Novel synthesis of 2-trifluoromethyl, 2-perfluoroalkyl-2-hydroxy-2*H*-chromenes and their regiospecific reaction with silyl enol-ethers.

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General Methods and Spectroscopic Measurements:

All synthetic reactions were performed in oven-dried glassware. Chromatographic column purifications were performed on silica gel (40-63 μm). Solvents were freshly distilled prior to use, all other solvents and reagents were used as purchased from the manufacturers. ^1H , ^{13}C NMR spectra were run at 300 MHz. Evolution of the reactions was monitored by ^{19}F NMR spectroscopy: NMR analysis of samples from the reaction mixtures were done every 30min. At the end of the reaction as judged by ^{19}F NMR spectroscopy and TLC, the conversions or NMR yields were determined by comparison of the integrations of ^{19}F NMR signals of starting products and formed products. Chemical shifts are given in ppm, the internal standard reference is Trimethylsilane for ^1H and ^{13}C , and CFCl_3 for ^{19}F spectras. Abbreviations used in description of NMR spectra: s: singlet, d: doublet, t: triplet, dd: double doublet, q: quadruplet, bs: broad signal. The coupling constants (J) are given in Hertz. High resolution mass spectra were recorded in the FAB^+ mode.

2-perfluoropropyl-6-methoxy-2H-chromen-2-ol **2b**.

Same process than **2a**. Title chromenol is obtained, total yield 89 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.4 (s, 3H, OCH_3), 4 (bs, 1H, OH), 5.7 (dd, $J = 9.8\text{Hz}$ and 2.1Hz , 1H, $\text{C}=\text{CH}$), 6.3 (dd, $J = 9.8\text{Hz}$ and 2.7Hz , 1H, $\text{CH}=\text{C}$), 6.5 (m, 1H), 6.6 (dd, $J = 8.8\text{Hz}$, and 2.9Hz , 1H), 6.9 (dd, $J = 8.8\text{Hz}$ and 1.3Hz , 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 56, 95.8 (t, C- CF_3 , $^2J_{\text{CF}} = 25.5\text{Hz}$), 112.2, 116.7, 117.5, 117.7, 119.8, 129.2, 143.5, 155.3; ^{19}F NMR (282.3MHz, C_6D_6) δ : -80.8 (s, 3F), -121 (d, $^2J_{\text{FF}} = 282.4\text{Hz}$, 1F), -123.8 (s, 2F), -126 (d, $^2J_{\text{FF}} = 282.4\text{Hz}$, 1F); IR (cm^{-1} KBr) 3550-3200 (OH); MS (m/z): 347 (M^+ , 100). HRMS calcd for $\text{C}_{13}\text{H}_{10}\text{F}_7\text{O}_3$ 347,0518 found 347,0520. Anal. Calcd for $\text{C}_{13}\text{H}_9\text{F}_7\text{O}_3$: C, 45.10; H, 2.62; O, 13.86, Found: C, 45.12; H, 2.63; O, 13.89.

2-perfluoropentyl-6-methoxy-2H-chromen-2-ol 2c.

Same process than **2a**. Title chromenol is obtained, total yield 85 %. Spectral data: ^1H NMR (400.13MHz, C_6D_6) δ : 3.2 (bs, 1H, OH), 3.4 (s, 3H, OCH_3), 5.7 (d, $J = 9.8\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6.25 (d, $J = 9.8\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.5 (d, $J = 2.9\text{Hz}$, 1H), 6.6 (dd, $J = 8.8\text{Hz}$, and 2.9Hz , 1H), 6.9 (d, $J = 8.8\text{Hz}$, 1H); ^{13}C NMR (100.6MHz, CDCl_3) δ : 56.2, 95.9 (t, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 25.45\text{Hz}$), 112.1, 116.8, 117.1, 117.7, 119.1, 129.2, 143.7, 155.2; ^{19}F NMR (235.36MHz, CDCl_3) δ : -81.5 (s, 3F), -120.2 (s, 2F), -121.4 (td, $^2J_{\text{FF}} = 285.4\text{Hz}$ and $^3J_{\text{FF}} = 16.5\text{Hz}$, 1F), -123 (s, 2F), -126.1 (td, $^2J_{\text{FF}} = 285.4\text{Hz}$ and $^3J_{\text{FF}} = 16.8\text{Hz}$, 1F), -126.5 (s, 2F); IR (cm^{-1} KBr) 3500-3200 (OH); MS (m/z): 447 (M^+ , 100). HRMS calcd for $\text{C}_{15}\text{H}_{10}\text{F}_{11}\text{O}_3$ 447,0454 found 447,0457. Anal. calcd for $\text{C}_{15}\text{H}_9\text{F}_{11}\text{O}_3$: C, 40.38; H, 2.03; O, 10.76, Found: C, 40.40; H, 2.04; O, 10.73.

2-trifluoromethyl-2H-chromen-2-ol 2d.

Same process than **2a**. Title chromenol is obtained, total yield 80%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.5 (bs, 1H, OH), 5.7 (d, $J = 9.9\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6.4 (d, $J = 9.9\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.8 (m, 2H), 6.9-7.1 (m, 2H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 95.1 (q, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 33.8\text{Hz}$), 113, 117.1, 117.2, 118.8, 120.1, 124 (q, CF_3 , $^1J_{\text{CF}} = 285.4\text{Hz}$), 130.5, 145.1, 155.9 (q, $J = 3.75\text{Hz}$); ^{19}F NMR (282.3MHz, C_6D_6) δ : -84.3 (s, 3F); MS (m/z): 217 (M^+ , 100). HRMS calcd for $\text{C}_{10}\text{H}_8\text{F}_3\text{O}_2$ 217,0476 found 217,0472. Anal. calcd for $\text{C}_{10}\text{H}_7\text{F}_3\text{O}_2$: C, 55.56; H, 3.26; O, 14.80, Found: C, 55.58; H, 3.27; O, 14.78.

2-perfluoropentyl-2H-chromen-2-ol 2e.

Same process than **2a**. Title chromenol is obtained, total yield 83 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.5 (bs, 1H, OH), 5.7 (d, $J = 9.9\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6.3 (d, $J = 9.9\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.8 (m, 2H), 6.9-7.1 (m, 2H);

^{13}C NMR (75.47Hz, C_6D_6) δ : 95.9 (t, C-CF₃, $^2J_{\text{CF}} = 27.1$ Hz), 116.2, 116.6, 118.5, 122.6, 127.4, 128.5, 130.6, 150; ^{19}F NMR (282.37MHz, C_6D_6) δ : -81 (s, 3F), -119.8 (s, 2F), -120.6 (td, $^2J_{\text{FF}} = 279.5$ Hz and $^3J_{\text{FF}} = 18$ Hz, 1F), -122.5 (s, 2F), -125.1 (td, $^2J_{\text{FF}} = 279.5$ Hz and $^3J_{\text{FF}} = 18.1$ Hz, 1F), -126 (s, 2F); MS (m/z): 417 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_8\text{F}_{11}\text{O}_2$ 417,0349 found 417,0351. Anal. calcd for $\text{C}_{14}\text{H}_7\text{F}_{11}\text{O}_2$: C, 40.40; H, 1.70; O, 7.69, Found: C, 40.42; H, 1.73; O, 7.71.

2-perfluoropropyl-7-methyl-2H-chromen-2-ol 2f.

Same process than **2a**. Title chromenol is obtained, total yield 80 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 2.1 (s, 3H), 3.5 (bs, 1H, OH), 5.6 (d, $J = 9.8$ Hz, 1H, C=CH), 6.4 (d, $J = 9.8$ Hz, 1H, CH=C), 6.7 (d, $J = 7.7$ Hz, 1H), 6.8 (m, 2H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 20.2, 91.4 (t, C-CF₃, $^2J_{\text{CF}} = 33.4$ Hz), 110.1, 113.4 117.2, 117.4, 119.2, 130.1, 143.7, 156.2; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.8 (s, 3F), -121.2 (qd, $^2J_{\text{FF}} = 282.4$ Hz and $^3J_{\text{FF}} = 14.6$ Hz, 1F), -123.8 (s, 2F), -126.4 (qd, $^2J_{\text{FF}} = 282.4$ Hz and $^3J_{\text{FF}} = 14.6$ Hz, 1F); MS (m/z): 331 (M^+ , 100). HRMS calcd for $\text{C}_{13}\text{H}_{10}\text{F}_7\text{O}_2$ 331,0569 found 331,0572. Anal. calcd for $\text{C}_{13}\text{H}_9\text{F}_7\text{O}_2$: C, 47.29; H, 2.75; O, 9.69, Found: C, 47.30; H, 2.72; O, 9.68.

2-trifluoromethyl-7-methoxy-2H-chromen-2-ol 2g.

Same process than **2a**. Title chromenol is obtained, total yield 88 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.2 (bs, 1H, OH), 3.3 (s, 3H, OCH₃), 5.5 (d, $J = 9.8$ Hz, 1H, C=CH), 6.3 (d, $J = 9.8$ Hz, 1H, CH=C), 6.5 (dd, $J = 8.3$ Hz, and 2.4 Hz, 1H), 6.6 (m, 1H), 6.7 (d, $J = 8.3$ Hz, 1H); ^{13}C NMR (75.4MHz, C_6D_6) δ : 54.9, 94.2 (q, C-CF₃, $^2J_{\text{CF}} = 34$ Hz), 101.9, 109.8, 111.9, 112.8, 122.6 (q, CF₃, $^1J_{\text{CF}} = 285.4$ Hz), 129.1, 151.6, 162;

^{19}F NMR (282.3MHz, C_6D_6) δ : -84.4 (s, 3F); MS (m/z): 247 (M^+ , 100); HRMS calcd for $\text{C}_{11}\text{H}_{10}\text{F}_3\text{O}_3$ 247,0582 found 247,0580. Anal. calcd for $\text{C}_{11}\text{H}_9\text{F}_3\text{O}_3$: C, 53.67; H, 3.68; O, 19.50, Found: C, 53.63; H, 3.66; O, 19.52.

2-perfluoropropyl-8-methoxy-2H-chromen-2-ol 2h.

Same process than **2a**. Title chromenol is obtained, total yield 70 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.4 (s, 3H, OCH_3), 4.4 (bs, 1H, OH), 5.6 (dd, $J = 9.8\text{Hz}$ and 2.2Hz , 1H, $\text{C}=\text{CH}$), 6.4-6.6 (m, 3H), 6.8 (dd, $J = 8.4\text{Hz}$ and 2.1Hz , 1H); ^{13}C NMR (75.4MHz, C_6D_6) δ : 55.1, 94.5 (q, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 34.4\text{Hz}$), 102, 108, 110.9, 112.4, 122.4 (q, CF_3 , $^1J_{\text{CF}} = 285.3\text{Hz}$), 129.2, 151.6, 161.8; ^{19}F NMR (282.3MHz, C_6D_6) δ : -80.5 (s, 3F), -121.3 (d, $^2J_{\text{FF}} = 283.8\text{Hz}$, 1F), -123.7 (s, 2F), -125.8 (d, $^2J_{\text{FF}} = 284\text{Hz}$, 1F); MS (m/z): 347 (M^+ , 100); HRMS calcd for $\text{C}_{13}\text{H}_{10}\text{F}_7\text{O}_3$ 347,0518 found 347,0521. Anal. calcd for $\text{C}_{13}\text{H}_9\text{F}_7\text{O}_3$: C, 45.10; H, 2.62; O, 13.86, Found: C, 45.12; H, 2.61; O, 13.85.

2-perfluoropentyl-8-chloro-2H-chromen-2-ol 2i.

Same process than **2a**. Title chromenol is obtained, total yield 59 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 4.5 (bs, 1H, OH), 5.6 (d, $J = 9.8\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6.2 (d, $J = 9.8\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.4-6.7 (m, 3H); ^{13}C NMR (75.4MHz, C_6D_6) δ : 95.6 (t, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 25.5\text{Hz}$), 112.2, 116.5, 117.2, 117.6, 120.2, 130.1, 143.5, 155.5; ^{19}F NMR (282.3MHz, C_6D_6) δ : -81.1 (s, 3F), -119.6 (s, 2F), -121.1 (td, $^2J_{\text{FF}} = 280\text{Hz}$ and $^3J_{\text{FF}} = 18.1\text{Hz}$, 1F), -123.2 (s, 2F), -126.2 (td, $^2J_{\text{FF}} = 280.1\text{Hz}$ and $^3J_{\text{FF}} = 18.1\text{Hz}$, 1F), -126.4 (s, 2F); MS (m/z): 451 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_7\text{ClF}_{11}\text{O}_2$ 450,9959 found 450,9960. Anal. calcd for $\text{C}_{14}\text{H}_6\text{ClF}_{11}\text{O}_2$: C, 37.31; H, 1.34; O, 7.10, Found: C, 37.29; H, 1.35; O, 7.09.

2-trifluoromethyl-6-chloro-2H-chromen-2-ol 2j.

Same process than **2a**. Title chromenol is obtained, total yield 72 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 4.5 (bs, 1H, OH), 5.9 (d, $J = 9.8\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6.4 (d, $J = 9.9\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.55 (d, $J = 2.9\text{Hz}$, 1H), 6.7 (dd, $J = 8.8\text{Hz}$, and 2.9Hz , 1H), 6.95 (d, $J = 8.8\text{Hz}$, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 96.1 (q, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 27\text{Hz}$), 108, 112, 116.2, 117.5, 119.6 (q, CF_3 , $^1J_{\text{CF}} = 286\text{Hz}$), 128.8, 144.2, 155.1; ^{19}F NMR (282.3MHz, C_6D_6) δ : -84.2 (s, 3F); MS (m/z): 251 (M^+ , 100). HRMS calcd for $\text{C}_{10}\text{H}_7\text{ClF}_3\text{O}_2$ 251.0087 found 251.0090. Anal. calcd for $\text{C}_{10}\text{H}_6\text{ClF}_3\text{O}_2$: C, 47.93; H, 2.41; O, 12.77, Found: C, 47.95; H, 2.42; O, 12.78.

2-perfluoropentyl-6-chloro-2H-chromen-2-ol 2k.

Same process than **2a**. Title chromenol is obtained, total yield 70 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 4.4 (bs, 1H, OH), 5.5 (d, $J = 9.9\text{Hz}$, 1H, $\text{C}=\text{CH}$), 6 (d, $J = 9.9\text{Hz}$, 1H, $\text{CH}=\text{C}$), 6.6 (d, $J = 8.6\text{Hz}$, 1H), 6.75 (d, $J = 2.47\text{Hz}$, 1H), 6.9 (dd, $J = 8.6\text{Hz}$ and 2.5Hz , 1H); ^{13}C NMR (75.46Hz, C_6D_6) δ : 95.9 (t, $\text{C}-\text{CF}_3$, $^2J_{\text{CF}} = 27.9\text{Hz}$), 116.7, 117.3, 117.9, 119.7, 127, 127.5, 130.3, 148.3; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.9 (s, 3F), -119.8 (s, 2F), -120.6 (d, $^2J_{\text{FF}} = 285.2\text{Hz}$, 1F), -122.5 (s, 2F), -125 (d, $^2J_{\text{FF}} = 285.3\text{Hz}$, 1F), -125.9 (s, 2F); MS (m/z): 451 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_7\text{ClF}_{11}\text{O}_2$ 450.9959 found 450.9961. Anal. calcd for $\text{C}_{14}\text{H}_6\text{ClF}_{11}\text{O}_2$: C, 37.31; H, 1.34; O, 7.10, Found: C, 37.29; H, 1.36; O, 7.12.

2-trifluoromethyl-6-cyano-2H-chromen-2-ol 2l.

Same process than **2a**. Title chromenol is obtained, total yield 54 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3 (bs, 1H, OH), 5.5 (d, $J = 9.9\text{Hz}$, 1H, $\text{C}=\text{CH}$),

6 (d, $J = 9.9\text{Hz}$, 1H, CH=C), 6.6 (d, $J = 8.7\text{Hz}$, 1H), 6.8 (d, $J = 2.5\text{ Hz}$, 1H), 6.9 (dd, $J = 8.7\text{Hz}$ and 2.5 Hz , 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 95.2 (q, C-CF₃, $^2J_{CF} = 33.2\text{ Hz}$), 113.6, 117.4, 117.5, 118.4, 120.2, 123.8 (q, CF₃, $^1J_{CF} = 285.2\text{ Hz}$), 130.3, 145.2, 155.8; ^{19}F NMR (282.4MHz, C_6D_6) δ : -84.4 (s, 3F); MS (m/z): 242 (M^+ , 100). HRMS calcd for $\text{C}_{11}\text{H}_7\text{F}_3\text{NO}_2$ 242.0429 found 242.0434. Anal. calcd for $\text{C}_{11}\text{H}_6\text{F}_3\text{NO}_2$: C, 54.78; H, 2.51; O, 13.27, Found: C, 54.80; H, 2.52; O, 13.29.

2-perfluoropentyl-6-cyano-2H-chromen-2-ol 2m.

Same process than **2a**. Title chromenol is obtained, total yield 56 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.1 (bs, 1H, OH), 5.5 (d, $J = 9.9\text{Hz}$, 1H, C=CH), 6.1 (d, $J = 9.9\text{Hz}$, 1H, CH=C), 6.6 (d, $J = 8.7\text{Hz}$, 1H), 6.7 (d, $J = 2.6\text{Hz}$, 1H), 6.9 (dd, $J = 8.7\text{Hz}$ and 2.6 Hz , 1H); ^{13}C NMR (75.46Hz, C_6D_6) δ : 95.7 (t, C-CF₃, $^2J_{CF} = 28.1\text{ Hz}$), 117.3, 118, 119.7, 127.3, 127.7, 130.3, 149.3; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.8 (s, 3F), -119.7 (t, $^3J_{FF} = 14.1\text{ Hz}$, 2F), -120.5 (td, $^2J_{FF} = 275.5\text{ Hz}$ and $^3J_{FF} = 14.2\text{ Hz}$, 1F), -122.4 (s, 2F), -124.9 (td, $^2J_{FF} = 279\text{ Hz}$ and $^3J_{FF} = 14.5\text{ Hz}$, 1F), -125.8 (s, 2F); MS (m/z): 442 (M^+ , 100). HRMS calcd for $\text{C}_{15}\text{H}_7\text{F}_{11}\text{NO}_2$ 442.0301 found 442.0300. Anal. calcd for $\text{C}_{15}\text{H}_6\text{F}_{11}\text{NO}_2$: C, 40.83; H, 1.37; O, 7.25, Found: C, 40.80; H, 1.36; O, 7.26.

2-perfluoropentyl-6-nitro-2H-chromen-2-ol 2n.

Same process than **2a**. Title chromenol is obtained, total yield 48 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.2 (bs, 1H, OH), 5.6 (d, $J = 9.9\text{Hz}$, 1H, C=CH), 6.1 (dd, $J = 9.9\text{Hz}$ and 2.5 Hz , 1H, CH=C), 6.65 (d, $J = 8.6\text{Hz}$, 1H), 6.75 (d, $J = 2.4\text{Hz}$, 1H), 6.92 (dd, $J = 8.6\text{Hz}$ and 2.5 Hz , 1H); ^{13}C NMR (75.46Hz, C_6D_6) δ : 95.9 (t, C-CF₃, $^2J_{CF} = 27.9\text{ Hz}$), 117.3, 117.5, 117.9, 119.7, 127, 127.5, 129.6, 130.3, 148.3;

^{19}F NMR (282.4MHz, C_6D_6) δ : -80.9 (s, 3F), -119.8 (m, 2F), -120.7 (d, $^2J_{\text{FF}} = 288$ Hz, 1F), -122.5 (s, 2F), -125 (d, $^2J_{\text{FF}} = 287$ Hz, 1F), -125.9 (s, 2F); MS (m/z): 462 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_7\text{F}_{11}\text{NO}_4$ 462,0199 found 462,0196. Anal. calcd for $\text{C}_{14}\text{H}_6\text{F}_{11}\text{NO}_4$: C, 36.46; H, 1.31; O, 13.88, Found: C, 36.45; H, 1.34; O, 13.90.

2-trifluoromethyl-6-nitro-2*H*-chromen-2-ol **2o**.

Same process than **2a**. Title chromenol is obtained, total yield 50 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 3.2 (bs, 1H, OH), 5.6 (d, $J = 9.9$ Hz, 1H, C=CH), 6.1 (d, $J = 9.9$ Hz, 1H, CH=C), 6.7 (d, $J = 8.8$ Hz, 1H), 6.8 (d, $J = 2.5$ Hz, 1H), 7 (dd, $J = 8.8$ Hz and 2.5 Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 92 (q, C- CF_3 , $^2J_{\text{CF}} = 34$ Hz), 109.3, 114, 114.1, 114.7, 116.7, 120.3 (q, CF_3 , $^1J_{\text{CF}} = 286.2$ Hz), 126.8, 141.8, 152.4; ^{19}F NMR (282.4MHz, C_6D_6) δ : -84 (s, 3F); MS (m/z): 262 (M^+ , 100). HRMS calcd for $\text{C}_{10}\text{H}_7\text{F}_3\text{NO}_4$ 262,0327 found 262.0330. Anal. calcd for $\text{C}_{10}\text{H}_6\text{F}_3\text{NO}_4$: C, 45.99; H, 2.32; O, 24.51, Found: C, 45.97; H, 2.30; O, 24.55.

2-(2-(perfluoropentyl)-6-methoxy-4*H*-chromen-4-yl)-2-methylpropanal **4b**:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.5 (s, CH_3 , 3H), 0.6 (s, CH_3 , 3H), 3.1 (s, OCH_3 , 3H), 3.3 (d, $^3J_{\text{HH}} = 6$ Hz, =C-CH₂, 1H), 5.4 (d, $^3J_{\text{HH}} = 6$ Hz, =CH₂, 1H), 6.3-6.4 (m, 2H), 6.7 (d, $J = 8.7$ Hz, 1H), 9 (s, CHO, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 18.2, 18.6, 39.8, 52, 55, 106.6, 114.2, 114.4, 117.6, 120.8, 146.5, 156.7, 203.5; ^{19}F NMR (282.4MHz, C_6D_6) δ : -81.8 (s, 3F), -116.5 (q, $^3J_{\text{FF}} = 14.1$ Hz, 2F), -122.2 (m, 2F), -122.5 (m, 2F), -125.9 (m, 2F); MS (m/z): 501 (M^+ , 100). HRMS calcd for $\text{C}_{19}\text{H}_{16}\text{F}_{11}\text{O}_3$ 501.0924 found 501.0920. Anal. calcd for $\text{C}_{19}\text{H}_{15}\text{F}_{11}\text{O}_3$: C, 45.61; H, 3.02; O, 9.59, Found: C, 45.68; H, 3.10; O, 9.56.

2-(2-(trifluoromethyl)-6-methoxy-4H-chromen-4-yl)-2-methylpropanal 4c:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.7 (s, CH_3 , 3H), 0.8 (s, CH_3 , 3H), 3.3 (s, OCH_3 , 3H), 3.4 (dd, $J = 5.8\text{Hz}$ and 1.2Hz , $=\text{C}-\underline{\text{CH}}$, 1H), 5.5 (d, $^3J_{\text{HH}} = 5.8\text{Hz}$, $=\underline{\text{CH}}$, 1H), 6.5 (m, 2H), 6.9 (d, $J = 8.7\text{Hz}$, 1H), 9.2 (s, CHO, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 18.2, 18.5, 39.4, 52, 55, 103.4, 114.1, 114.4, 117.7, 120.7, 143.1, 146.5, 156.5, 203.6; ^{19}F NMR (282.4MHz, C_6D_6) δ : -71.6 (s, 3F); MS (m/z): 301 (M^+ , 100). HRMS calcd for $\text{C}_{15}\text{H}_{16}\text{F}_3\text{O}_3$ 301.1052 found 301.1055. Anal. calcd for $\text{C}_{15}\text{H}_{15}\text{F}_3\text{O}_3$: C, 60.00; H, 5.04; O, 15.98, Found: C, 60.04; H, 5.10; O, 15.99.

Methyl 2-(2-(trifluoromethyl)-6-methoxy-4H-chromen-4-yl)-2-methylpropanoate 4d:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1 (s, CH_3 , 3H), 1.01 (s, CH_3 , 3H), 3.3 (s, OCH_3 , 3H), 3.4 (s, OCH_3 , 3H), 3.9 (d, $J = 5.7\text{ Hz}$, $=\text{C}-\underline{\text{CH}}$, 1H), 5.6 (d, $^3J_{\text{HH}} = 5.8\text{ Hz}$, $=\underline{\text{CH}}$, 1H), 6.5 (dd, $J = 8.9\text{ Hz}$ and 2.9 Hz , 1H), 6.6 (d, $J = 2.9\text{Hz}$, 1H), 6.9 (d, $J = 8.9\text{ Hz}$, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 20.8, 22.1, 41.9, 49, 51.4, 55, 103.4 (q, $J = 3.5\text{ Hz}$), 113.9, 114.1, 117.6, 120.7 (q, $J = 275.3\text{ Hz}$, CF_3), 121.4, 142.8 (q, $J = 36.2\text{ Hz}$, $\underline{\text{C}}-\text{CF}_3$), 146.5, 156.6, 176.4; ^{19}F NMR (282.4MHz, C_6D_6) δ : -71.6 (s, 3F); MS (m/z): 331 (M^+ , 100). HRMS calcd for $\text{C}_{16}\text{H}_{18}\text{F}_3\text{O}_4$ 331.1157 found 331.1155. Anal. calcd for $\text{C}_{16}\text{H}_{17}\text{F}_3\text{O}_4$: C, 58.18; H, 5.19; O, 19.38, Found: C, 58.19; H, 5.21; O, 19.40.

1-(2-(trifluoromethyl)-6-methoxy-4H-chromen-4-yl)-3,3-dimethylbutan-2-one 4e:

Same process than **4a**. Title chromene is obtained, total yield 97%.

Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.9 (s, 3 CH_3 , 9H), 2.4 (dd, $^2J_{\text{HH}} = 18.3$ Hz and $^3J_{\text{HH}} = 7.8$ Hz, $\text{CH}-\underline{\text{CH}}_2$, 1H), 2.6 (dd, $^2J_{\text{HH}} = 18.2$ Hz and $^3J_{\text{HH}} = 5.7$ Hz, $\text{CH}-\underline{\text{CH}}_2$, 1H), 3.3 (s, OCH_3 , 3H), 4.1 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.6 (d, $J = 4.8$ Hz, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.5 (dd, $J = 8.9$ Hz and 2.9 Hz, 1H), 6.6 (d, $J = 2.9$ Hz, 1H), 6.9 (d, $J = 8.9$ Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 25.8, 29.6, 30, 43.8, 46.6, 55.1, 105.9 (q, $J = 3.6$ Hz), 113.1, 114, 117.8, 120.3 (q, $J = 271.5$ Hz, CF_3), 123.8, 140.6 (q, $J = 36.3$ Hz, $\underline{\text{C}}-\text{CF}_3$), 144.7, 156.9, 211.6; ^{19}F NMR (282.4MHz, C_6D_6) δ : -72 (s, 3F); MS (m/z): 329 (M^+ , 100). HRMS calcd for $\text{C}_{17}\text{H}_{20}\text{F}_3\text{O}_3$ 329.1365 found 329.1368. Anal. calcd for $\text{C}_{17}\text{H}_{19}\text{F}_3\text{O}_3$: C, 62.19; H, 5.83; O, 14.62, Found: C, 62.20; H, 5.84; O, 14.62.

Methyl 2-(2-trifluoromethyl)-7-methoxy-4*H*-chromen-4-yl)-2-methylpropanoate 4f:

Same process than **4a**. Title chromene is obtained, total yield 95%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1 (s, CH_3 , 3H), 1.1 (s, CH_3 , 3H), 3.2 (s, OCH_3 , 3H), 3.4 (s, OCH_3 , 3H), 3.8 (dd, $J = 5.8$ Hz and 1.3 Hz, $=\text{C}-\underline{\text{CH}}$, 1H), 5.7 (d, $^3J_{\text{HH}} = 5.8$ Hz, $=\underline{\text{CH}}$, 1H), 6.6 (d, $J = 2.5$ Hz, 1H), 6.7 (dd, $J = 8.5$ Hz and 2.6 Hz, 1H), 6.9 (d, $J = 8.5$ Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 20.7, 22.3, 42.1, 49, 51.5, 55.2, 103.4 (q, $J = 3.3$ Hz), 113.9, 114.2, 117.8, 121.1 (q, $J = 275.4$ Hz, CF_3), 121.5, 142.7 (q, $J = 37.1$ Hz, $\underline{\text{C}}-\text{CF}_3$), 146.6, 156.7, 177.1; ^{19}F NMR (282.4MHz, C_6D_6) δ : -71.6 (s, 3F); MS (m/z): 331 (M^+ , 100). HRMS calcd for $\text{C}_{16}\text{H}_{18}\text{F}_3\text{O}_4$ 331.1157 found 331.1159. Anal. calcd for $\text{C}_{16}\text{H}_{17}\text{F}_3\text{O}_4$: C, 58.18; H, 5.19; O, 19.38, Found: C, 58.16; H, 5.18; O, 19.36.

1-(2-trifluoromethyl)-7-methoxy-4*H*-chromen-4-yl)-3,3-dimethylbutan-2-one 4g:

Same process than **4a**. Title chromene is obtained, total yield 96%.

Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.9 (s, 3 CH_3 , 9H), 2.4 (dd, $^2J_{\text{HH}} = 17.6$ Hz and $^3J_{\text{HH}} = 7.8$ Hz, $\text{CH}-\underline{\text{CH}}_2$, 1H), 2.6 (dd, $^2J_{\text{HH}} = 17.6$ Hz and $^3J_{\text{HH}} = 5.7$ Hz, $\text{CH}-\underline{\text{CH}}_2$, 1H), 3.3 (s, OCH_3 , 3H), 4.1 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.7 (d, $J = 4.8$ Hz, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.6 (d, $J = 2.5$ Hz, 1H), 6.7 (dd, $J = 8.5$ Hz and 2.5 Hz, 1H), 6.8 (d, $J = 8.5$ Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 25.8, 27, 28.7, 43.8, 46.6, 54.9, 101.4, 107.4 (q, $J = 3.6$ Hz), 112.4, 114.6, 115.1, 120.3 (q, $J = 271.3$ Hz, CF_3), 124.1, 129.2, 140.2 (q, $J = 36.4$ Hz, $\underline{\text{C}}-\text{CF}_3$), 151.4, 160, 211.7; ^{19}F NMR (282.4MHz, C_6D_6) δ : -72.1 (s, 3F); MS (m/z): 329 (M^+ , 100). HRMS calcd for $\text{C}_{17}\text{H}_{20}\text{F}_3\text{O}_3$ 329.1365 found 329.1366. Anal. calcd for $\text{C}_{17}\text{H}_{19}\text{F}_3\text{O}_3$: C, 62.19; H, 5.83; O, 14.62, Found: C, 62.21; H, 5.83; O, 14.61.

1-(2-perfluoropropyl)-8-methoxy-4H-chromen-4-yl)-3,3-dimethylbutan-2-one 4h:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.9 (s, 3 CH_3 , 9H), 2.5 (d, $^2J_{\text{HH}} = 2.25$ Hz, $\text{CH}-\underline{\text{CH}}_2$, 1H), 2.52 (s, $\text{CH}-\underline{\text{CH}}_2$, 1H), 3.4 (s, OCH_3 , 3H), 4.2 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.8 (d, $J = 5$ Hz, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.5 (dd, $J = 8.1$ Hz and 0.9 Hz, 1H), 6.6 (d, $J = 7.8$ Hz, 1H), 6.9 (t, $J = 7.9$ Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 25.8, 29.8, 43.8, 46.7, 55.6, 109.6 (q, $J = 5.3$ Hz), 111, 119.7, 123.9, 124.6, 140.3 (q, $J = 27.4$ Hz, $\underline{\text{C}}-\text{CF}_3$), 140.8, 148.7, 211.4; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.6 (s, 3F), -118 (s, 2F), -126.7 (s 2F); MS (m/z): 429 (M^+ , 100). HRMS calcd for $\text{C}_{19}\text{H}_{20}\text{F}_7\text{O}_3$ 429.1301 found 429.1311. Anal. calcd for $\text{C}_{19}\text{H}_{19}\text{F}_7\text{O}_3$: C, 53.28; H, 4.47; O, 11.21, Found: C, 53.29; H, 4.48; O, 11.22.

1-(2-(perfluoropentyl)-4H-chromen-4-yl)propan-2-one 4i:

Same process than **4a**. Title chromene is obtained, total yield 97%.

Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1.4 (s, CH_3 , 3H), 1.8 (dd, $^2J_{\text{HH}} = 18\text{Hz}$ and $^3J_{\text{HH}} = 7.9\text{Hz}$, $\text{CH}-\underline{\text{CH}_2}$ 1H), 2 (dd, $^2J_{\text{HH}} = 18\text{Hz}$ and $^3J_{\text{HH}} = 5.4\text{Hz}$, $\text{CH}-\underline{\text{CH}_2}$, 1H), 3.7 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.6 (d, $J = 4.9\text{Hz}$, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.6-6.8 (m, 4H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 27.3, 27.7, 50.4, 107.9, 115, 120.8, 123, 126.7, 138.3, 148.8, 202; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.8 (s, 3F), -117.2 (t, $^3J_{\text{FF}} = 14.1\text{Hz}$, 2F), -122.5 (m, 2F), -122.7 (m, 2F), -126 (m, 2F); MS (m/z): 457 (M^+ , 100). HRMS calcd for $\text{C}_{17}\text{H}_{12}\text{F}_{11}\text{O}_2$ 457.0662 found 457.0665. Anal. calcd for $\text{C}_{17}\text{H}_{11}\text{F}_{11}\text{O}_2$: C, 44.75; H, 2.43; O, 7.01, Found: C, 44.72; H, 2.41; O, 7.00.

2-(2-(trifluoromethyl)-4H-chromen-4yl)-2-methylpropanal 4j:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.5 (s, $(\text{CH}_3)_2$, 6H), 3.2 (d, $^3J_{\text{HH}} = 6\text{ Hz}$, $=\text{C}-\underline{\text{CH}}$, 1H), 5.4 (d, $^3J_{\text{HH}} = 6\text{ Hz}$, $=\underline{\text{CH}}$, 1H), 6.5-6.8 (m, 4H), 9 (s, CHO, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 18.2, 18.3, 39.5, 52, 107.6, 116.9, 119.9, 124.6, 128.6, 129.7, 142.4, 152.5, 203.3; ^{19}F NMR (282.4MHz, C_6D_6) δ : -71.5 (s, 3F); MS (m/z): 271 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_{14}\text{F}_3\text{O}_2$ 271.0946 found 271.0950. Anal. Calcd for $\text{C}_{14}\text{H}_{13}\text{F}_3\text{O}_2$: C, 62.22; H, 4.85; O, 11.84, Found: C, 62.20; H, 4.85; O, 11.82.

1-(2-(perfluoropropyl)-7-methyl-4H-chromen-4yl)propan-2-one 4k:

Same process than **4a**. Title chromene is obtained, total yield 95 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1.6 (s, CH_3 , 3H), 2.1 (s, CH_3 , 3H), 2.15 (dd, $^2J_{\text{HH}} = 17.9\text{Hz}$ and $^3J_{\text{HH}} = 7.8\text{Hz}$, $\text{CH}-\underline{\text{CH}_2}$ 1H), 2.2 (dd, $^2J_{\text{HH}} = 17.9\text{Hz}$ and $^3J_{\text{HH}} = 5.5\text{Hz}$, $\text{CH}-\underline{\text{CH}_2}$, 1H), 3.9 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.8 (d, $J = 4.9\text{Hz}$, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.7-6.9 (m, 3H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 20.6, 28.9, 29.4, 52.3, 109.6, 117.3, 119.6, 125.8, 138.5, 140.4, 150.5, 204;

^{19}F NMR (282.4MHz, C_6D_6) δ : -80.7 (s, 3F), -118.2 (m, 2F), -126.7 (m, 2F); MS (m/z): 371 (M^+ , 100). HRMS calcd for $\text{C}_{16}\text{H}_{14}\text{F}_7\text{O}_2$ 371.0882 found 371.0879. Anal. Calcd for $\text{C}_{16}\text{H}_{13}\text{F}_7\text{O}_2$: C, 51.90; H, 3.54; O, 8.64, Found: C, 51.91; H, 3.54; O, 8.66.

1-(2-perfluoropropyl)-8-chloro-4H-chromen-4-yl)-3,3-dimethylbutan-2-one 4l:

Same process than **4a**. Title chromene is obtained, total yield 97 %. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.9 (s, 3 CH_3 , 9H), 2.5 (d, $^2J_{\text{HH}} = 2.2$ Hz, $\text{CH}-\underline{\text{CH}_2}$, 1H), 2.5 (s, $\text{CH}-\underline{\text{CH}_2}$, 1H), 4.1 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.9 (d, $J = 5.1$ Hz, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.5 (dd, $J = 8.2$ Hz and 0.9 Hz, 1H), 6.6 (d, $J = 7.8$ Hz, 1H), 6.8 (t, $J = 8$ Hz, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 25.8, 29.8, 43.8, 46.7, 55.6, 109.6 (t, $J = 5$ Hz), 111, 119.7, 123.9, 124.6, 140.3 (t, $J = 27.4$ Hz, $\underline{\text{C}}-\text{CF}_3$), 140.7, 148.9, 211.5; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.5 (s, 3F), -117 (t, $^3J_{\text{FF}} = 14.2$ Hz, 2F), -122.1 (m, 2F), -122.5 (m, 2F), -126 (m, 2F); MS (m/z): 533 (M^+ , 100). HRMS calcd for $\text{C}_{20}\text{H}_{17}\text{ClF}_{11}\text{O}_2$ 533.0741 found 533.0744. Anal. calcd for $\text{C}_{20}\text{H}_{16}\text{ClF}_{11}\text{O}_2$: C, 45.09; H, 3.03; O, 6.01, Found: C, 45.10; H, 3.04; O, 6.00.

1-(2-(perfluoropentyl)-6-cyano-4H-chromen-4-yl)propan-2-one 4m:

Same process than **4a**. Title chromene is obtained, total yield 92%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1 (s, CH_3 , 3H), 1.9 (d, $^3J_{\text{HH}} = 6.7\text{Hz}$, $\text{CH}-\underline{\text{CH}_2}$ 2H), 3.65 (m, $\underline{\text{CH}}-\text{CH}_2$, 1H), 5.75 (d, $J = 4.9\text{Hz}$, $=\underline{\text{CH}}-\text{CH}$, 1H), 6.6 (d, $J = 8.5\text{Hz}$, 1H), 6.8-6.9 (m, 2H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 29, 29.3, 51.7, 109.4, 118.2, 124.2, 128.4, 129.7, 149.1, 203.5; ^{19}F NMR (282.4MHz, C_6D_6) δ : -80.8 (s, 3F), -117.2 (t, $^3J_{\text{FF}} = 14.1\text{Hz}$, 2F), -122.5 (m, 2F), -122.7 (m, 2F), -125.9 (m, 2F); MS (m/z): 482 (M^+ , 100). HRMS calcd for $\text{C}_{18}\text{H}_{11}\text{F}_{11}\text{NO}_2$ 482.0614 found 482.0610. Anal. Calcd for $\text{C}_{18}\text{H}_{10}\text{F}_{11}\text{NO}_2$: C, 44.92; H, 2.09; O, 6.65, Found: C, 44.90; H, 2.10; O, 6.67.

1-(2-(trifluoromethyl)-6-cyano-4*H*-chromen-4yl)propan-2-one 4n:

Same process than **4a**. Title chromene is obtained, total yield 96%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 1.3 (s, CH_3 , 3H), 1.7 (d, $^3J_{\text{HH}} = 6.7\text{Hz}$, $\text{CH}-\text{CH}_2$ 2H), 3.5 (m, $\text{CH}-\text{CH}_2$, 1H), 5.55 (d, $J = 4.9\text{Hz}$, $=\text{CH}-\text{CH}$, 1H), 6.4 (d, $J = 8.6\text{Hz}$, 1H), 6.6-6.7 (m, 2H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 27.6, 27.9, 50.3, 116.7, 122.8, 126.8, 128.3, 147.6, 202; ^{19}F NMR (282.4MHz, C_6D_6) δ : -71.9 (s, 3F); MS (m/z): 282 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_{11}\text{F}_3\text{NO}_2$ 282.0742 found 282.0745. Anal. calcd for $\text{C}_{14}\text{H}_{10}\text{F}_3\text{NO}_2$: C, 59.79; H, 3.58; O, 11.38, Found: C, 59.81; H, 3.60; O, 11.35.

2-(2-(perfluoropentyl)-6-nitro-4*H*-chromen-4yl)-2-methylpropanal 4o:

Same process than **4a**. Title chromene is obtained, total yield 92%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.4 (s, CH_3 , 3H), 0.5 (s, CH_3 , 3H), 3.2 (d, $^3J_{\text{HH}} = 6\text{ Hz}$, $=\text{C}-\text{CH}$, 1H), 5.4 (d, $^3J_{\text{HH}} = 6\text{Hz}$, $=\text{CH}$, 1H), 6.5 (d, $J = 8.6\text{Hz}$, 1H), 6.6-6.7 (m, 2H), 8.9 (s, CHO, 1H); ^{13}C NMR (75.4Hz, C_6D_6) δ : 18, 18.5, 39.1, 51.8, 107.7, 118.1, 121.7, 128.7, 129.6, 151, 202.8; ^{19}F NMR (282.4MHz, C_6D_6) δ : -81.7 (s, 3F), -116.6 (q, $^3J_{\text{FF}} = 14.2\text{ Hz}$, 2F), -122.2 (m, 2F), -122.6 (m, 2F), -125.9 (m, 2F); MS (m/z): 516 (M^+ , 100). HRMS calcd for $\text{C}_{18}\text{H}_{13}\text{F}_{11}\text{NO}_4$ 516.0669 found 516.0671. Anal. calcd for $\text{C}_{18}\text{H}_{12}\text{F}_{11}\text{NO}_4$: C, 41.96; H, 2.35; O, 12.42, Found: C, 41.94; H, 2.34; O, 12.45.

2-(2-(trifluoromethyl)-6-nitro-4*H*-chromen-4yl)-2-methylpropanal 4p:

Same process than **4a**. Title chromene is obtained, total yield 98%. Spectral data: ^1H NMR (300.13MHz, C_6D_6) δ : 0.4 (s, CH_3 , 3H), 0.45 (s, CH_3 , 3H), 3.1 (d, $^3J_{\text{HH}} = 6\text{ Hz}$, $=\text{C}-\text{CH}$, 1H), 5.3 (d, $^3J_{\text{HH}} = 6\text{Hz}$, $=\text{CH}$, 1H), 6.4 (d, $J = 8.63\text{Hz}$, 1H), 6.6-6.7 (m, 2H), 8.8 (s, CHO, 1H);

^{13}C NMR (75.4Hz, C_6D_6) δ : 15.7, 16.2, 27.7, 36.9, 49.6, 105.5, 115.9, 119.4, 126.6, 127.4, 140.1, 148.8, 200.5; ^{19}F NMR (282.4MHz, C_6D_6) δ : -72.1 (s, 3F); MS (m/z): 316 (M^+ , 100). HRMS calcd for $\text{C}_{14}\text{H}_{13}\text{F}_3\text{NO}_4$ 316.0797 found 316.0794. Anal. calcd for $\text{C}_{14}\text{H}_{12}\text{F}_3\text{NO}_4$: C, 53.34; H, 3.84; O, 20.30, Found: C, 53.33; H, 3.80; O, 20.28.

S16

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 MCREST 0.0000000 sec
 MCWRR 1.225995 sec
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 PL1 5.50 usec
 PL2 8.00 usec
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 FIDRES 19.036306 Hz
 SFO2 6.116 ppm
 FMODE RF
 F2 - Processing parameters
 SI 1024
 SF 300.1300000 MHz
 WDW SINE
 SSB 0
 LB 0.00 Hz
 GB 0
 PC 1.40
 F1 - Processing parameters
 SI 1024
 SF 300.1300000 MHz
 WDW SINE
 SSB 0
 LB 0.00 Hz
 GB 0

F2 - Acquisition Parameters
 Date_ 2006.06
 Time_ 16.46
 INSTRUM spect
 PROBHD 5 mm QNP 1H/13
 PULPROG zgpg30
 TD 65536
 CQ 1656
 SOLVENT CDCl3
 NS 1024
 DS 4
 SWH 17985.611 Hz
 FIDRES 0.771518 Hz
 AQ 1.8219508 sec
 RG 2896.3
 DW 27.800 usec
 DE 8.00 usec
 DI 0.000000 sec
 D1 0.0300000 sec
 d11 0.0300000 sec
 d12 0.0002000 sec
 ===== CHANNEL f1 =====
 NUC1 13C
 P1 6.70 usec
 PL1 -3.00 dB
 SFO1 75.4752953 MHz
 ===== CHANNEL f2 =====
 CDEFG2 waltz16
 NUC2 1H
 PCPD2 100.00 usec
 PL1 0.00 dB
 PL2 22.00 dB
 PL3 22.00 dB
 SFO2 300.1312005 MHz
 F2 - Processing parameters
 SI 32768
 SF 75.4679147 MHz
 WDW EM
 SSB 0
 GB 1.00 Hz
 PC 1.40

-84.28

F2 - Acquisition Parameters
Date_ 20050707
Time 15.55
INSTRUM spect
PULPROG 5 mm QNP
TD 131072
SOLVENT C6D6
NS 16
DS 4
SWH 25062.656 Hz
FIDRES 0.191213 Hz
AQ 2.6149364 sec
RG 327.5
DM 19.950 usec
DE 8.00 usec
TE 300.0 K
D1 5.0000000 sec
***** CHANNEL f1 *****
NUC1 19F
P1 9.50 usec
PL1 0.00 dB
SFO1 282.3761058 MHz
F2 - Processing parameters
SI 32768
SF 282.4043460 MHz
WDW EM
SSB 0
LB 0.3 Hz
GB 0
PC 1.00

F2 - Acquisition Parameters

Date_ 20050709

Time_ 16:37

INSTRUM spect

PROBHD 5 mm QNP 1H/13

PULPROG zg30

TD 32768

SOLVENT CDCl₃

NS 1

DS 2

SMH 4844.961 Hz

FIDRES 0.147856 Hz

AQ 3.3817077 sec

RG 655

DE 103.200 usec

TE 300.0 K

D1 1.00000000 sec

===== CHANNEL f1 =====

NUC1 1H

P1 6.50 usec

PL1 -3.00 dB

SFO1 300.1322660 MHz

F2 - Processing parameters

SI 32768

SF 300.1300000 MHz

WDW EM

SSB 0

LFS 0.30 Hz

GB 1.00

PC 1.00

F2 - Acquisition Parameters

Date_ 500000
Time 23.18
INSTRUM spect
PROBHD 5 mm Dual 13
PULPROG zg30
TD 32768
SOLVENT C6D6
NS 16
DS 2

SWH 8223.685 Hz
FIDRES 0.250367 Hz
AQ 1.9923444 sec
RG 574.7
DM 60.800 usec
DE 4.50 usec
TE 300.0 K
D1 1.0000000 sec
P1 10.00 usec
DE 4.50 usec
SF01 400.1324710 MHz
NUC1 1H
PL1 -6.00 dB

F2 - Processing parameters

SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

1D NMR plot parameters

CX 30.00 cm
F1P 11.000 ppm
F1 4401.43 Hz
F2P -1.000 ppm
F2 -400.13 Hz
PPMCH 0.40000 ppm/cm
HZCM 160.05200 Hz/cm

F2 - Acquisition Parameters

Date_ 500000

Time 17.03

INSTRUM spect

PROBHD 5 mm Dual 13

PULPROG zgpg30

TD 65536

SOLVENT CDCl3

NS 5343

DS 2

SWH 31847.133 Hz

FIDRES 0.485949 Hz

AQ 1.0288652 sec

RG 4096

DW 15.700 usec

DE 4.50 usec

TE 300.0 K

D12 0.0002000 sec

PL13 20.00 dB

D1 1.00000000 sec

CPDPRG2 waltz16

PCPD2 100.00 usec

SFO2 400.1316005 MHz

NUC2 1H

PL2 -6.00 dB

PL12 17.00 dB

P1 6.00 usec

DE 4.50 usec

SFO1 100.6254358 MHz

NUC1 13C

PL1 -6.00 dB

D11 0.03000000 sec

F2 - Processing parameters

SI 32768

SF 100.6127250 MHz

WDW EM

SSB 0

LB 1.00 Hz

GB 0

PC 1.40

1D NMR plot parameters

CX 30.00 cm

F1P 215.000 ppm

F1 21531.74 Hz

F2P -5.000 ppm

F2 -503.06 Hz

PPMCM 7.35333 ppm/cm

HZCM 737.82672 Hz/cm

F2 - Acquisition parameters
 Date_ 15.24
 Time 15.24
 INSTRUM spect
 PROBHD 5 mm Dui1 13
 PULPROG cosy45
 TO 1024
 SOLVENT CDCl₃
 NS 4
 DS 4
 SWH 3453.039 Hz
 FIDRES 3.372108 Hz
 AQ 0.1463262 sec
 RG 512
 DM 144.800 usec
 DE 231.43 usec
 YC 200.00 usec
 D1 1.97693798 sec
 P1 10.00 usec
 D0 0.00003300 sec
 DE 231.43 usec
 SFO1 400.1316154 MHz
 NUC1 ¹H
 P1 1.00 usec
 PL1 -5.00 dB
 YAG 0.0002660 sec
 F1 - Acquisition parameters
 NUC1 128
 TO 128
 SFO1 400.1316 MHz
 FIDRES 26.976864 Hz
 SN 6.030 ppm
 F2 - Processing parameters
 SI 512
 SF 400.1300000 MHz
 MDW SINE
 SSF 0
 LB 0.00 Hz
 GB 0
 PC 1.40
 F1 - Processing parameters
 SI 512
 MC2 GF
 SF 400.1300000 MHz
 MDW SINE
 SSF 0
 LB 0.00 Hz
 GB 0
 2D NMR plot parameters
 CX2 20.00 cm
 CY2 20.00 cm
 FZD0 7.00 ppm
 FZD1 3116.60 Hz
 F2PH1 5.446 ppm
 F2H1 2179.15 Hz
 F1PL0 7.738 ppm
 F1PL1 3095.36 Hz
 F1PH1 5.446 ppm
 F1PH2 5.446 ppm
 F2PH2 0.11714 ppm/cm
 F2H2M 46.87230 Hz/cm
 F1PH2M 0.11461 ppm/cm
 F1H2M 45.86067 Hz/cm

F2 - Acquisition Parameters
 Date_ 20050705
 Time 18.16
 INSTRUM spect
 PROBD 5 mm QNP 1H/13
 PULPROG zg30
 TD 32768
 SOLVENT C6D6
 NS 16
 DS 2
 SWH 4844.961 Hz
 FIDRES 0.147856 Hz
 AQ 3.3817077 sec
 RG 101.6
 DW 103.200 usec
 DE 8.00 usec
 TE 300.2 K
 D1 1.00000000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P1 6.50 usec
 PL1 -2.00 dB
 SFO1 300.1322660 MHz

F2 - Processing parameters
 SI 32768
 SF 300.1300000 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

F2 - Acquisition Parameters
 Date_ 20050705
 Time_ 15:06
 INSTRUM spect
 PROHD 5 mm QNP 1H/13
 PULPROG zgpg30
 TD 65536
 SOLVENT C6D6
 NS 1024
 DS 4
 SWH 17985.611 Hz
 FIDRES 0.274439 Hz
 AQ 1.8219508 sec
 RG 2896.3
 RW 27.800 usec
 DE 6.000 usec
 TE 300.0 K
 D1 1.00000000 sec
 d11 0.03000000 sec
 d12 0.00002000 sec
 ===== CHANNEL f1 =====
 NUC1 13C
 P1 6.70 usec
 PL1 -3.00 dB
 SFO1 75.4752953 MHz
 ===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 1H
 PCPD2 100.00 usec
 PL2 0.00 dB
 PL12 22.00 dB
 PL13 22.00 dB
 SFO2 300.1312005 MHz
 F2 - Processing parameters
 SI 32768
 SF 75.4677324 MHz
 WDW EM
 SSB 0
 GB 1.00 Hz
 PC 1.40

F2 - Acquisition Parameters
 Date_ 20080707
 Time_ 18.14
 INSTRUM spect
 PROBHD 5 mm QNP 1H/13
 PULPROG zgpg30
 TD 131072
 SOLVENT C6D6
 NS 16
 DS 4
 SWH 25062.656 Hz
 FIDRES 0.131213 Hz
 AQ 2.6149364 sec
 RG 327.5
 DW 15.350 usec
 DE 8.00 usec
 TE 300.0 K
 D1 5.0000000 sec
 ===== CHANNEL f1 =====
 NUC1 13C
 P1 19.00 usec
 PL1 0.00 dB
 SFO1 282.3761058 MHz
 F2 - Processing parameters
 SI 32768
 SF 282.4033660 MHz
 WDW EM
 SSB 0
 GB 0
 PC 1.00

F2 - Acquisition Parameters
 Date_ 20060602
 Time_ 12.37
 INSTRUM 5 mm QNP 1H/13
 PROBHD 5 mm QNP 1H/13
 PULPROG zg30
 TD 32768
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 4844.96 Hz
 FIDRES 0.147864 Hz
 AQ 3.381707 sec
 RG 161.3
 DW 103.200 usec
 DE 8.00 usec
 TE 300.0 K
 D1 1.00000000 sec
 ===== CHANNEL f1 =====
 NUC1 1H
 P1 6.50 usec
 PL1 -3.00 dB
 SFO1 300.1322660 MHz
 F2 - Processing parameters
 SI 32768
 SF 300.1300000 MHz
 WDW EM
 SSB 0
 LB 0
 GB 0
 FC 1.00

S21H1C2 m-OMe / C6D6
HmqcA3 C6D6 jpb jpb 1

[illegible]

Current Data Parameters
NAME Jun02-2006
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20060602
Time 12:25
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
PC 13002
SOLVENT CDCl3
NS 16
DS 4
SWH 25062.653 Hz
FIDRES 0.191213 Hz
AQ 2.6149164 sec
RG 362
RW 19.950 usec
DE 8.00 usec
TE 300.0 K
D1 5.0000000 sec

===== CHANNEL f1 =====
NUC1 13C
P1 9.50 usec
PL 0.00 dB
SFO1 282.3761058 MHz

F2 - Processing parameters
SI 32768
SF 282.403460 MHz
WDW EM
SSB 0
GB 0
PC 1.00

 F2 - Acquisition Parameters
 Date_ 20060519
 Time_ 13:02
 INSTRUM spect
 PROBD 5 mm QNP 1H/13
 PULPROG zgpg30
 TD 32768
 SOLVENT C6D6
 NS 16
 DS 4
 SFO 4844.961 Hz
 FIDRES 0.147856 Hz
 AQ 3.3817077 sec
 RG 40.3
 DW 103.200 usec
 DE 8.00 usec
 TE 300.2 K
 D1 1.00000000 sec
 ===== CHANNEL f1 =====
 NUC1 1H
 P1 6.50 usec
 PL1 -3.00 dB
 SFO1 300.1322660 MHz
 F2 - Processing parameters
 SI 32768
 SF 300.1300000 MHz
 MEW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

2181.73
2090.44
2081.59
2071.02
2009.90
2006.92
2001.05
1998.07
1969.79
1966.84
1934.54
1924.62
1774.93
1765.06

F2 - Acquisition Param
Date_ 20050605
Time 15.05
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 4844.961
FIDRES 0.147856
AQ 3.381077
RG 103.200
DE 8.00
TE 300.0
D1 1.00000000
===== CHANNEL f1 =====
NUC1 13C
P1 6.50
PL1 -3.00
SFO1 300.1322660
F2 - Processing paramete
SI 32768
SF 300.130000000
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

F2 - Acquisition Parameter
Date_ 20050610
Time 18.14
INSTRUM spect
PULPROG 5 mm QNP 1H/13
TD 32768
SOLVENT CDCl3
NS 32
DS 2
SWH 4844.961 Hz
FIDRES 0.147656 Hz
AQ 3.367777 s
RG 912.3
LW 103.200 u
DE 8.00 u
TE 300.0 K
D1 1.00000000 s
===== CHANNEL f1 =====
NUC1 1H
P1 6.50 u
PL1 -3.00 dB
SFO1 300.1322660 MHz
F2 - Processing parameter
SI 32768
SF 300.1300000 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

F2 - Acquisition Parameters
Date_ 20050611
Time 18.06
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 16
DS 2
SWH 4844.961
FIDRES 0.147856
AQ 3.358077
RG 406.4
DM 103.200
DE 8.00
TE 300.0
D1 1.00000000
===== CHANNEL f1 =====
NUC1 1H
P1 6.50
PL1 -3.00
SFO1 300.1322660
F2 - Processing parameters
SI 32768
SF 300.1300000
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

2102.77
2097.16
2094.75
2092.41
2078.42
2075.89
2069.74
2067.21
2060.59
2057.95
2054.88
2050.75
2048.99
2046.24
2044.10
2035.95
2032.98
2023.14
2020.64
2003.78
1993.82
1989.65
1985.17
1978.03
1976.78
1974.92
1969.20
1808.16
1798.20
1663.26
1658.12

1469.93
1316.39

993.89
917.17

F2 - Acquisition Parameters
Date_ 20080611
Time_ 8:06
INSTRUM spect
PROBHD 5 mm QNP 1H/13
PULPROG zg30
TD 32768
SOLVENT C6D6
NS 12
DS 2
SWH 4844.961
FIDRES 0.147856
AQ 3.381707
RG 406.4
DM 103.200
DE 8.00
TE 300.2
PT 0.00
D1 1.00000000
===== CHANNEL f1 =====
NUC1 1H
P1 6.50
PL1 -3.00
SFO1 300.1322660
F2 - Processing parameters
SI 32768
SF 300.1300000
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

F2 - Acquisition Parameters
 Date_ 20050611
 Time 17.01
 INSTRUM spect
 PROBD 5 mm QNP 1H/13
 PULPROG zgpg30
 SOLVENT C6D6
 NS 16
 DS 2
 SWH 4844.861 Hz
 FIDRES 0.147856 Hz
 AQ 3.381756 s
 RG 656
 DW 103.200 ns
 DE 8.00 ns
 TE 300.0 K
 D1 1.00000000 s
 ===== CHANNEL f1 =====
 NUC1 1H
 P1 6.50 ns
 PL1 -3.00 dB
 SFO1 300.1322660 MHz
 F2 - Processing parameters
 SI 32768
 SF 300.1300000 MHz
 NPM EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00