RHODIUM-CATALYZED ENANTIOSELECTIVE DIBORATION OF SIMPLE ALKENES.

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Supplementary Material

General. ¹H NMR spectra were recorded on Bruker DRX (400 MHz or 300 MHz). Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as the internal standard (CDCl₃: 7.24 ppm). Data are reported as follows: chemical shift, integration, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, br = broad, m = multiplet), coupling constants (Hz) and assignment. ¹³C NMR were recorded on a Bruker DRX 400 (100 MHz) spectrometer with complete proton decoupling. Chemical shifts are reported in ppm from tetramethylsilane with the solvent as the internal standard (CDCl₃: 77.0 ppm). High resolution mass spectrometry was performed by the University of Minnesota Mass Spectrometry Service Laboratory. Infrared (IR) spectra were obtained using a ASI ReactIR 1000.

Liquid chromatography was performed using forced flow (flash chromatography) on silica gel (SiO₂, 32 to 63 μm) purchased from Scientific Adsorbents, Inc. Thin layer chromatography (TLC) was performed on EM science 0.25 mm silica gel 60 plates. Visualization was achieved UV light or phosphomolybdic acid in ethanol followed by heating.

Analytical gas-liquid chromatography (GLC) was performed on a Hewlett-Packard 6890 Series chromatograph equipped with a CTC Analysis Combi Pal autosampler by Leap Technologies (Carrboro, NC), a split mode capillary injection system, a flame ionization detector and a Supelco β-dex 120 column with helium as the carrier gas. Analytical high performance liquid chromatography (HPLC) was performed on a Shimadzu liquid chromatograph equipped with a UV detector and either a Chiralcel OJ or a Chiralcel OD column.

All reactions were conducted in oven and flame dried glassware under an inert atmosphere of argon. Alkene starting materials were all commercially available. [(nbd)Rh(acac)], bis(catecholato)diboron, and THF were purchased from Aldrich Chemical Company and (*S*)-Quinap was purchased from Strem Chemical Company. All reagents were used as received.

Representative Procedure for Catalytic, Enantioselective Diboration Reaction

An oven-dried 20 mL vial equipped with a stir-bar was charged with 7.4 mg (0.025 mmol) of (bicyclo[2.2.1]hepta-2,5-diene)-(2,4-pentanedionato)-rhodium(I), 11.1 mg (0.025 mmol) of (*S*)-Quinap, and 1.0 mL of THF under an inert atmosphere of argon in a dry-box. The resultant yellow solution was stirred for 5 minutes. After this time, 132 mg (0.55 mmol) of bis(catecholato)diboron was added to the solution under argon. The solution turned immediately from yellow to dark brownish-red. The solution was allowed to stir for 5 minutes. After this time, 71 mg (0.50 mmol) of *trans*-5-decene was added to the solution under argon. The vial was sealed with a screw-cap and removed from the dry box, where the solution was allowed to stir for 15 hours at ambient temperature. After this time, 1 mL of THF was added to the solution, followed by dropwise addition of 0.800 mL of 3 M NaOH and then 0.800 mL of 30% H₂O₂ dropwise (for hazards associated with H₂O₂ see, Encyclopedia of Reagents for Organic synthesis, L.A. Paquette, Ed. John Wiley and Sons, New York, 1995, Volume 4, 2731). The solution was allowed to stir at ambient temperature for 3 hours. The solution was then quenched with 1 mL of saturated aqueous Na₂S₂O₃ and 10 mL of 1 M NaOH. The mixture was extracted with ethyl acetate (3 x 25 mL) and the combined organic layers were washed with brine (1 x 10 mL). The organic layers were then dried over anhydrous MgSO₄, filtered, and the solvent removed by rotary evaporation. The crude material was purified by silica gel chromatography (2 : 1 hexanes : ethyl acetate) to provide 71 mg (81%) of pure (*5R*, *6R*)-decane-5, 6-diol.

Representative Procedure for Large-Scale Catalytic, Enantioselective Diboration Reaction

An oven-dried 50 mL round-bottom flask equipped with a stir-bar was charged with 11.9 mg (0.041 mmol) of (bicyclo[2.2.1]hepta-2,5-diene)-(2,4-pentanedionato)-rhodium(I), 17.8 mg (0.041 mmol) of (*S*)-Quinap, and 2.0 mL of THF under an inert atmosphere of argon in a dry-box. The resultant yellow solution was stirred for 5 minutes. After this time, 2.12 g (8.90 mmol) of bis(catecholato)diboron was added to the solution under argon. The solution turned immediately from yellow to dark brownish-red. The suspension was allowed to stir for 5 minutes. After this time, 1.14 g (8.09 mmol) of *trans*-5-decene was added to the solution under argon. The vial was sealed with a screw-cap and removed from the dry box, where the solution was allowed to stir for 4 hours at ambient temperature. At this time, an additional 2 mL of THF was added and the solution was allowed to stir at ambient temperature for 12 hours. After this time, 16 mL of THF was added to the solution, followed by 27 mL of 3 M NaOH dropwise and then 27 mL of 30% H₂O₂ dropwise with caution. The solution was allowed to stir at ambient temperature for 3 hours. The solution was then quenched with 15 mL of saturated aqueous Na₂S₂O₃ and 50 mL of 1 M NaOH. The mixture was extracted with ethyl acetate (3 x 150 mL) and the combined organic layers were washed with 1 M NaOH (1 x 50 mL), water (1 x 50 mL) and brine (1 x 50 mL). The organic layers were then dried over anhydrous MgSO₄, filtered, and the solvent removed by rotary evaporation. The crude material was purified by silica gel chromatography (2 : 1 hexanes : ethyl acetate) to provide 968 mg (69%) of pure (*5R*, *6R*)-decane-5, 6-diol.

(1R, 2R)-1-phenylpropane-1,2-diol. IR (neat): 3384 (br, s), 1455 (s), 1038 (s) cm^{-1} ; ^1H NMR: δ 7.25-7.42 (5H, m, aromatic), 4.36 (1H, d, $J = 7.6$ Hz, ArCHOH), 3.85 (1H, qd, $J = 7.2$ Hz, 6.4 Hz, CH_3CHOH), 2.44 (2H, broad s, OH), 1.05 (3H, d, $J = 6.4$ Hz, CH_3); ^{13}C NMR: δ 141.0, 128.5, 128.2, 126.8, 79.5, 72.2, 18.8. HRMS (FAB) Calc'd for $\text{C}_9\text{H}_{12}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 170.1181 Found ($\text{M} + \text{NH}_4$) $^+$: 170.1177.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Norrby, P-O.; Becker, H.; Sharpless, K. B. *J. Am. Chem. Soc.* **1996**, *118*, 35). Absolute stereochemistry established in comparison to authentic 1R, 2R isomer prepared via a Sharpless asymmetric dihydroxylation (Norrby, P-O.; Becker, H.; Sharpless, K. B. *J. Am. Chem. Soc.* **1996**, *118*, 35).

Chiral GLC (β -dex, Supelco, 140 $^\circ\text{C}$) analysis of diol product:

(5R, 6R)-decane-5, 6-diol. IR (neat): 3477 (br, s), 1640 (s) cm^{-1} ; ^1H NMR: δ 3.39 (2H, br s, CH_2CHOH), 1.92 (2H, br s, OH), 1.54-1.25 (12H, m, $-\text{CH}_2-$), 0.89 (6H, t, $J = 7.0$ Hz, CH_3); ^{13}C NMR: δ 74.5, 33.3, 27.8, 22.7, 14.0. HRMS (FAB) Calc'd for $\text{C}_{10}\text{H}_{22}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 192.1964 Found ($\text{M} + \text{NH}_4$) $^+$: 192.1958.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Choudary, B. M.; Chowdari, N. S.; Jyothi, K.; Kantam, M. L. *J. Am. Chem. Soc.* **2002**, *124*, 5341). Absolute stereochemistry established in comparison to authentic 1R, 2R isomer prepared via a Sharpless asymmetric dihydroxylation (Sharpless, K. B.; Amberg, W.; Bennani, Y. L.; Crispino, G. A.; Hartung, J.; Jeong, K.-S.; Kwong, H.-L.; Morikawa, K.; Wang, Z.-M.; Xu, D.; Zhang, X.-L. *J. Org.* **1992**, *57*, 2768).

Chiral GLC (β -dex, Supelco, 110 $^\circ\text{C}$) analysis of diol product:

(1R, 2R)-1, 2-diphenyl-ethane-1, 2-diol. IR (neat): 3475 (br, s), 1640 (s) cm^{-1} ; ^1H NMR: δ 7.24-7.12 (6H, m, Ph), 7.11-7.01 (4H, m Ph), 4.67 (2H, s, PhCHOH), 2.95 (2H, br s, OH); ^{13}C NMR: δ 139.8, 128.1, 127.9, 126.9, 79.1. HRMS (FAB) Calc'd for $\text{C}_{14}\text{H}_{14}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 232.1338 Found ($\text{M} + \text{NH}_4$) $^+$: 232.1337.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Wang, Z.-M.; Sharpless, K. B. *J. Org. Chem.* **1994**, 59, 8302). Absolute stereochemistry established in comparison to commercially available authentic 1S, 2S isomer.

Chiral HPLC (Chiralcel-OJ, Daicel, 6% iPrOH in hexanes, 0.6 mL/min) analysis of diol product:

(1R)-phenyl-ethane-1, 2-diol. IR (neat): 3369 (br, s), 2925 (m), 1453 (s), 1071 (s), 1027 (s) cm^{-1} ; ^1H NMR: δ 7.41-7.26 (5H, m, Ph), 4.81 (1H, dd, $J = 8.0$ Hz, 3.6 Hz, PhCH(OH)), 3.75 (1H, dd, $J = 10.8$ Hz, 3.6 Hz, $\text{CH}_a\text{H}_b\text{OH}$), 3.65 (1H, dd, $J = 10.8$ Hz, 8.0 Hz, $\text{CH}_a\text{H}_b\text{OH}$), 2.25 (2H, br s, OH); ^{13}C NMR: δ 140.5, 128.6, 128.0, 126.1, 74.7, 68.1. HRMS (FAB) Calc'd for $\text{C}_8\text{H}_{10}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 156.1025 Found ($\text{M} + \text{NH}_4$) $^+$: 156.1026.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Choudary, B. M.; Chowdari, N. S.; Jyothi, K.; Kantam, M. L. *J. Am. Chem. Soc.* **2002**, *124*, 5341). Absolute stereochemistry established in comparison to authentic 1R isomer prepared via a Sharpless asymmetric dihydroxylation (Sharpless, K. B.; Amberg, W.; Bennani, Y. L.; Crispino, G. A.; Hartung, J.; Jeong, K.-S.; Kwong, H.-L.; Morikawa, K.; Wang, Z.-M.; Xu, D.; Zhang, X.-L. *J. Org.* **1992**, *57*, 2768).

Chiral GLC (β -dex, Supelco, 130 $^\circ\text{C}$) analysis of diol product:

(2R)-2-phenylpropane-1, 2-diol. IR (neat): 3375 (br, s), 2927 (m), 1447 (s), 1044 (s) cm^{-1} ; ^1H NMR: δ 7.43 (2H, m, Ph), 7.36 (2H, m, Ph), 7.26 (1H, m, Ph), 3.77 (1H, d, $J = 11.2$ Hz, $\text{CH}_a\text{H}_b\text{OH}$), 3.61 (1H, d, $J = 11.2$ Hz, $\text{CH}_a\text{H}_b\text{OH}$), 2.60 (1H, br s, OH), 1.86 (1H, br s, OH), 1.51 (3H, s, CH_3); ^{13}C NMR: δ 145.0, 128.4, 127.2, 125.1, 74.8, 71.1, 26.1. HRMS (FAB) Calc'd for $\text{C}_9\text{H}_{12}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 170.1181 Found ($\text{M} + \text{NH}_4$) $^+$: 170.1182.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Choudary, B. M.; Chowdari, N. S.; Jyothi, K.; Kantam, M. L. *J. Am. Chem. Soc.* **2002**, *124*, 5341). Absolute stereochemistry established in comparison to authentic 1R isomer prepared via a Sharpless asymmetric dihydroxylation (Sharpless, K. B.; Amberg, W.; Bennani, Y. L.; Crispino, G. A.; Hartung, J.; Jeong, K.-S.; Kwong, H.-L.; Morikawa, K.; Wang, Z.-M.; Xu, D.; Zhang, X.-L. *J. Org.* **1992**, *57*, 2768).

Chiral GLC (β -dex, Supelco, 120 $^\circ\text{C}$) analysis of diol product:

(1R, 2S)-indan-1, 2-diol. IR (neat): 3354 (br, s), 2952 (m), 2929 (s) cm^{-1} ; ^1H NMR: δ 7.4 (1H, m), 7.2-7.3 (3H, m), 5.00 (1H, dd, $J = 5.6$ Hz, 5.6 Hz, C CHOH), 4.51 (1H, br m, C HOHCH_2), 3.12 (1H, dd, $J = 16.4$ Hz, 5.6 Hz, C H_aH_b), 2.95 (1H, dd, $J = 16.4$ Hz, 4.4 Hz, C H_aH_b), 2.42 (1H, d, $J = 5.6$ Hz, OH), 2.34 (1H, d, $J = 4.4$ Hz, OH); ^{13}C NMR: δ 141.9, 140.1, 128.8, 127.2, 125.4, 125.0, 75.9, 73.4, 38.6. HRMS (FAB) Calc'd for $\text{C}_9\text{H}_{10}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 168.1025 Found ($\text{M} + \text{NH}_4$) $^+$: 168.1026.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Takeshita, H.; Hatsui, T. *J. Org. Chem.* **1978**, 43, 3080). Absolute stereochemistry established in comparison to authentic 1R, 2S isomer prepared via a Sharpless asymmetric dihydroxylation (Becker, H.; King, S. B.; Taniguchi, M.; Vanhessche, K. P. M.; Sharpless, K. B. *J. Org. Chem.* **1995**, 60, 3940).

Chiral HPLC (Chiralcel-OJ, Daicel, 7.5% iPrOH in hexanes, 1 mL/min)) analysis of diol product:

(1S, 2R)- 1,2,3,4-Tetrahydro-naphthalene-1,2-diol. IR (neat): 3479 (br, s), 3054 (s), 2254 (m), 1646 (br, m) cm^{-1} ; ^1H NMR: δ 7.4 (1H, m), 7.2-7.3 (2H, m), 7.1 (1H, m), 4.68 (1H, d, $J = 3.2$ Hz, CCHOH), 4.00 (1H, ddd, $J = 10.0$ Hz, 3.6 Hz, 3.2 Hz, CHOHCH_2), 2.95 (1H, dt, $J = 17.2$ Hz, 5.6 Hz, CCH_aH_b), 2.77 (1H, ddd, $J = 17.2$ Hz, 9.2 Hz, 6.0 Hz, CCH_aH_b), 2.34 (2H, br s, OH), 1.97-2.08 (1H, m, COHCH_2), 1.86-1.95 (1H, m, COHCH_2); ^{13}C NMR: δ 136.3, 136.2, 129.9, 128.6, 128.2, 126.4, 69.9, 69.5, 26.9, 26.2. HRMS (FAB) Calc'd for $\text{C}_{10}\text{H}_{12}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 182.1181 Found ($\text{M} + \text{NH}_4$) $^+$: 182.1175.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Orsini, F.; Sello, G.; Travaini, E.; Di Gennaro, P. *Tetrahedron Asymmetry* **2002**, 13, 253). Absolute stereochemistry established in comparison to authentic 1R, 2S isomer prepared via a Sharpless asymmetric dihydroxylation (Becker, H.; King, S. B.; Taniguchi, M.; Vanhessche, K. P. M.; Sharpless, K. B. *J. Org. Chem.* **1995**, 60, 3940).

Chiral HPLC (Chiralcel-OJ, Daicel, 7.5% iPrOH in hexanes, 0.5 mL/min) analysis of diol product:

(1R, 2S)-2-Methyl-indan-1,2-diol. IR (neat): 3386 (br, s), 2960 (m), 2927 (s), 2856 (m) cm^{-1} ; ^1H NMR: δ 7.4 (1H, m), 7.15-7.3 (3H, m), 4.70 (1H, d, $J = 6.4$ Hz, CCHOH), 3.04 (1H, d, $J = 16.0$ Hz, CH_aH_b), 2.94 (1H, d, $J = 16.0$ Hz, CH_aH_b), 2.45 (1H, d, $J = 6.4$ Hz, CHOH), 2.25 (3H, s, CCH_3OH), 1.47 (1H, s, CCH_3); ^{13}C NMR: δ 142.8, 139.9, 128.6, 127.1, 125.3, 125.0, 80.6, 79.8, 44.7, 24.7. HRMS (FAB) Calc'd for $\text{C}_{10}\text{H}_{12}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 182.1181 Found ($\text{M} + \text{NH}_4$) $^+$: 182.1175.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in analogy to all other syn diols produced by dihydroxylation method. Absolute stereochemistry established in comparison to authentic 1R, 2S isomer prepared via a Sharpless asymmetric dihydroxylation (report of analogous compound: Barboni, L.; Lambertucci, C.; Ballini, R.; Appendino, G.; Bombardelli, E. *Tetrahedron Lett.* **1998**, 39, 7177).

Chiral HPLC (Chiralcel-OD, Daicel, 10% iPrOH in hexanes, 1 mL/min) analysis of diol product:

(1S, 2R)-1-phenylpropane-1,2-diol. IR (neat): 3384 (br, s), 1455 (s), 1038 (s) cm^{-1} ; ^1H NMR: δ 7.25-7.38 (5H, m, aromatic), 4.66 (1H, d, $J = 4.0$ Hz, ArCHOH), 4.00 (1H, qd, $J = 6.4$ Hz, 4.0 Hz CH_3CHOH), 2.40 (1H, br s, OH), 1.90 (1H, br s, OH), 1.07 (3H, d, $J = 6.4$ Hz, CH_3); ^{13}C NMR: δ 140.7, 128.3, 127.8, 126.6, 77.5, 71.2, 17.3. HRMS (FAB) Calc'd for $\text{C}_9\text{H}_{12}\text{O}_2$ ($\text{M} + \text{NH}_4$) $^+$: 170.1181 Found ($\text{M} + \text{NH}_4$) $^+$: 170.1181.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Fronza, G.; Fuganti, C.; Grasselli, P.; Mele, A. *J. Org. Chem.* **1991**, 56, 6019). Absolute stereochemistry established in comparison to authentic 1R, 2S isomer prepared via a Sharpless asymmetric dihydroxylation (Becker, H.; King, S. B.; Taniguchi, M.; Vanhessche, K. P. M.; Sharpless, K. B. *J. Org. Chem.* **1995**, 60, 3940).

Chiral GLC (β -dex, Supelco, 140°C) analysis of diol product:

(1R, 2R)-1-(4-Methoxy-phenyl)-propane-1,2-diol. IR (neat): 3452 (br, s), 1638 (br, m), 1515 (m) cm^{-1} ; ^1H NMR: δ 7.23 (2H, m, aromatic), 6.86 (2H, m, aromatic), 4.29 (1H, d, $J = 7.6$ Hz, ArCHOH), 3.75-3.86 (1H, m, CH_3CHOH), 3.79 (3H, s, OCH_3), 2.59 (1H, broad s, OH), 2.54 (1H, s, OH), 1.01 (3H, d, $J = 6.4$ Hz, CH_3); ^{13}C NMR: δ 159.4, 133.1, 128.0, 113.9, 79.1, 72.2, 55.3, 18.7. HRMS (FAB) Calc'd for $\text{C}_{10}\text{H}_{14}\text{O}_3$ ($\text{M} + \text{NH}_4$) $^+$: 200.1287 Found ($\text{M} + \text{NH}_4$) $^+$: 200.1282.

Proof of Stereochemistry. Stereochemical ratios were determined in comparison to authentic racemic materials prepared by osmium tetroxide dihydroxylation. Relative stereochemistry determined in comparison to ^1H NMR reported for the syn diol (Mohan, R. S.; Whalen, D. L. *J. Org. Chem.* **1993**, 58, 2663). Absolute stereochemistry established in comparison to authentic 1R, 2R isomer prepared via Sharpless asymmetric dihydroxylation (analogous to β -Methylstyrene: Norrby, P-O.; Becker, H.; Sharpless, K. B. *J. Am. Chem. Soc.* **1996**, 118, 35).

Chiral GLC (β -dex, Supelco, 160 $^\circ\text{C}$) analysis of diol product:

(1*S*, 2*R*)-di(pinacolatoboryl) 1-phenyl-propane. ^1H NMR: δ 7.0-7.25 (5H, m, aromatic), 2.20 (1H, d, $J = 12.0$ Hz, ArCHB), 1.45-1.57 (1H, m, CH₃CHB), 1.24 (12H, s, OCCH₃), 1.15 (6H, s, OCCH₃), 1.14 (6H, s, OCCH₃), 0.73 (3H, d, $J = 7.6$ Hz, CH₃); ^{13}C NMR: δ 142.9, 128.9, 128.0, 124.9, 83.1, 83.0, 25.0, 24.9, 24.8, 24.5, 24.2, 14.5.

(2*R*, 3*R*)-2-Methyl-3-phenyl-butane-1,4-diol. ^1H NMR: δ 7.1-7.35 (5H, m), 3.89 (1H, dd, $J = 10.8$ Hz, 6.4 Hz, ArCHCH_aH_bOH), 3.85 (1H, dd, $J = 10.8$ Hz, 5.6 Hz, ArCHCH_aH_bOH), 3.70 (1H, dd, $J = 11.2$ Hz, 4.4 Hz, CH₃CHCH_aCH_bOH), 3.58 (1H, dd, $J = 11.2$ Hz, 6.4 Hz, CH₃CHCH_aCH_bOH), 2.71 (1H, dt, $J = 8.8$ Hz, 6.4 Hz, ArCH), 2.62 (2H, br s, OH), 1.97-2.10 (1H, br m, CHCH₃), 0.74 (3H, d, $J = 6.8$ Hz, CH₃); ^{13}C NMR: δ 141.8, 128.5, 128.3, 126.6, 66.7, 65.8, 52.0, 38.6, 15.8. HRMS (FAB) Calc'd for C₁₁H₁₆O₂ (M + NH₄)⁺: 198.1494 Found (M + NH₄)⁺: 198.1493.