±)-5a-b S5-S6
General Procedure for Eschenmoser-Claisen Rearrangement S6-S7
Characterization of (±)-4a-b S7
General Procedure for Synthesis of Iodolactone Intermediates (±)-3a-b S8
Characterization of (±)-3a-b S8-S9
General Procedure and Characterization of diols (±)-8a-b S9-S10
General Procedure and Characterization of (±)-9a-b S11-S12
General Procedure and Characterization of ketoaldehyde (±)-10a-b S12-S13
Procedure and Characterization of Sec-amine (±)-11a S14-S15
Synthesis and Characterization of Amine Derivatives (±)-12a-b S15-S16
Total Synthesis and Characterization of mesembrane (±)-1a S16-S17
Total Synthesis and Characterization of crinane (±)-2a S18-S19
Synthesis and Characterization of Amine Derivatives (±)-14a-b S19-S20

1H-NMR, 13C-NMR and Mass Spectra S22-S87
EXPERIMENTAL SECTION

Materials and Methods

Unless otherwise stated, reactions were performed in oven-dried glassware fitted with rubber septa under a nitrogen atmosphere and were stirred with Teflon-coated magnetic stirring bars. Liquid reagents and solvents were transferred via syringe using standard Schlenk techniques. Tetrahydrofuran (THF), diethyl ether (Et₂O) was distilled over sodium/benzophenone ketyl. Dichloromethane (CH₂Cl₂), toluene, and benzene were distilled over calcium hydride. All other solvents such as chloroform, methanol, ethanol, p-xylene, DMSO and reagents such as 1,3-cyclohexanedione, p-TSA.H₂O, 2-butanol, veratrole, 4-bromoveratrole, 4-bromo-1,2-(methylene dioxy)benzene, cerium(III) chloride heptahydrate, sodium borohydride, N,N-dimethylacetamide dimethyl acetal, methyl chloroformate, LiAlH₄, iodine, DBU, oxalyl chloride, triethylamine, sodium cyanoborohydride, acetic acid, trifluoroacetic acid, benzyl chloroformate, ammonium acetate, methylamine, Eschenmoser's salt etc. were used as received, unless otherwise noted. Thin layer chromatography was performed using Merck Silicagel 60 F-254 precoated plates (0.25 mm) and visualized by UV irradiation, 2,4-DNP, anisaldehyde stain and other stains. Silicagel from Merck (particle size 100-200 mesh), basic alumina was used for flash chromatography. Melting points were recorded on a digital melting point apparatus from Jyoti Scientific (AN ISO 9001:2000) and are uncorrected. ¹H and ¹³C NMR spectra were recorded on Bruker 400, 500 MHz spectrometers with ¹³C operating frequencies of 100, 125 MHz, respectively. Chemical shifts (δ) are reported in ppm relative to the residual solvent signal (δ = 7.26 for ¹H NMR and δ = 77.0 for ¹³C NMR). Data for ¹H NMR spectra are reported as follows: chemical shift (multiplicity, coupling constants, number of hydrogen). Abbreviations are as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), br (broad). IR spectra were recorded on a FT-IR system (Spectrum BX) from PerkinElmer spectrometer and are reported in frequency of absorption (cm⁻¹). Only selected IR absorbencies are reported. High-resolution mass spectrometry (HRMS) data were recorded on MicrOTOF-Q-II mass spectrometer using methanol as solvent. High resolution mass spectra and NMR data were obtained from the Central Instrumentation Facility (CIF) at the Indian Institute of Science Education and Research (IISER) Bhopal.
Synthesis of vinylogous ester (6):

A mixture of 1,3-cyclohexanonedione (20.0 g, 178.36 mmol, 1.0 equiv.), p-toluenesulfonic acid monohydrate (1.69 g, 8.92 mmol) and 2-butanol (50 mL) in benzene (150 mL) was held at reflux in dean-stark apparatus for 12 h and then cooled to RT. Most of the solvent was removed under vacuum and the resulting residue was poured into brine and extracted with ether. The organic phase was dried (anhydrous Na₂SO₄), filtered and concentrated to give a crude residue which on purification by flash chromatography afforded 27.6 g (92% yields) of compound 6 as yellow oil. Rₚ = 0.49 (30% EtOAc in hexane).

1H NMR (400 MHz, CDCl₃) δ: 5.30 (s, 1H), 4.18-4.11 (m, 1H), 2.33-2.27 (m, 4H), 1.91 (p, J = 6.49 Hz, 2H), 1.66-1.57 (m, 1H), 1.56-1.46 (m, 1H), 1.19 (d, J = 6.10 Hz, 3H), 0.85 (t, J = 7.46 Hz, 3H); 13C NMR (100 MHz, CDCl₃) δ 200.1, 177.5, 102.9, 75.9, 36.6, 29.5, 28.6, 21.2, 18.6, 9.5; IR (film) νmax 2945, 2882, 1634, 1377, 1330, 1222, 1186, 1137, 1099, 1029, 995, 930, 875, 826, 759 cm⁻¹; HRMS (ESI) m/z 191.1063 [M + Na]+; calculated for [C₁₀H₁₆O₂ + Na]+: 191.1043.

General Procedure for Stork-Danheiser’s Sequence of Vinylogous Esters ±-(7a-b):

A flame-dried round-bottom flask was charged with vinylogous ester 6 (20.0 mmol), dry THF (30 mL) and cooled to 0 °C. To this solution, aryl magnesium bromide (24.0 mmol) in dry THF (20 mL) was added dropwise via syringe over 10 min. After stirring...
for 6-8 h at RT, the reaction mixture was quenched by the addition of 1(N) HCl (20 mL) at 0 °C. The reaction mixture was stirred for 3 h while it was allowed to warm to room temperature and then neutralized by the addition of saturated NaHCO₃ solution. The resulting mixture was extracted with EtOAc (4 x 30 mL). The combined organic layers were dried over Na₂SO₄ and concentrated under vacuum. The crude product was purified by flash chromatography (hexanes and EtOAc as eluents) to give 3-aryl-cyclohexenone 7.

3',4'-Dimethoxy-5,6-dihydro-[1,1'-biphenyl]-3(4H)-one (7a): 3.4 g, 73% yield as yellow solid, R_f = 0.30 (30% EtOAc in hexane). ¹H NMR (400 MHz, CDCl₃) δ 7.15 (dd, J = 8.4, 2.0 Hz, 1H), 7.08 (d, J = 1.9 Hz, 1H), 6.89 (d, J = 8.4 Hz, 1H), 6.41 (s, 1H), 3.92 (s, 3H), 3.91 (s, 3H), 2.77 (t, J = 5.7 Hz, 2H), 2.48 (t, J = 6.4 Hz, 2H), 2.15 (t, J = 6.4 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 200.0, 159.4, 150.9, 149.0, 131.1, 123.9, 119.5, 110.9, 108.9, 55.97, 55.94, 37.2, 27.9, 22.8; IR (film) ν max 3322, 2943, 2844, 1650, 1597, 1519, 1455, 1255, 1185, 1024, 964, 885, 440 cm⁻¹; HRMS (ESI) m/z 255.0994 [(M + Na)⁺; calculated for [C₁₄H₁₆O₃ + Na]⁺: 255.0992]; mp 118–120 °C.

3-(Benzo[d][1,3]dioxol-5-yl)cyclohex-2-enone (7b): 3.7 g, 85% yield as colorless crystalline solid, R_f = 0.45 (50% EtOAc in hexane). ¹H NMR (400 MHz, CDCl₃) δ 7.04 (dd, J = 8.2, 1.8 Hz, 1H), 6.98 (d, J = 1.7 Hz, 1H), 6.79 (d, J = 8.2 Hz, 1H), 6.29 (s, 1H), 5.97 (s, 2H), 2.69-2.66 (m, 2H), 2.44-2.40 (m, 2H), 2.09 (p, J = 6.4 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 199.8, 159.1, 149.3, 148.2, 132.8, 124.2, 120.7, 108.4, 106.2, 101.6, 37.2, 28.1, 22.8; IR (film) ν max 2916, 2943, 2844, 1650, 1597, 1519, 1455, 1255, 1185, 1024, 964, 885, 440 cm⁻¹; mp 102-104 °C, [lit. (G. E. Keck and R. R. Webb, J. Am. Chem. Soc., 1981, 103, 3173) 100-103 °C].
General Procedure for Synthesis of 3-Aryl-cyclohexenol (±)-5a-b:

In a round-bottom flask, 3-aryl-cyclohexenone 7 (15.0 mmol, 1.0 equiv) was dissolved in MeOH (40 mL). To this solution was added CeCl₃·7H₂O (6.7 g, 18.0 mmol, 1.2 equiv). The reaction mixture was stirred at RT for 15 minutes and then was cooled to 0 ºC. NaBH₄ (681 mg, 18.0 mmol, 1.2 equiv) was added to the reaction mixture over 15 minutes. The reaction mixture was continued stirring. At the completion of the reaction (TLC, 30 min), it was quenched with saturated aq. NH₄Cl (10 mL) and aq. NaHCO₃ (10 mL). After stirring vigorously for 30 mins, the solvent was removed under reduced pressure. Water (20 mL) was added to the crude reaction mixture and it was extracted with CH₂Cl₂ (3 X 30 mL). The combined organic extracts were washed with saturated aq. NaCl (20 mL), dried over Na₂SO₄, and concentrated under reduced pressure. The crude product was purified by flash chromatography to provide of allylic alcohol 5.

3',4'-Dimethoxy-3,4,5,6-tetrahydro-[1,1'-biphenyl]-3-ol ±(5a): 3.2 g, 92% yield as colorless crystalline solid, Rᶠ = 0.25 (30% EtOAc in hexane). 

\[ 3 \text{H NMR} \ (400 \text{ MHz, CDCl}_3) \delta 6.94-6.93 \text{ (m, 2H)}, 6.82-6.79 \text{ (m, 1H)}, 6.054-6.051 \text{ (m, 1H)}, 4.37 \text{ (s, 1H)}, 3.87 \text{ (s, 3H)}, 3.86 \text{ (s, 3H)}, 2.44-2.31 \text{ (m, 2H)}, 1.94-1.84 \text{ (m, 2H)}, 1.77-1.61 \text{ (m, 3H)}; \] 

\[ 13 \text{C NMR} \ (100 \text{ MHz, CDCl}_3) \delta 148.7, 148.6, 139.7, 134.3, 125.3, 117.8, 110.9, 108.7, 66.4, 55.9, 55.8, 31.8, 27.6, 19.4; \text{ IR (film) \nu} \text{ max} \ 3445, 2921, 2840, 1615, 1458, 1406, 1259, \]

\(3\)-(Benzo[\textit{d}][1,3]dioxol-5-yl)cyclohex-2-enol (5b): \(3.1\) g, 96\% yield as white solid, \(R_f=0.40\) (50\% EtOAc in hexane). \(^1\)H NMR (500 MHz, CDCl\(_3\)) \(\delta 6.92\) (d, \(J = 1.8\) Hz, 1H), 6.88 (dd, \(J = 8.1, 1.8\) Hz, 1H), 6.76 (d, \(J = 8.1\) Hz, 1H), 6.04-6.02 (m, 1H), 5.95 (s, 2H), 4.37-4.36 (m, 1H), 2.43-2.36 (m, 1H), 2.33-2.26 (m, 1H), 2.18 (brs, 1H), 1.96-1.86 (m, 2H), 1.76-1.62 (m, 2H); \(^13\)C NMR (125 MHz, CDCl\(_3\)) \(\delta 147.7, 146.9, 139.4, 135.8, 125.7, 118.9, 108.0, 106.0, 101.0, 66.3, 31.6, 27.7, 19.5\); IR (film) \(\nu_{\text{max}} \delta 3402, 2932, 1720, 1650, 1606, 1548, 1486, 1372, 1247, 1160, 1104, 1040, 970, 936, 865, 807, 738, 703, 634\) cm\(^{-1}\); mp 105-108 °C.

**General Procedure For Eschenmoser-Claisen Rearrangement:**

An oven-dried Schlenk flask was charged with a solution of alcohol (±)-5 (generally in 3.0 mmol scale, 1.0 equiv) in \(p\)-xylene followed by addition of \(N, N\)-dimethylacetamide dimethyl acetal (3.07 mL, 21.0 mmol, 7.0 equiv). The solution was sparged with \(N_2\) and then sealed and heated at 160 °C for 18 h. The reaction mixture was allowed to cool to room temperature and concentrated. The crude product was purified by flash chromatography to give of amide 4.
2-(3',4'-Dimethoxy-1,2,3,4-tetrahydro-[1,1'-biphenyl]-1-yl)-N,N-imethylacetamide ±(4a): 746 mg, 82% yield as yellow gel, \( R_f = 0.20 \) (40% EtOAc in hexane). \( ^1H \text{NMR} \) (400 MHz, CDCl\(_3\)) \( \delta \) 6.87-6.85 (m, 2H), 6.78-6.76 (m, 1H), 6.14 (d, \( J = 10.2 \) Hz, 1H), 5.89-5.85 (m, 1H), 3.83 (s, 3H), 3.82 (s, 3H), 2.81 (s, 3H), 2.71 (s, 3H), 2.69-2.67 (m, 2H), 2.10-1.90 (m, 4H), 1.59-1.54 (m, 1H), 1.41-1.33 (m, 1H); \( ^{13}C \text{NMR} \) (100 MHz, CDCl\(_3\)) \( \delta \) 170.8, 148.4, 147.0, 140.3, 133.1, 128.0, 118.8, 110.7, 110.5, 55.9, 55.8, 45.1, 41.8, 37.8, 36.5, 35.4, 25.3, 18.8; \( \text{IR} \) (film) \( \nu_{\text{max}} \) 2934, 1640, 1519, 1258, 1238, 1179, 1145, 1028, 757 cm\(^{-1}\); \( \text{HRMS} \) (ESI) m/z 304.1905 \([M + H]^+\); calculated for [C\(_{18}\)H\(_{25}\)NO\(_3\) + H]\(^+\): 304.1907).

2-(1-(Benzod[d][1,3]dioxol-5-yl)cyclohex-2-en-1-yl)-N,N-dimethylacetamide ±(4b): 750 mg, 87% yield as yellow gel, \( R_f = 0.25 \) (40% EtOAc in hexane). \( ^1H \text{NMR} \) (400 MHz, CDCl\(_3\)) \( \delta \) 6.82 (m, 1H), 6.76 (dd, \( J = 8.2, 1.6 \) Hz, 1H), 6.68 (d, \( J = 8.2 \) Hz, 1H), 6.10 (d, \( J = 10.7 \) Hz, 1H), 5.87 (s, 2H), 5.85-5.82 (m, 1H), 2.8 (s, 3H), 2.79 (s, 3H), 2.66 (ABq, \( J = 14.7 \) Hz, 2H), 2.0-1.95 (m, 3H), 1.89-1.82 (m, 1H), 1.55-1.48 (m, 1H), 1.39-1.33 (m, 1H); \( ^{13}C \text{NMR} \) (100 MHz, CDCl\(_3\)) \( \delta \) 170.5, 147.4, 145.3, 141.8, 143.0, 128.1, 119.8, 107.6, 107.4, 100.8, 44.8, 42.0, 37.8, 37.2, 35.3, 25.2, 18.7; \( \text{IR} \) (film) \( \nu_{\text{max}} \) 2931, 1643, 1487, 1433, 1238, 1143, 1101, 1039, 935, 812, 745 cm\(^{-1}\); \( \text{HRMS} \) (ESI) m/z 288.1607 \([M + H]^+\); calculated for [C\(_{17}\)H\(_{21}\)NO\(_3\) + H]\(^+\): 288.1594.

General Procedure for Synthesis of Iodolactone Intermediates (±)-3a-b:
A solution of amide 4 (5 mmol, 1 equiv), in 1:1 mixture of THF:Water (20 mL) was added iodine (1.5 g, 6 mmol, 1.2 equiv) and the reaction mixture was heated at 60 ºC for 4h and cooled to room temperature. This was followed by reductive work up with saturated aqueous sodium bisulphate solution. The reaction mixture was extracted with EtOAc (3 X 20 mL). The combined organic extracts were washed with saturated aq. NaCl (30 mL), dried over Na₂SO₄, and concentrated under reduced pressure. The crude product was purified by flash chromatography to provide of 3 as a solid.

(3,4-Dimethoxyphenyl)-7-iodohexahydrobenzofuran-2(3H)-one ±(3a): 1.73 g, 86% yield as white solid, R_f = 0.35 (40% EtOAc in hexane). ^1H NMR (400 MHz, CDCl₃) δ 6.91-6.89 (m, 1H), 6.84-6.80 (m, 2H), 5.0 (d, J = 6.8 Hz, 1H), 4.23-4.18 (m, 1H), 3.86 (s, 3H), 3.83 (s, 3H), 2.71 (ABq, J = 17.2 Hz, 2H), 2.76-2.24 (m, 1H), 2.08-1.93 (m, 3H), 1.79-1.75 (m, 1H), 1.62-1.53 (m, 1H); ^13C NMR (100 MHz, CDCl₃) δ 174.1, 149.2, 148.4, 135.5, 118.2, 111.2, 109.6, 88.5, 56.2, 55.9, 46.7, 41.7, 34.1, 32.6, 25.6, 21.9; IR (film) v_max 2920, 2838, 1770, 1590, 1519, 1455, 1251, 1098, 1028, 946, 914, 806, 739 cm⁻¹; HRMS (ESI) m/z 403.0418 [(M + H)⁺; calculated for [C₁₀H₁₀I₃O₄ + H]⁺: 403.0401]; mp 125-127 °C.
(Benzo[d][1,3]dioxol-5-yl)-7-iodohexahydrobenzofuran-2(3H)-one ±(3b): 1.64 g, 85% yield as white solid, R<sub>f</sub> = 0.35 (30% EtOAc in hexane). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.86-6.82 (m, 2H), 6.77 (d, J = 8.1 Hz, 1H), 5.95 (s, 2H), 4.97 (d, J = 6.8 Hz, 1H), 4.25-4.2 (m, 1H), 2.71 (ABq, J = 21.8 Hz, 2H), 2.31-2.24 (m, 1H), 2.1-1.92 (m, 3H), 1.84-1.75 (m, 1H), 1.63-1.53 (m, 1H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 173.9, 148.3, 146.8, 136.9, 119.1, 108.3, 106.6, 101.4, 88.5, 46.8, 42.0, 34.0, 32.7, 25.3, 21.8; IR (film) <i>υ</i><sub>max</sub> 2930, 2859, 1783, 1489, 1447, 1238, 1204, 1169, 1040, 1017, 935, 812, 735 cm<sup>-1</sup>; HRMS (ESI) m/z 387.0069 [(M + H)<sup>+</sup>]; calculated for [C<sub>15</sub>H<sub>15</sub>IO<sub>4</sub> + H]<sup>+</sup>: 387.0088; mp 171-173 °C.

General Procedure for Synthesis of diols (±)-8a-b:

To a suspension of lithium aluminium hydride, (605 mg, 16.0 mmol, 4.0 equiv) in THF (30 mL) at 0 °C was added a solution of compound 3 (4.0 mmol, 1.0 equiv) in THF (30 mL). The reaction mixture was allowed to warm to room temperature, fitted with a water condenser, heated to 80 °C and held at reflux for 20h. The reaction mixture was cooled to RT and then to 0 °C and quenched with EtOAc, basified with 4(N) NaOH solution and extracted with EtOAc (3 X 25 mL). The combined organic extracts were washed with saturated aq. NaCl (30 mL), dried over Na<sub>2</sub>SO<sub>4</sub>, and concentrated under reduced pressure. The crude product was purified by flash chromatography to provide 8.
2-(3,4-Dimethoxyphenyl)-2-(2-hydroxyethyl)cyclohexanol \( \pm (\text{8a}) \): 1.004 g, 90% yield as yellow gel, \( R_f = 0.15 \) (50% EtOAc in hexane). \( ^1\text{H NMR} \) (400 MHz, CDCl\(_3\)) \( \delta \) 6.94-6.93 (m, 2H), 6.83-6.81 (m, 1H), 4.23 (brs, 1H), 3.86 (s, 3H), 3.85 (s, 3H), 3.58-3.53 (m, 1H), 3.49-3.43 (m, 1H), 2.78 (brs, 2H), 2.25-2.18 (m, 1H), 1.82-1.73 (m, 6H), 1.5-1.49 (m, 1H), 1.38-1.36 (m, 2H); \( ^{13}\text{C NMR} \) (100 MHz, CDCl\(_3\)) \( \delta \) 148.8, 147.1, 137.9, 119.2, 111.0, 110.6, 72.7, 59.3, 56.0, 55.8, 45.4, 29.8, 29.7, 22.7, 21.6, 20.6; \( \text{IR} \) (film) \( \upsilon_{\text{max}} \) 3352, 2935, 2110, 1781, 1649, 1506, 1454, 1355, 1238, 1204, 1169, 1109, 1039, 1017, 935, 808, 736 cm\(^{-1}\); \( \text{HRMS} \) (ESI) m/z 303.1601 \([\text{M} + \text{Na}]^+; \) calculated for [C\(_{16}\)H\(_{24}\)O\(_4\) + Na]\(^+\): 303.1567].

2-(Benzo[d][1,3]dioxol-5-yl)-2-(2-hydroxyethyl)cyclohexanol \( \pm (\text{8b}) \): 973 mg, 92% yield as white solid, \( R_f = 0.2 \) (50% EtOAc in hexane). \( ^1\text{H NMR} \) (400 MHz, CDCl\(_3\)) \( \delta \) 6.90 (d, \( J = 1.7 \) Hz, 1H), 6.84 (dd, \( J = 6.5, 1.7 \) Hz, 1H), 6.75 (d, \( J = 8.2 \) Hz, 1H), 5.91 (s, 2H), 4.16-4.14 (m, 1H), 3.54-3.49 (m, 1H), 3.45-3.39 (m, 1H), 3.05 (brs, 2H), 2.22-2.14 (m, 1H), 1.83-1.64 (m, 6H), 1.52-1.44 (m, 1H), 1.39-1.32 (m, 2H); \( ^{13}\text{C NMR} \) (100 MHz, CDCl\(_3\)) \( \delta \) 147.8, 145.4, 139.5, 119.9, 108.0, 107.6, 100.9, 72.5, 59.1, 45.7, 38.8, 35.8, 29.8, 22.7, 21.5; \( \text{IR} \) (film) \( \upsilon_{\text{max}} \) 3351, 2935, 2866, 1612, 1489, 1437, 1240, 1040, 937, 913, 738, 431 cm\(^{-1}\); \( \text{HRMS} \) (ESI) m/z 287.1254 \([\text{M} + \text{Na}]^+; \) calculated for [C\(_{15}\)H\(_{20}\)O\(_4\) + Na]\(^+\): 287.1254]; mp 90-92 °C.

**General Procedure for Synthesis of (±)-9a-b:**
A solution of iodolactone 3 (0.5 mmol, 1 equiv), in toluene (7 mL) was added DBU (112 µL, 0.75 mmol, 1.5 equiv) and the reaction mixture was refluxed at 110 ºC for 5h. Upon completion of the reaction (monitoring by TLC), it was diluted by 10 mL EtOAc. The whole reaction mixture was taken in a separatory funnel and extracted with 10 mL of water. The organic filtrate was dried over anhydrous Na₂SO₄ and concentrated in a rotary evaporator under vacuum. The crude product was purified by flash chromatography to provide 9.

3a-(3,4-Dimethoxyphenyl)-3,3a,4,5-tetrahydrobenzofuran-2(7aH)-one ±(9a): 129 mg, 94% yield as colorless gel, Rₘ = 0.30 (20% EtOAc in hexane). ¹H NMR (500 MHz, CDCl₃) δ 6.82 (d, J = 8.3 Hz, 1H), 6.70-6.67 (m, 2H), 6.28-6.25 (m, 1H), 6.16-6.13 (m, 1H), 4.94 (d, J = 4.2 Hz, 1H), 3.87 (s, 3H), 3.86 (s, 3H), 2.89 (ABq, J = 16.9 Hz, 2H), 2.10-2.04 (m, 1H), 1.85-1.73 (m, 3H); ¹³C NMR (125 MHz, CDCl₃) δ 175.0, 149.0, 148.1, 135.9, 135.0, 122.8, 118.0, 111.1, 109.4, 78.2, 56.0, 55.9, 44.6, 44.2, 31.6, 22.0; IR (film) vₛₘₐₓ 2921, 1780, 1592, 1520, 1468, 1255, 1201, 1150, 1027, 978, 809 cm⁻¹; HRMS (ESI) m/z 313.0839 [(M + K)+; calculated for [C₁₆H₁₈O₄ + K]⁺: 313.0837].
3a-([d][1,3]dioxol-5-yl)-3,3a,4,5-tetrahydrobenzofuran-2(7aH)-one \(\pm (9b)\): 119 mg, 92% yield as white solid, \(R_f=0.40\) (20% EtOAc in hexane). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta 6.74\) (d, \(J = 8.1\) Hz, 1H), 6.62 (d, \(J = 1.8\) Hz, 1H), 6.56 (dd, \(J = 8.1, 1.9\) Hz, 1H), 6.25-6.21 (m, 1H), 6.12-6.09 (m, 1H), 5.93 (s, 2H), 4.86 (d, \(J = 4.2\) Hz, 1H), 2.83 (ABq, \(J = 13.2\) Hz, 2H), 2.08-2.0 (m, 1H), 1.85-1.61 (m, 3H); \(^1^3\)C NMR (100 MHz, CDCl\(_3\)) \(\delta 174.8, 148.0, 146.5, 136.3, 136.0, 122.7, 118.9, 108.3, 106.6, 101.2, 78.1, 44.8, 44.4, 31.7, 21.9\); IR (film) \(\nu_{\text{max}}\) 2920, 2856, 2343, 1775, 1460, 1237, 1196, 1106, 1037, 810 cm\(^{-1}\); HRMS (ESI) \(m/z\) 259.0983 [(M + H)\(^{+}\); calculated for [C\(_{15}\)H\(_{14}\)O\(_4\) + H]\(^{+}\): 259.0965]; mp 96-98 ºC.

General Procedure for Synthesis of ketoaldehyde \((\pm)-10a-b\):

A flame-dried round-bottom flask was charged with DMSO (528 µL, 10.0 mmol, 10 equiv), CH\(_2\)Cl\(_2\) (8 mL) and cooled to -78 ºC. In a separate flask, oxalyl chloride (257 µL 3.0 mmol, 3 equiv) was dissolved in CH\(_2\)Cl\(_2\) (6 mL). The oxalyl chloride solution was added dropwise to the DMSO/ CH\(_2\)Cl\(_2\) solution at -78 ºC via syringe over 15 mins. After stirring for 30 mins at -78 ºC, diol \((\pm)-8\) (1.0 mmol, 1.0 equiv) in CH\(_2\)Cl\(_2\) (10 mL) was added dropwise over 30 mins and the reaction mixture was stirred at -78 ºC for an additional 2.5 h. Triethylamine (1.4 mL, 10.0 mmol, 10 equiv) was added dropwise and then the reaction mixture was stirred at that temperature for an hour and then allowed to slowly warm to RT. After stirring at RT for 1 h, the reaction mixture was poured into a separatory funnel and washed with water (20 mL). The aqueous layer was extracted with CH\(_2\)Cl\(_2\) (2 X 20 mL). The combined organic extracts were dried over Na\(_2\)SO\(_4\) and concentrated under vacuum. The crude product was purified by flash chromatography to afford of \((\pm)-10\).
Das, De, Shubhashish and Bisai Supporting Information

2-(1-(3,4-Dimethoxyphenyl)-2-oxocyclohexyl)acetaldehyde $\pm$(10a): 246 mg, 89% yield as colorless gel, $R_f = 0.56$ (40% EtOAc in hexane). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 9.55 (s, 1H), 6.85 (d, $J = 8.4$ Hz, 1H), 6.76 (dd, $J = 8.4, 1.8$ Hz, 1H), 6.64 (s, 1H), 3.85 (s, 3H), 3.83 (s, 3H), 2.70-2.65 (m, 3H), 2.46-2.33 (m, 2H), 2.02-1.89 (m, 2H), 1.79-1.65 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 212.0, 201.7, 149.6, 148.3, 131.7, 118.9, 111.6, 109.7, 56.0, 55.9, 55.7, 53.4, 39.5, 35.9, 27.7, 21.3; IR (film) $\nu_{\text{max}}$ 2939, 2865, 1707, 1589, 1519, 1465, 1259, 1153, 1026, 811 cm$^{-1}$; HRMS (ESI) m/z 299.1249 [(M + Na)$^+$; calculated for [C$_{16}$H$_{20}$O$_4$ + Na]$^+$: 299.1254].

2-(1-(Benzo[d][1,3]dioxol-5-yl)-2-oxocyclohexyl)acetaldehyde $\pm$(10b): 239 mg, 92% yield as white solid, $R_f = 0.35$ (20% EtOAc in hexane). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 9.55 (s, 1H), 6.78 (d, $J = 8.1$ Hz, 1H), 6.72-6.69 (m, 1H), 6.63-6.61 (m, 1H), 5.95 (s, 2H), 2.66-2.57 (m, 3H), 2.47-2.33 (m, 2H), 1.98-1.89 (m, 2H), 1.77-1.68 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 211.8, 201.6, 148.7, 146.9, 133.3, 120.0, 108.9, 106.9, 101.3, 55.8, 53.4, 39.5, 36.1, 27.8, 21.3; IR (film) $\nu_{\text{max}}$ 2939, 2866, 1713, 1706, 1610, 1489, 1345, 1241, 1039, 934, 814 cm$^{-1}$; HRMS (ESI) m/z 261.1122 [(M + H)$^+$; calculated for [C$_{15}$H$_{16}$O$_4$ + H]$^+$: 261.1121], mp 38-40 °C.

Optimization of reductive amination of $(\pm)$-10:
An oven-dried round-bottom flask was charged with ketoaldehyde (±)-10a (50 mg, 0.181 mmol, 1.0 equiv) in EtOH (3 mL), followed by addition of NH$_2$OAc (28 mg, 0.362 mmol, 2.0 equiv), NaBH$_3$CN (45 mg, 0.724 mmol, 4.0 equiv) and protic acid (0.087 mmol, 0.1 equiv) respectively. The reaction mixture was stirred at room temperature for indicated time. The reaction mixture was then basified with 2(NaOH and extracted with CH$_2$Cl$_2$. The combined organic layers were dried over anhydrous K$_2$CO$_3$ and concentrated under vacuum. The crude product was purified by flash chromatography to give amine 11a as a light yellow gel.

3a-(3,4-dimethoxyphenyl)octahydro-1H-indole ±(11a): 42 mg, 89% yield as colorless gel, R$_f$ = 0.3 (1 mL MeOH + 30 mL CH$_2$Cl$_2$ + 1 mL Et$_3$N). $^1$H NMR (400 MHz, CDCl$_3$) δ 6.95-6.91 (m, 2H), 6.84 (d, $J$ = 8.2 Hz, 1H), 3.91 (s, 3H), 3.89 (s, 3H), 3.48 (t, $J$ = 4.3 Hz, 1H), 3.2-3.13 (m, 1H), 3.07-3.00 (m, 1H), 2.08-2.02 (m, 2H), 1.99-1.87 (m, 3H), 1.82-1.67 (m, 3H), 1.55-1.48 (m, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ

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<table>
<thead>
<tr>
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<th>acid</th>
<th>solvent</th>
<th>temp.</th>
<th>time</th>
<th>%yield$^b$</th>
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<td>12 h</td>
<td>72%</td>
</tr>
<tr>
<td>2.</td>
<td>AcOH (1 equiv.)</td>
<td>MeOH</td>
<td>0 - 25 °C</td>
<td>12 h</td>
<td>75%</td>
</tr>
<tr>
<td>3.</td>
<td>TFA (1 equiv.)</td>
<td>EtOH</td>
<td>0 - 25 °C</td>
<td>10 h</td>
<td>89%</td>
</tr>
<tr>
<td>4.</td>
<td>AcOH (1 equiv.)</td>
<td>EtOH</td>
<td>0 - 25 °C</td>
<td>10 h</td>
<td>88%</td>
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<tr>
<td>5.</td>
<td>TFA (1 equiv.)</td>
<td>THF</td>
<td>0 - 25 °C</td>
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<td>35%</td>
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<td>6.</td>
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<td>32%</td>
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<td>7.</td>
<td>TFA (10 mol%)</td>
<td>EtOH</td>
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<td>83%</td>
</tr>
<tr>
<td>8.</td>
<td>AcOH (10 mol%)</td>
<td>EtOH</td>
<td>0 - 25 °C</td>
<td>16 h</td>
<td>85%</td>
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$^a$2.0 equiv. of NH$_2$OAc and 3.0 equiv. NaBH$_3$CN were used in each case and all the reactions were performed on a 0.20 mmol of (±)-10a in 2 mL of solvent under inert atmosphere. $^b$isolated yields after column chromatography.
Synthesis of Amine Derivatives ±(12a-b):

A round-bottom flask was charged with amine (±)-11a (0.25 mmol; 1.0 equiv.) in toluene : NaHCO₃ (1:1) (7 mL) at room temperature. To this reaction mixture chloroformate (0.3 mmol, 1.2 equiv) was added dropwise and it was stirred for 30 min at room temperature. Upon completion of the reaction (monitoring by TLC), it was diluted by 10 mL EtOAc. The whole reaction mixture was taken in a separatory funnel and extracted with 5 mL of water. The organic filtrate was dried over anhydrous Na₂SO₄ and concentrated in a rotary evaporator under vacuum. The crude product was purified by flash chromatography to give product 12 as a light yellow gel.

**Methyl 3a-(3,4-dimethoxyphenyl)octahydro-1H-indole-1-carboxylate ±(12a):** 68 mg, 85% yield as colorless gel, Rₛ = 0.30 (30% EtOAc in hexane). ¹H NMR (400 MHz, CDCl₃) δ 6.83-6.77 (m, 3H), 4.25-4.11 (m, 1H), 3.85 (s, 3H), 3.84 (s, 3H), 3.69-3.62 (m, 3H), 3.39-3.34 (m, 1H), 3.09-3.07 (m, 1H), 2.39-2.31 (m, 1H), 2.15-2.02 (m, 3H), 1.92-1.90 (m, 1H), 1.66-1.55 (m, 4H), 1.49-1.43 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 155.3, 148.7, 147.2, 140.1, 117.7, 111.0, 109.3, 59.6, 55.9, 55.8, 52.1, 57.1, 43.3, 35.6, 33.3, 29.7, 23.2, 22.3; IR (film) νₑₛₐₓ 2928, 2856, 1696, 1520, 1454, 1392, 1256, 1155, 1099, 1011, 911 cm⁻¹; HRMS (ESI) m/z 262.1818 [(M + H)+; calculated for [C₁₆H₂₃NO₂ + H]⁺: 262.1802].
1029, 769 cm\(^{-1}\); **HRMS** (ESI) m/z 320.1859 [(M + H)\(^+\)]; calculated for [C\(_{18}\)H\(_{25}\)NO\(_4\) + H]\(^+\): 320.1856.

**Benzyl 3a-(3,4-dimethoxyphenyl)octahydro-1H-indole-1-carboxylate \(\pm(12b)\):** 81 mg, 82% yield as yellow gel, \(R_f = 0.55\) (30% EtOAc in hexane). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.35-7.25 (m, 5H), 6.86-6.71 (m, 3H), 5.19-5.03 (m, 2H), 4.29-4.16 (m, 1H), 3.84 (s, 3H), 3.78-3.75 (m, 3H), 3.41 (t, \(J = 9.4\) Hz, 1H), 3.18-3.12 (m, 1H), 2.40-2.32 (m, 1H), 2.17-2.04 (m, 2H), 1.97-1.89 (m, 1H), 1.66-1.43 (m, 6H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (rotameric mixture) \(\delta\) 154.64, 154.61, 148.73, 148.71, 147.28, 147.22, 140.14, 140.11, 137.19, 137.17, 128.47, 128.39, 127.86, 127.75, 127.65, 127.52, 117.68, 117.48, 111.05, 111.01, 109.25, 109.23, 66.59, 66.33, 59.67, 59.60, 55.84, 55.80, 47.86, 47.12, 43.57, 43.42, 35.93, 35.54, 33.38, 31.92, 31.58, 29.70, 29.32, 28.37, 23.54, 23.24, 22.35, 22.28; **IR** (film) \(\nu_{\text{max}}\) 3055, 2929, 2855, 1696, 1519, 1454, 1416, 1348, 1265, 1154, 1029, 805 cm\(^{-1}\); **HRMS** (ESI) m/z 396.2179 [(M + H)\(^+\)]; calculated for [C\(_{24}\)H\(_{29}\)NO\(_4\) + H]\(^+\): 396.2169.

**Total Synthesis of \((\pm)-\text{mesembrane}\):**
An oven-dried round-bottom flask was charged with ketoaldehyde (±)-10a (20 mg, 0.072 mmol, 1.0 equiv) in EtOH (3 mL), followed by addition of methylamine in THF (364 µL, 0.72 mmol, 10.0 equiv), NaBH₃CN (19 mg, 0.291 mmol, 4.0 equiv) and protic acid (0.0072 mmol, 0.1 equiv) respectively. The reaction mixture was stirred at room temperature for indicated time. The reaction mixture was then basified with 2(NaOH and extracted with CH₂Cl₂. The combined organic layers were dried over anhydrous K₂CO₃ and concentrated under vacuum. The crude product was purified by flash chromatography to give amine 1a and 13 as a light yellow gel.

3a-(3,4-dimethoxyphenyl)-1-methyloctahydro-1H-indole ±(1a): 17 mg, 88% yield as colorless gel, Rf = 0.45 (1 mL MeOH + 30 mL CH₂Cl₂ + 1 mL Et₃N). ¹H NMR (400 MHz, CDCl₃) δ 6.94-6.90 (m, 2H), 6.84-6.81 (m, 1H), 3.89 (s, 3H), 3.88 (s, 3H), 3.28-3.23 (m, 1H), 2.59 (brs, 1H), 2.33 (s, 3H), 2.32-2.29 (m, 1H), 1.96-1.80 (m, 4H), 1.67-1.65 (m, 3H), 1.50-1.45 (m, 2H), 1.39-1.36 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 148.6, 146.8, 140.3, 118.9, 110.7, 110.6, 68.7, 55.9, 55.8, 54.4, 47.5, 41.0, 40.7, 36.1, 23.7, 22.9, 20.4; IR (film) νmax 2932, 2856, 1589, 1519, 1464, 1410, 1326, 1257, 1148, 1030, 805 cm⁻¹; HRMS (ESI) m/z 276.1965 [(M + H)⁺; calculated for [C₁₇H₂₅NO₂ + H]⁺: 276.1958].

3a-(Benzo[d][1,3]dioxol-5-yl)-1-methyloctahydro-1H-indole ±(13): 23 mg, 91% yield as colorless gel, Rf = 0.50 (1 mL MeOH + 30 mL CH₂Cl₂ + 1 mL Et₃N). ¹H NMR (400 MHz, CDCl₃) δ 6.84 (d, J = 1.7 Hz, 1H), 6.80 (dd, J = 8.2, 1.7 Hz, 1H), 6.72 (d, J = 8.2 Hz, 1H), 5.90 (s, 2H), 3.31-3.25 (m, 1H), 2.59 (brs, 1H), 2.33 (s, 3H), 2.32-2.28 (m, 1H), 1.91-1.73 (m, 5H), 1.60-1.57 (m, 2H), 1.47-1.44 (m, 1H), 1.36-1.34 (m, 1H), 1.16-1.10 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 147.6, 145.2, 141.3, 119.6, 107.7,
107.6, 100.8, 68.9, 47.7, 40.9, 40.7, 35.9, 23.5, 22.7, 20.3; IR (film) $\nu_{\text{max}}$ 2920, 2857, 2787, 1726, 1505, 1485, 1455, 1360, 1340, 1265, 1237, 1191, 1110, 1082, 976 cm$^{-1}$; HRMS (ESI) m/z 260.1650 [(M + H)$^+$; calculated for [C$_{16}$H$_{21}$NO$_2$ + H]$^+$: 260.1645].

**Total Synthesis of Crinane $\pm$(2a):**

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+ NaBH3CN + NH$_2$OAc + protic acid, EtOH 0-25 °C
\[\begin{array}{c}
+ (10b) \\
\end{array}\]
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Same procedure as reductive amination of 11a.  
3a-(Benzo[d][1,3]dioxol-5-yl)octahydro-1H-indole $\pm$(11b): 21 mg, 88% yield as yellow gel, $R_f$ = 0.40 (1 mL MeOH + 30 mL CH$_2$Cl$_2$ + 1 mL Et$_3$N). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 6.85 (d, $J$ = 1.8 Hz, 1H), 6.80 (dd, $J$ = 8.2 Hz, 1H), 6.73 (d, $J$ = 8.2 Hz, 1H), 5.91 (s, 2H), 3.40 (s, 1H), 3.16-3.09 (m, 1H), 3.02-2.96 (m, 1H), 2.5 (brs, 1H), 2.02-1.96 (m, 1H), 1.91-1.85 (m, 1H), 1.77-1.73 (m, 3H), 1.69-1.62 (m, 1H), 1.55-1.39 (m, 4H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 147.7, 145.3, 140.6, 119.4, 107.8, 107.5, 100.8, 60.9, 47.9, 42.9, 41.2, 33.8, 29.7, 26.1, 22.0; IR (film) $\nu_{\text{max}}$ 3382, 2924, 2857, 1472, 1234, 1119, 1040, 936, 808 cm$^{-1}$; HRMS (ESI) m/z 246.1469 [(M + H)$^+$; calculated for [C$_{15}$H$_{19}$NO$_2$ + H]$^+$: 246.1489.}
2,3,4,4a-Tetrahydro-1H,6H-5,11b-ethano[1,3]dioxolo[4,5-j]phenanthridine ±(2a):
An oven-dried round-bottom flask was charged with (±)-11b (21 mg, 0.082 mmol, 1.0 equiv) in dry THF (7 mL). To the reaction mixture, Eschenmoser's salt (23 mg, 0.124 mmol, 1.5 equiv) was added and heated the reaction mixture at 40 °C for 30h. Upon completion of the reaction (monitoring by TLC), THF was removed under vacuum and then 10 ml EtOAc and 1(N) NaOH was added until the solution became basic. The organic phases were combined and dried over anhydrous K2CO3 and concentrated under vacuum. The crude product was purified by flash chromatography with basic alumina to give amine 2a as a light yellow gel. 16 mg, 72% yield as light yellow gel, Rf = 0.40 (10% MeOH in CH2Cl2). 1H NMR (400 MHz, CDCl3) δ 6.69 (s, 1H), 6.43 (s, 1H), 5.86 (s, 2H), 4.31 (d, J = 16.8 Hz, 1H), 3.72 (d, J = 16.8 Hz, 1H), 3.27-3.34 (m, 1H), 2.74-2.83 (m, 2H), 2.31-2.34 (m, 1H), 2.15-2.22 (m, 1H), 1.70-1.84 (m, 1H), 1.56-1.61 (m, 1H), 1.47-1.51 (m, 1H); 13C NMR (100 MHz, CDCl3) δ 146.1, 145.5, 142.3, 126.2, 106.2, 103.3, 100.6, 57.3, 62.1, 51.9, 42.8, 37.9, 29.0, 27.6, 24.4, 21.8; IR (film) νmax 2929, 2916, 2881, 1649, 1484, 1454, 1238, 1040, 935, 867 cm⁻¹; HRMS (ESI) m/z 258.1501 [M + H]+; calculated for [C167H19NO2 + H]+: 258.1489.

Synthesis of Amine Derivatives 14a-b:
A round-bottom flask was charged with amine (±)-11b (0.03 mmol; 1.0 equiv.) in toluene : NaHCO3 (1:1) (5 mL) at room temperature. To this reaction mixture chloroformate (0.036 mmol, 1.2 equiv) was added dropwise and it was stirred for 30
min at room temperature. Upon completion of the reaction (monitoring by TLC), it was
diluted by 10 mL EtOAc. The whole reaction mixture was taken in a separatory funnel
and extracted with 7 mL of water. The organic filtrate was dried over anhydrous Na₂SO₄
and concentrated in a rotary evaporator under vacuum. The crude product was purified
by flash chromatography to give product 14 as a light yellow gel.

**Methyl 3a-(benzo[d][1,3]dioxol-5-yl)octahydro-1H-indole-1-carboxylate ±(14a):** 7
mg, 74% yield as light yellow gel, R_f = 0.40 (30% EtOAc in hexane). ^1H NMR (400
MHz, CDCl₃) δ 6.84-6.72 (m, 3H), 5.93 (s, 2H), 4.19-4.08 (m, 1H), 3.70-3.64 (m, 3H),
3.41-3.37 (m, 1H), 3.13 (m, 1H), 2.38-2.30 (m, 1H), 2.17-2.12 (m, 1H), 2.04-1.92 (m,
2H), 1.68-1.29 (m, 6H); ^13C NMR (100 MHz, CDCl₃) (rotameric mixture) δ 155.32,
155.26, 147.79, 145.68, 141.61, 141.45, 118.38, 107.98, 106.63, 106.47, 100.93, 59.82,
52.26, 52.08, 48.21, 47.45, 43.53, 43.31, 36.26, 35.91, 33.09, 31.51, 29.14, 28.24, 23.45,
23.17, 22.31; IR (film) ν_max 2928, 2862, 2357, 2321, 1695, 1649, 1454, 1394, 1266,
1236, 1193, 1155, 1116, 1041, 939, 807, 770, 738, 705 cm⁻¹; HRMS (ESI) m/z
304.1562 [M + H]^+; calculated for [C₁₇H₂₁NO₄ + H]^+: 304.1543.

**Benzyl 3a-(benzo[d][1,3]dioxol-5-yl)octahydro-1H-indole-1-carboxylate ±(14b):** 9
mg, 83% yield as colorless gel, R_f = 0.50 (20% EtOAc in hexane). ^1H NMR (400 MHz,
CDCl₃) δ 7.38-7.31 (m, 5H), 6.86-6.67 (m, 3H), 5.94 (s, 2H), 5.20-5.07 (m, 2H), 4.25-
4.12 (m, 1H), 3.46-3.41 (m, 1H), 3.23-3.16 (m, 1H), 2.40-2.32 (m, 1H), 2.19-1.92 (m,
3H), 1.69-1.37 (m, 6H); ^13C NMR (100 MHz, CDCl₃) (rotameric mixture) δ 154.63,
154.44, 147.82, 145.69, 141.41, 141.38, 140.94, 137.22, 128.56, 128.48, 128.39, 127.83,
127.74, 127.64, 127.48, 126.98, 118.38, 118.30, 107.95, 106.69, 106.56, 106.46, 100.94,
100.93, 66.59, 66.34, 59.88, 59.82, 48.21, 47.47, 43.59, 43.40, 37.17, 35.81, 33.16,
31.49, 29.70, 29.27, 23.50, 23.16, 22.33, 22.28; **IR** (film) $v_{\text{max}}$ 2929, 2857, 1696, 1649, 1415, 1348, 1265, 1236, 1154, 1098, 1040, 938, 808, 739, 700 cm$^{-1}$; **HRMS** (ESI) m/z 380.1856 [(M + H)$^+$; calculated for [C$_{23}$H$_{25}$NO$_4$ + H]$^+$: 380.1856].
$^1$H, $^{13}$C and Mass spectral traces

$^1$H NMR (400 MHz, CDCl$_3$) of compound (6)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound (6)
Scanned copy of mass spectrum of \( (6) \)
**1H NMR (400 MHz, CDCl₃) of compound (7a)**

![1H NMR spectrum of compound (7a)](image-url)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound (7a)
Scanned copy of mass spectrum of (7a)
$^1$H NMR (400 MHz, CDCl$_3$) of compound (7b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound (7b)
$^1$H NMR (400 MHz, CDCl$_3$) of compound (5a)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound (5a)
Scanned copy of mass spectrum of $\pm(5a)$
$^1$H NMR (500 MHz, CDCl$_3$) of compound (5b)
$^{13}$C NMR (125 MHz, CDCl$_3$) of compound (5b)
$^1$H NMR (400 MHz, CDCl$_3$) of compound ±(4a)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm$(4a)
Scanned copy of mass spectrum of $\textpm(4a)$
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(4b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm(4b)$
Scanned copy of mass spectrum of ±(4b)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(3a)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound ±(3a)
Scanned copy of mass spectrum of $\pm(3a)$
<math>\text{1H NMR (400 MHz, CDCl}_3\text{) of compound } \pm\text{(3b)}\end{math>
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound ±(3b)
Scanned copy of mass spectrum of $\pm (3b)$
$^1H$ NMR (400 MHz, CDCl$_3$) of compound $\pm(8a)$
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm$(8a)
Scanned copy of mass spectrum of $\pm(8a)$
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(8b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound ±(8b)
Scanned copy of mass spectrum of ±(8b)
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Scanned copy of mass spectrum of \( \pm(9b) \)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(10a)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound \(\pm(10a)\)
Scanned copy of mass spectrum of \(\pm(10a)\)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(10b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm$(10b)
Scanned copy of mass spectrum of ±(10b)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(11a)
Scanned copy of mass spectrum of \( \pm (11a) \)
$^1$H NMR (400 MHz, CDCl$_3$) of compound ±(12a)
Scanned copy of mass spectrum of $=\text{(12a)}$
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(12b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm$(12b)
Scanned copy of mass spectrum of +(12b)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$ (1a)
Scanned copy of mass spectrum of $\pm(1a)$
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\mathcal{Z}$-(13)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $(13)$
Scanned copy of mass spectrum of ±(13)
$^1$H NMR (400 MHz, CDCl$_3$) of compound ±(11b)
Scanned copy of mass spectrum of ±(11b)
\[ ^{13} \text{C NMR (100 MHz, CDCl}_3 \text{) of compound } \pm (2a) \]
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) of compound ±(2a)
Scanned copy of mass spectrum of \((2a)\)
$^1$H NMR (400 MHz, CDCl$_3$) of compound $\pm$(14a)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound 14a
Scanned copy of mass spectrum of -(14a)
$^1$H NMR (400 MHz, CDCl$_3$) of compound ±(14b)
$^{13}$C NMR (100 MHz, CDCl$_3$) of compound $\pm$(14b)
Scanned copy of mass spectrum of ±(14b)